Distribution, Politics and Efficiency: A Common Agency Approach*

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Abstract

This paper investigates the impact of wealth distribution on economic efficiency when redistribution is done via the composition of public expenditure, and is influenced by the interaction of pressure groups. This is modeled in a common agency framework, and it is first shown that, in the presence of a productive activity, truthful equilibria of common agency games might be inefficient if there is no perfect commitment or perfect credit markets. This result is then used to show that wealth distribution can have a larger effect on efficiency than what is due to the capital market imperfections themselves, in that it sets in motion the conflict between pressure groups that leads to a distorted allocation of government expenditures (even under perfect information): the resulting allocation fails to reach the constrained optimum. Moreover, the inefficiency is not due to any intrinsic distortionary effect of redistribution, being linked to the nature of the political process. Finally, changes in distribution can have two additional effects in the outcome of this process, other than by changing the relative proportion of agents favoring redistribution: it changes the efficient allocation itself, for the policy variable has a direct productive effect, and impacts each groups' ability to coordinate as such. The overall effect might be ambiguous.

1 Introduction

Much has been written in the last decade or so about possible effects of wealth distribution on economic growth and efficiency. Part of this literature has emphasized capital market imperfections, which could lead to some degree of persistence of the initial distribution while constraining some agents to inefficient

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levels of investment - e.g. Galor and Zeira (1993), Banerjee and Newman (1993), or Aghion and Bolton (1997). Other authors, such as Bertola (1993), Alesina and Rodrik (1994), and Persson and Tabellini (1994), have stressed politico-economic mechanisms: wealth distribution might have some impact on a political decision concerning redistribution, which affects economic performance. In its most usual incarnation, this latter approach models some (typically positive) relation between wealth inequality and redistribution, via political process, along with some other (typically negative) relation between redistribution and economic growth. In any case, even the more recent examples of this literature (e.g. Bénabou, 2000), which obtain more general results, do so by modeling the political process essentially as a voting on tax rates, which allows for some type of median voter result to determine the political equilibrium.[1]

Although this might be a valid abstraction for many purposes, this modeling strategy might obscure some important aspects of the much more complex real political systems, and these aspects could have significant impact on the relation between wealth distribution and economic performance. On one hand, as far as the *object* of the political process is concerned, one such aspect could be the decision on the *composition of government expenditures*: governments can spend in different ways, with different macroeconomic and welfare impacts, which might depend on the wealth distribution. In other words, this composition can be thought of as a redistributive variable, obviously determined by some political process. On the other hand, as far as the *nature* of the political process is concerned, there is a huge spectrum of forms of political participation that go well beyond voting. Among those, one that has long been recognized and studied by economists is the action of pressure groups that try to influence the policy-maker's decisions to their benefit. The main purpose of this paper is to investigate the consequences of extending the aforementioned literature on these two directions, modeling the political process by means of the interaction of pressure groups, defined by the wealth distribution, lobbying to influence the decision on the composition of government expenditures.[2]

A well-developed framework to model this lobbying activity by pressure groups is *common agency*, by which one means situations in which several principals, with different and possibly conflicting interests, try to influence the decisions of a single principal. More specifically, the issue of efficiency - which is the crucial one for the purposes of this paper - has been particularly well addressed in these common agency games[3], in its most general form by Dixit, Grossman and Helpman (1997) (henceforth cited as DGH, 1997). Given these

[1] A survey of both strands of literature can be found in Bertola (2000).

[2] As emphasized by Atkinson (1997, p. 316), "[it seems] important to see how far the findings depend on whether the outcome is governed by the preferences of the median voter, or by the ideology or preferences of political parties, or by political pressure from different interest groups (...). There has been relatively little research by economists which has set side by side different possible explanations of income redistribution".

[3] Unlike most principal-agent setups, common agency games present a non-trivial efficiency issue even under perfect information, as they raise the question of whether an efficient allocation of resources can be achieved when the several principals act in a noncooperative way.

considerations, the common agency framework seems adequate for this paper.[4]

However, the results of the common agency literature might indicate a clear-cut answer to the question of the efficiency of the political equilibrium under the interaction of pressure groups: the main result of DGH (1997) states that if principals behave truthfully (in the sense of revealing their true preferences, and hence paying to the agent in the form of contributions all they are possibly wiling to give in exchange for the agent's decision), then the equilibrium of the common agency game is efficient. Moreover, such truthful behavior is shown to be optimal from the principals' standpoint, in a well-defined sense. This key result appears in most of the politico-economic models that apply the common agency approach[5], and even models that obtain inefficiency results do so by abandoning the notion of truthful behavior (e.g. Besley and Coate, 2001).[6]

This remarkable result could lead us to conclude that the interaction of pressure groups will result in an efficient allocation, and therefore this could not be a channel of influence of wealth distribution on economic efficiency.[7] This paper argues that this is *not* the case. We claim that, if a productive activity is explicitly modeled - and its consequences fully accounted for, especially in terms of a distinction between available resources before and after production is consumated -, the result of efficiency of truthful equilibria only holds under some mechanism by which principals could perfectly commit to announced contribution schedules, or a perfect credit market which allowed principals to have access to resources that would only be available in the future. When this is not the case, the resulting allocation might be inefficient, as political and productive activities compete for resources. This is so because the agents who will "specialize" in lobbying are precisely those who have comparative advantage in

[4] A different way by which a purpose similar to ours - namely, the relation between distribution and efficiency in a setup where the decision on the composition of government expenditures is subject to the influence of lobbying- has been pursued is in the context of a signaling game (Esteban and Ray, 2000). Specifically, lobbying might help revealing to the government each individual's productivity, which is not observable. This approach, however, is not suitable to model lobbying by pressure groups, which is what we are focusing on here. In addition, the results emerge from the imperfect information setup, whereas the results to be presented in this paper hold even under perfect information.

[5] For instance, DGH (1997) and Dixit (1996), on tax rate decisions, or Grossman and Helpman (1994, 1995a, 1995b), on trade tariffs.

[6] "Bernheim and Whinston (1986), Grossman and Helpman (1994), and DGH (1997) have all argued that we should expect equilibria with truthful contribution schedules to be played. At the end of the day, however, they do not offer an account of the decision making process which guarantees convergence to these equilibria" (Besley and Coate, 2001, p. 79, our abbreviation). We feel that those authors' arguments on why to expect truthful behavior are persuasive: the fact that truthful contribution schedules are always a best response (which implies the existence of truthful equilibria), the fact that they are the only coalition-proof equilibria, and the fact that they might be focal in the set of equilibria due to the very fact that they might lead to efficiency.

[7] It is important to notice that this efficiency result recognizes the government (the agent in the application of common agency to the modeling of the interaction of pressure groups) as one of the players, hence it does not identify political contributions as deadweight loss. This differs from what is usually done in the literature on rent-seeking. In this sense, our paper differs from another attempt to relate distribution and efficiency in a lobbying model, that of Rodriguez (1999), which follows this rent-seeking literature.

this activity, being relatively less productive, and the principal's decision will be distorted.

Applying this result to our particular interest, the interplay of wealth distribution and economic efficiency, we present a model in which two pressure groups, defined by the initial wealth distribution ("rich" and "poor") in the presence of technological nonconvexities, seek to influence the composition of governmental expenditures. We are able to reach some conclusions that differ from those usually obtained in the existing literature. When compared to the models with capital-market imperfections, we obtain an additional inefficiency, directly linked to the political process, beyond the one that results from the imperfections themselves. In this sense, wealth distribution can have an even larger impact on efficiency, as it sets in motion the conflict between pressure groups. To put it in other terms, the inefficiency could arise not only because a poor individual might not be able to pay for the education that he or she would otherwise pursue, but also because government expenditures on education might be distorted as a result of the lobbying activity. When compared to the politico-economic models, our results differ in that they do not stem from an intrinsic inefficient feature of redistribution, rather being a consequence of the political process itself.

Moreover, there are two new effects that do not appear in the usual literature. The first of them, which we dub the "efficiency effect", is due to the fact that the policy variable has a direct productive impact, which means that changes in the wealth distribution also change the efficient composition of public expenditure, hence the optimal decision on the policy variable. The second effect, which we label the "coordination effect", is due to the impact of wealth distribution on the size of the groups and their ability to coordinate as such, as in the well-known Olsonian view of pressure groups (Olson, 1965), which affects the political equilibrium. We also show that these effects can lead to ambiguity in the direction of the impact of changes in wealth distribution on efficiency: an increase in the proportion of poor agents (i.e. agents who are restricted in terms of their productive capacity) might even improve efficiency in a well-defined sense, under some circumstances.

To achieve the twofold purpose of extending the literature on common agency, and the literature on wealth distribution and economic performance, the paper is divided as follows: Section 2 presents a formal model of common agency, and extends it to explicitly model a productive activity, showing how the efficiency results are changed; Section 3 presents the model of interaction of pressure groups defined by the wealth distribution, trying to influence the composition of government expenditures; Section 4 concludes.

2 The efficiency of truthful equilibria of common agency games in a production economy

Let us start with the common agency problem exactly as defined by DGH (1997), within a context of perfect information. After all, the question being addressed is whether an efficient allocation can be achieved in a common agency setup abstracting away informational problems. Let there be a (finite) set L of principals - pressure groups, for instance - in which every principal $i \in L$ has continuous preferences denoted by $U_i(\mathbf{a}, c_i)$, where $\mathbf{a}$ is the vector chosen by the agent - e.g. the policy-maker. Principals wish to influence this choice, and c_i is a scalar that stands for the payment made with that purpose by principal i to the agent. It is assumed that U^i is decreasing in c_i. The agent has continuous preferences $G(\mathbf{a}, \mathbf{c})$, where $\mathbf{c}$ is the payment vector, and G is assumed to be increasing in each component of $\mathbf{c}$. In words, the agent enjoys being paid, while the principals do not like to make contributions. Principal i chooses a payment schedule $C_i(\mathbf{a}) \in C_i$, which maps every possible action $\mathbf{a} \in A$ into a contribution to the agent. Sets C_i and A represent institutional and feasibility constraints on possible choices, and it is assumed that $C_i \in C_i$ implies that $C_i(\mathbf{a}) \geq 0$ for every $\mathbf{a} \in A$, and also that if $C_i \in C_i$ then any C_i^* such that $C_i^*(\mathbf{a}) \geq 0$ and $C_i(\mathbf{a}) \geq C_i^*(\mathbf{a})$ for every $\mathbf{a} \in A$ also belongs to C_i. That simply means that payments must be nonnegative, and that any (nonnegative) payment smaller than some feasible payment must also be feasible.

Having those definitions, the analysis focuses on a two-stage game: in the second stage, the agent chooses the optimal action given the payment functions chosen by each principal, which were defined noncooperatively in the first stage, taking account of the agent's eventual response. Subgame perfection, however, leaves room for a large multiplicity of equilibria, as noted by DGH (1997, p. 757). Therefore a refinement is called upon, and the analysis focuses on *truthful Nash equilibria*, i.e. equilibria in which every principal offers a truthful payment schedule, as previously informally described. In the present context that translates into the following formal statement:

Definition 1 *A payment schedule $C_i^T(\mathbf{a},u_i^*)$ is truthful relative to a constant u_i^* if $C_i^T(\mathbf{a},u_i^*) \equiv \min\{\overline{C_i}(\mathbf{a}), \max[0, \varphi_i(\mathbf{a}, u_i^*)]\}$ for every $\mathbf{a} \in A$, where φ_i is defined by $U_i[\mathbf{a}, \varphi_i(\mathbf{a}, u_i^*)] = u_i^*$ for every $\mathbf{a} \in A$, and $\overline{C_i}(\mathbf{a}) = \sup\{C^i(\mathbf{a}) | C_i \in C_i\}$.*

That means that principal i will give the compensating variation (φ_i) to the agent, provided that this payment be feasible.

The fundamental result of the common agency literature, due to Bernheim and Whinston and generalized by Proposition 4 in DGH (1997, p. 761), establishes the Pareto efficiency of truthful Nash equilibria, and it will be helpful to go through the argument that underlies its proof[8]. Assume there were a policy vector $\mathbf{a}^*$ and a payment vector $\mathbf{c}^*$ that Pareto-dominated the truthful equilibrium

[8] The heuristic argument is provided by DGH (1997). In order to get a formal proof, however, one must refer to Dixit, Grossman and Helpman (1999).

pair of $\{\mathbf{a}^0, \mathbf{C}^0\}$(with respect to utility levels u_i^0). As principal i must be at least as well off as in equilibrium, and once payments reduce its utility, it must be the case that $c_i^* \leq C_i^T(\mathbf{a}^*,u_i^0)$, for this is by assumption a truthful schedule. Hence the agent cannot strictly prefer $\mathbf{a}^*$ and $\mathbf{c}^*$ to the equilibrium values, following a revealed preference logic: once $\mathbf{a}^*$ and $\{C_i^T(\mathbf{a}^*,u_i^0)\}_{i\in L}$ were available, yet he chose $\{\mathbf{a}^0, \mathbf{C}^0\}$, then he must not prefer the former to the latter. Given that $c_i^* \leq C_i^T(\mathbf{a}^*,u_i^0)$, it follows that he also does not prefer $\mathbf{a}^*$ and $\mathbf{c}^*$ to the former, for his utility is increasing in each principal's payment. It must therefore be true that the strict inequalty that is required to characterize Pareto-dominance is valid for some principal i: some of the principals must strictly prefer $\mathbf{a}^*$ and c_i^* to the equilibrium values. This would mean, however, that such principal would not be optimizing in equilibrium: he could have offered c_i^* in exchange for $\mathbf{a}^*$, and the agent would have accepted, for he would still be receiving the truthful contributions $C_j^T(\mathbf{a}^*,u_j^0)$ from every other principal j (and $C_j^T(\mathbf{a}^*,u_j^0) \geq c_j^*$, as was seen above). This means that $\{\mathbf{a}^0, \mathbf{C}^0\}$ was not an equilibrium, and this contradiction establishes the Pareto efficiency of truthful equilibria.

Let us now assume that the common agency game takes place in a production economy: the agent's choice affects the principals ' production function, Ψ_i, and individual utilities depend on this function's (scalar) output. The production technology also uses as an input the resources directly invested by each principal, which will be denoted k_i. Therefore our setup may be summed up as follows: each principal has continuous preferences $U_i[\Psi_i(\mathbf{a}, k_i), c_i]$, which are increasing in Ψ_i and in k_i and satisfy the Inada conditions; the agent has continuous preferences $G[\mathbf{a}, \mathbf{c}; \mathbf{\Psi}(\mathbf{a}, \mathbf{k})]$, where $\mathbf{\Psi}$ is the vector of production outputs and $\mathbf{k}$ is the vector of k_i. The main point to bear in mind is that the existence of a productive activity stresses the importance of *time* in the common agency game: the resource availability at the end of the production process is not the same as at its start, and this availability influences the outcome, as well as it depends on it.

In order to capture this point, it is convenient to rewrite the common agency problem in a generalized framework, as a *three-stage game*, rather than the two stages in which it is usually modeled. More specifically, we shall consider that: at stage one, principals announce payment schedules $C_i(\mathbf{a}) \in C_i$, just as usual; at the second stage, the agent chooses a policy vector $\mathbf{a} \in A$, and the principals decide how much they will pay simultaneously to the implementation of the chosen policy, c_i^s; finally, principals decide how much will be paid at the end of the game, c_i^d. In other words, it is possible to pay part of the contribution immediately while postponing some of it, at each principal's discretion, therefore potentially deferring effective payments. Production takes place between the second and third stages. Let us now define formally the strategic form of the *generalized common agency game* as follows:

Definition 2 *The strategic form of the generalized common agency game is* $\Gamma \equiv \{N, (S_i)_{i\in N}, (u_i)_{i\in N}\}$ *such that*

(i) $N = L \cup \{j\}$, *(set of players, where* L *is the set of principals and* j *refers to the agent)*

(ii) $u_i = U_i[\Psi_i(\mathbf{a}, w_i - c_i^s) - c_i^d], i \in L$, $u_i = G[\mathbf{a}, \mathbf{c}^s + \mathbf{c}^d; \mathbf{\Psi}(\mathbf{a}, \mathbf{w} - \mathbf{c}^s)], i = j$, *(payoffs)*

(iii) $S_i = C_i \times \Re_+ \times \Re_+, i \in L$, $S_i = A, i = j$, *(strategy spaces).*

It is being assumed, for the sake of simplicity, that each principal's utility depends on its consumption, which turns out to be output minus the contribution paid at the end of the game. Output depends on the action chosen by the agent and on invested resources, which consist of total resources available at the start of the game, w_i, minus second-stage payments[9] - therefore credit markets, where principals could have access to resources beyond their initial availabilities, are being ruled out. Consumption takes place only at the end of the game, and it is also assumed that there is no discounting whatsoever.

To check how the existence of production may alter the outcome of the common agency game, let us first assume there is *perfect commitment by the principals*, meaning that each principal can somehow commit to the announced payment schedule in a credible manner. It may be formally stated by imposing $c_i^s + c_i^d = C_i(\mathbf{a})$ for every possible $\mathbf{a}$ chosen by the agent, which shows that the latter is indifferent between being paid in the second or in the third stage - after all, its utility function implies that the agent cares only about total contributions, at least directly. The point is that the set of feasible contributions is conditioned by the possibility of paying *after* production: the maximal feasible payment by principal i is its total output in case the agent chooses the action that maximizes such principal's utility and all of the resources initially available are invested in production, or simply $\overline{C}_i(w_i) \equiv \Psi_i(\overline{a}_i, w_i)$, where $\overline{a}_i \equiv \arg\max_{\mathbf{a} \in A} \Psi_i(\mathbf{a}, w_i)$. Given that payments can be made after production - and also given that the principal's utility is increasing in Ψ_i, which is increasing in k_i -, it is thus optimal that principal i invest w_i on the production function, or equivalently, $c_i^s = 0$ in any subgame-perfect Nash equilibrium. This in turn implies that w_i may be considered parameters in the utility functions, which can thus be written as $U_i(\mathbf{a}, c_i)$ and $G(\mathbf{a}, \mathbf{c})$: this is precisely how they appear in DGH (1997). It is then possible to directly apply their Proposition 4, and one is led to conclude that *truthful equilibria lead to Pareto-efficient allocations in generalized common agency games with perfect commitment by the principals with respect to announced payment schedules.* In fact, all that production does within a perfect commitment framework is to define the set of feasible contributions, C_i.

Let us now consider the case in which there is no such perfect commitment. Proceeding by backward induction in Γ, it is straightforward to see that a subgame-perfect equilibrium necessarily involves $c_i^d = 0$: once the policy chosen by the agent has been implemented, principals have no incentive whatsoever to make any further payment, for it would decrease their utilities. Any promise of a strictly positive c_i^d would not be credible, and the agent will take account of that by demanding that payments be made simultaneously to policy implementation.

[9] It is being assumed here that there is no storage technology allowing resources to be kept by the principals between stages two and three, without being invested. This assumption is not essential to any result, while making the analysis a lot simpler

This means that payments must be made *before* production, and that affects the amount of resources available for those payments and for productive investment, as all of them must come from the total each principal possesses at the start of the game, w_i. Formally, we have $\overline{C}_{i\prime}(w_i) \equiv w_i$, which defines a new feasible set $C_{i\prime}$, and the utility functions must be now written as $U_i[\Psi_i(\mathbf{a}, w_i - c_i^s)]$ and $G[\mathbf{a}, \mathbf{c}^s; \mathbf{\Psi}(\mathbf{a}, \mathbf{w} - \mathbf{c}^s)]$. Simply assuming that $w_i < \Psi_i(\overline{a}_i, w_i)$, which amounts only to assuming that producing makes sense - if that were not true it would be better to consume the initial resources[10] -, then $C_{i\prime}$ is a proper subset of C_i. A careful analysis of the aforementioned heuristic argument behind the proof of Proposition 4 of DGH (1997) shows that this suffices to break the proposition's validity as a fully general result: it could be the case that there were $\mathbf{a}^*$ and $\mathbf{c}^*$ such that $C_i^T(\mathbf{a}^*, u_i^0), c_i^* \in C_i$ and $C_i^T(\mathbf{a}^*, u_i^0), c_i^* \notin C_{i\prime}$, for some $i \in L$, so that the revealed preference argument would lose its validity. To put it another way, the absence of perfect commitment reduces the set of feasible payments: there may be a feasible allocation which Pareto-dominates the equilibrium one, but which is not feasible in the restricted set generated by such absence. The relevant set for efficiency analysis, however, is C_i, for it is the one which embodies the technological production possibilities of the economy.

Moreover, the above discussion shows that it is possible to think of total contributions, $c_i = c_i^s + c_i^d$, as being the relevant decision variables, for one of its components will always be zero in equilibrium, regardless of which of the two cases is being analyzed - that is precisely what allows the equilibrium to be characterized just as it is in DGH (1997). One can see then that going from a perfect commitment setup to one in which such commitment is absent will change the utility function $U_i[\Psi_i(\mathbf{a}, w_i - c_i^s) - c_i^d]$, if it is thought of as a function of total contributions, and this may also change the result of individual optimization. Therefore *truthful equilibria may not lead to Pareto-efficient allocations in generalized common agency games without perfect commitment.* Once the time-production binomial is fully considered, the absence of perfect commitment changes the set of feasible payments in a way such that the new set is a proper subset of the other, and also leads to a different equilibrium regardless of the set of constraints[11].

What is really crucial to the above result is the impossibility of having access to produced resources before engaging in the productive activity. In this sense, *the existence of perfect credit markets could play the role of perfect commit-*

[10] This interpretation is not precise in the present context, for it is being assumed that it is impossible to store initial resources. However, that would make this latter assumption far more crucial than what we want it (or need it) to be.

[11] Another question could be one of how important the full account of the consequences of a productive activity is in obtaining those results. Could one arrive at them by simply introducing the effective timing of payments that was described, which obviously differs from the usual common agency framework? To check for this it suffices to consider the identity function as the production function (which is equivalent to actually ruling out production), assuming for the sake of simplicity that the agent's action is a consumption transfer a_i to each principal i. In this case the set of feasible payments obviously remains intact, and utilities (as functions of c) are now given by $U_i(a_i + w_i - c_i)$. Therefore the principals face the same problem in both situations, and the solutions must be the same. That shows that the presence of a productive activity is actually what gives rise to our result.

ment in the preceding argument: it would allow for the anticipation of future resources. The inefficiency of truthful equilibria of the common agency game could thus be associated with some kind of credit-market imperfection. It should be noted, however, that perfect credit markets require perfect commitment between borrowers and lenders, in the sense of perfect enforcement of contracts. That actually reveals the very nature of the inefficiency under analysis: it is linked to some institutional failure giving rise to a problem with contract enforcement, either within credit markets or between principals and agent. In other words, such inefficiency essentially results from a problem of incomplete contracts.

3 Distribution, pressure groups and efficiency

Having defined the generalized common agency game to encompass the existence of production, and having explored the possible consequences of such extension in terms of efficiency, let us now make use of this framework in order to investigate the impact of distribution on efficiency when the political process is modeled as an interaction of pressure groups trying to direct the composition of government expenditures.

3.1 The model

3.1.1 Individuals and Production

We model an economy that exists for a single period, with a continuum of individuals forming a population of size one. These individuals are identical but for their initial wealth, which is distributed according to the following: a proportion p of the population has initial wealth $\underline{w}$, while the remaining $1-p$ is endowed with $\overline{w}$, where $\underline{w} < \overline{w}$, as in Bourguignon and Verdier (2000) or Acemoglu and Robinson (2000). There is a single good, whose initial endowment may be either invested as capital or given to the government as political contribution, as will be seen shortly[12], and production occurs by means of atomistic projects with inelastic and unit labor supply, according to the following production function:

$$\Psi(k,g,s) = \begin{cases} A(g+\alpha s)^a k^{1-a}, k > k^* \\ Bs^a k^{1-a}, otherwise \end{cases} \quad (1)$$

where g and s are two types of government expenditures, k stands for capital, $0 < \alpha < 1$, $0 < a < 1$, $A\alpha^a > B$ (which means that, if given the option, individuals will prefer to use the first specification). Capital markets are assumed to be nonexistent. The presence of the exogenous k^* represents a nonconvexity of the production set, and as a result gives rise to the possibility of two classes, which will be called "rich " and "poor", defined by initial wealth distribution: agents who have the possibility of investing at least k^* will have access to a

[12] We are keeping the assumption of impossibility of storage, in line with the discussion in the previous section.

more productive technology, while those who have not will have to settle for a less efficient one; once there are no capital markets, investment is limited by initial wealth.

Each individual derives utility only from its consumption, and lives for a single period. Within this static framework, its objective will be to maximize disposable income, which will be totally consumed. Therefore the utility function of a rich (poor) individual can be written simply as $u_R(k_R, g, s) = \Psi_R(k_R, g, s)$ ($u_P(k_P, g, s) = \Psi_P(k_P, g, s)$), as given by (1).

As for the government expenditures, the production function allows for a fundamental role of such expenditures (as in Barro, 1990) - constituting what could be called "public capital "[13] -, but with the distinctive fact that there are different types of expenditures, according to their impact on production: while g is useful only to the rich, s is more beneficial to the poor (given the assumption on α). This is precisely what gives rise to conflicts of interests between classes within the model, and is meant to stand for the fact that there are many types of expenditure that are grasped by the richest strata, and some other types that are more useful to the poor even though they can be utilized by the rich (Ferreira, 1995). Public healthcare expenditures may exemplify the latter, while many types of subsidies could illustrate the former.[14] What is important, however, is that the existence of these two types of expenditures means that *the decision on the composition of total government expenditures is actually a decision on redistribution.*

3.1.2 Political process

First we assume that the two classes actually exist - those individuals with initial wealth $\underline{w}$ are the poor, and those endowed with $\overline{w}$ are the rich.[15] Moreover, they are articulated as pressure groups, trying to influence the government's policy decision concerning the choice between the the two aforementioned types of expenditure by means of political contributions: each group promises to pay some amount to the government, varying with the policy choice ($\mathbf{a} = \{g, s\}$). These contributions actually stand for a plethora of real-life practices, such as money (or time) devoted to campaign contributions, or pure bribery, among many others, as in Grossman and Helpman (1994). We also assume that individuals can only influence government behavior through this channel if they are part of an organized pressure group: each individual perceives itself as too small to influence policy decisions (Grossman and Helpman, 1994). In line with last section, we will also assume that there cannot be perfect commitment to the announced contribution schedules: there is no way by which either the rich or

[13] This denomination is inspired by Ferreira (1995), but here it actually represents a somewhat different concept, as that paper stresses the existence of a *single* type of government expenditure that is more needed by the poor than by the rich

[14] We will later consider the polar case in which $\alpha = 0$, possibly representing policies actually focused to the poor.

[15] This assumption, in the present context, amounts to assuming $\underline{w} < k^*$ and $\overline{w} > k^* + C_R(g^0)$, where $C_R(g^0)$ is the equilibrium contribution of a rich individual, as will soon be defined.

the poor can credibly promise to meet their announced political contributions after the government has implemented its decision. As we have seen, this implies that contributions must be paid *before* production, hence resources available to productive investment must be net of such payments.

As for the government, we assume that contributions enter directly into its utility function. With that respect, one can also see a major advantage of the common agency approach to modeling lobbying. The point is that it allows for a shortcut through which one can take account of part of the discussion concerning the capability of coordination of groups of agents with common interests[16], without explicitly modeling their formation: one may attach weights to each group's contribution in the government's utility function, representing a given group's relative ease of organization by a greater weight. In fact, the usual argument in that discussion states that smaller and less disperse groups have a higher probability of actually being formed, due to transaction costs and to the problem of free-riding, and this could be represented by letting these weights depend on each group's size. Within the present context, where the group of the poor (rich) has size p $(1-p)$, we can define these weights as $\lambda_P(p)$ and $\lambda_R(p)$, where $\lambda\prime_P(p) < 0$ and $\lambda\prime_R(p) > 0$, in order to capture this idea. The government, however, takes into account more than only political contributions: it is also supposed to worry about social welfare. That is just meant to capture the fact that actual political processes are not limited to pressure groups' interaction, as they also include more "democratic" channels that should be influenced by the effect of the government's decisions on the welfare of the majority.

All these features may be expressed, drawing upon Grossman and Helpman (1994), by modeling a government that maximizes the following objective function:

$$G = x\left[\lambda_R(p)(1-p)C_R(g,s) + \lambda_P(p)pC_P(g,s)\right] + (1-x)[(1-p)\Psi_R(g,s,C_R(g,s)) + p\Psi_P(g,s,C_P(g,s))]$$

where $C_j(g,s)$ is the political contribution from an individual member of group j as a function of the composition of government expenditures, which we shall assume to be continuously differentiable, and $x \in [0,1]$ is the weight attached to contributions *vis-à-vis* social welfare (considering for simplicity a Benthamite welfare function in which every individual has the same weight[17]). The individual's income $\Psi_j(g,s,C_j(g,s))$, as we have argued, stands for the utility function of an individual member of group j - which depends negatively on contributions because of the absence of perfect commitment (or credit markets). The government thus maximizes a convex combination of social welfare and political contributions from pressure groups, pondered by the latter's ease of effective organization. It is finally assumed that the government is subject to a balanced budget constraint:

$$\tau\left[(1-p)\overline{w} + p\underline{w}\right] = (1-p)g + s$$

[16]The classic reference here is Olson (1965).

[17]It should be pointed out here that such assumption implies that there is no social inequality-aversion.

where τ is an exogenously given tax rate on initial wealth. This restriction implies that s may be expressed as a function of g, so that the balanced budget constraint may be substituted into the government's objective function so that the government's problem may be summed up by the maximization of:

$$G = x\left[\lambda_R(p)(1-p)C_R(g) + \lambda_P(p)pC_P(g)\right] + (1-x)\left[(1-p)\Psi_R(g, C_R(g)) + p\Psi_P(g, C_P(g))\right] \quad (2)$$

Assuming perfect information, the problem is therefore written exactly as a generalized common agency game - where pressure groups are the principals, and the government is the agent - and its solution may be obtained as such.

3.2 Results

3.2.1 Efficiency of truthful equilibria

Let us now present the efficiency properties of truthful Nash equilibria within the model introduced in the last subsection. First let us characterize the efficient allocation[18], which will serve as a benchmark for comparisons with the political equilibrium allocation. This can be done with the following proposition:

Proposition 3 *A Pareto-efficient allocation $\{k_R^*, k_P^*, g^*, s^*\}$ must have*

$$\frac{k_R^*}{g^*+\alpha s^*} = \left[\frac{p}{1-\alpha(1-p)}\frac{B}{A}\right]^{\frac{1}{1-a}} \frac{k_P^*}{s^*}. \quad (3)$$

The expressions $\frac{k_R^*}{g^*+\alpha s^*}$ and $\frac{k_P^*}{s^*}$ represent what may be called the private-public capital ratios of the rich and the poor, respectively: how many units of private capital are invested per unit of public capital obtained by a given individual. Proposition 3 says that those ratios must be related in a precise manner in order to obtain an efficient allocation. The term $\frac{p}{1-\alpha(1-p)}$ is equal to $\frac{p(1-p)}{(1-p)[1-\alpha(1-p)]}$, which is exactly the ratio between the marginal cost to the group of the poor of an increase in the rich-specific type of expenditure g (i.e. a change of the composition of government expenditures) and its marginal benefit to the group of rich. The term $\frac{B}{A}$ gives a measure of the productive efficiency of the poor relative to that of the rich. Therefore an efficient allocation must equate one group's marginal cost to the other's marginal benefit, taking into account their relative efficiency on production.

On the other hand, the efficiency of (truthful) political equilibria may be characterized as follows:

Proposition 4 *(i) A feasible allocation $\{k_R^0, k_P^0, g^0, s^0\}$ is a truthful equilibrium only if*

[18] What we are calling an "efficient allocation" takes as given the fact that there are some individuals that are restrained in their productive possibilities, to a worse technology, given the absence of credit markets in which they could possibly have access to k^*. We could otherwise consider the outcome with perfect credit markets as being the efficient one, and our present notion of efficiency would be a second best. More on this will come later.

$$\frac{k_R^0}{g^0+\alpha s^0} = \frac{\lambda_P(p)}{\lambda_R(p)} \frac{p}{1-\alpha(1-p)} \frac{k_P^0}{s^0} \quad (4)$$

(ii) Such allocation is almost always Pareto-inefficient.

The intuition behind equation (4) is analogous to the one behind equation (3): a political equilibrium equates marginal costs and benefits, only that now what is taken into account is the groups' relative efficiency on lobbying. As far as the general efficiency properties of the political equilibrium are concerned, a first point can be made by the following result:

Corollary 5 *If both groups have the same articulation power ($\lambda_P(p) = \lambda_R(p)$), then a truthful equilibrium allocation is always inefficient.*

As this case is absolutely identical to the model presented in the last section, it provides a counterexample proving that the inefficiency that was then noted as possible may actually emerge in a common agency game without perfect commitment.[19] It can thus be said that the restriction on the Pareto-efficiency of truthful equilibria that is imposed by the absence of perfect commitment can actually be binding.

The inefficiency under analysis is *not* the one related to the absence of credit markets and the productive nonconvexity, as is usual in the literature. Indeed, what we call an efficient allocation actually takes as given the fact that some agents are constrained to a less productive technology. If our benchmark is the case in which all agents have access to the best technology available, the equilibrium allocation is not even the constrained optimum: there is an additional inefficiency *linked to the political process.* As a matter of fact, we have two levels of inefficiency: the first one generated by the existence of individuals who are constrained to a worse technology, the second one deriving from the fact that not even the constrained (to the first level) optimum is attained, because of the political inefficiency. This second level is the distinctive feature of our model: our point is that not only is there an inefficiency due to the fact that the poor cannot afford to pay for the level of private education that would make them more productive, for instance, but there is also another inefficiency due to the fact that the government will not provide them with the optimal level of public education.

In order to further analyze the nature of the inefficiency, let us first note that it can be measured by the absolute value of $\theta \equiv \left[\frac{p}{1-\alpha(1-p)}\frac{B}{A}\right]^{\frac{1}{1-\alpha}} - \frac{\lambda_P(p)}{\lambda_R(p)}\frac{p}{1-\alpha(1-p)}$, which is exactly the difference between the private-public capital ratio of the rich (relative to the poor's) in the efficient allocation and in the political equilibrium. Let us also define the political equilibrium as "poor-friendly" if $\theta < 0$, and "rich-friendly" otherwise. Such definition refers to the

[19] It is easy to check that introducing perfect commitment in our model actually leads to an efficient allocation if $\lambda_P(p) = \lambda_R(p)$, which is a mere application of the result due to DGH (1997), but can also be verified by an argument identical to the one used in the proof of Proposition 4. The result with perfect commitment may be inefficient if we consider $\lambda_P(p) \neq \lambda_R(p)$, but that would be trivial in that such inefficient would be generated simply by "corrupt " government behavior.

fact that in the former case the poor have more units of public capital per unit of private capital in equilibrium than would be efficient, while such advantage belongs to the rich in the latter case.

It is interesting to note that if we are in the case of $\lambda_P(p) = \lambda_R(p)$, i.e. both groups have the same articulation power, then we have a poor-friendly equilibrium. To put it another way, if the poor can organize themselves as effectively as the rich, the allocation of public expenditures that comes out of the political equilibrium will be more beneficial to them than the efficient one. This sounds somewhat surprising - for it means that a political system in which the government's decision-making is influenced by directing economic resources to the government turns out to be relatively beneficial to the poor -, and therefore requires a closer scrutiny.

The point is one of comparative advantages: $\lambda_P(p)$ and $\lambda_R(p)$ represent each group's "political productivity", i.e. their effectiveness in lobbying the government. That means each group will tend to "specialize" (not totally, due to decreasing returns to both types of capital) in the activity in which it has comparative advantage.[20] As the rich have an absolute advantage in production (by definition of the model), it would take an absolute advantage in lobbying large enough so as to compensate for the former and generate comparative advantage in the political activity. Otherwise it will be the poor who will be specializing in lobbying, and that will push the political equilibrium towards them. It could be the case in practice, however, that the rich turn out to be a smaller and less disperse group - which in our model would translate into $\lambda_P(p) < \lambda_R(p)$ -, and this difference could be enough to generate a "rich-friendly" equilibrium.

In any case, this throws light on the nature of the inefficiency in the model. To see this, let us note that a first intuitive explanation for the inefficiency result in a common agency setup could be that, as there is no perfect commitment nor credit markets, lobbying will bias the political equilibrium towards those who have more resources to pay political contributions, not those who have the highest-return projects.[21] Our model shows that this is not the case: the political equilibrium will be biased precisely towards those who have a comparative disadvantage in production. In other words, the impossibility of disentangling production and political contributions will introduce a bias towards those who are *less* productive at the margin: it is not that the political equilibrium *might* not benefit those with the highest-return projects, it *will* be driven precisely by those who are relatively less efficient in production.

It should also be stressed that what is being meant by an efficient allocation does take into account the role of the government as a player: resources used as political contributions are not being considered a deadweight loss, as is usual

[20] This can be seen in (4) by checking that $\lambda_j(p)$ is inversely related to the capital that is privately invested by members of group j, and is therefore directly related to their political contribution.

[21] This is what happens, for instance, in the paper by Acemoglu, Aghion and Zilibotti (2002), in which the association of lobbying and credit constraints leads to a situation in which "richer agents can pay greater bribes and have a greater influence on policy" (p. 37).

in the literature on rent-seeking.[22] The inefficiency that arises in our model is due to the fact that lobbying distorts the incentives on production, for it is an activity that competes for resources with the latter. As a result, the composition of government expenditures, which have a productive role, ends up being distorted. If there were perfect commitment, it would be possible to keep both activities apart from one another, and what would prevail would be perfectly analogous to the outcome of the common agency game without production. Without commitment, the two cannot be disentangled, and resource allocation ends up being distorted. Moreover, such inefficiency is not a mere consequence of "corrupt" government behavior: perfect commitment allows for an efficient outcome despite the fact that the government still likes to get contributions.

Another important aspect concerns the role of the assumption of nonexistence of credit markets. It has been mentioned that such assumption is closely linked to the inefficiency of truthful equilibria, for perfect credit markets could be perfectly substituted for perfect commitment - this is easy to see in the present model, without directly modeling the functioning of such markets, by introducing the notion of a small open economy that can borrow resources from abroad under an exogenous interest rate: the equilibrium outcome would be given by equation (3) (once again, provided that $\lambda_P(p) = \lambda_R(p)$). In our model, however, it is even more crucial, for it lies behind the very existence of the two pressure groups: if there were a credit market, the poor could borrow so that they could have access to the better technology, and the whole discussion would miss any point.

It may also be noted that this political inefficiency does not depend on the weight that the government attaches to political contributions *vis-à-vis* social welfare - as long as this weight remains strictly positive -, which can be seen from the fact that x does not appear in either (3) or (4). This remark reinforces the observation that the inefficiency stems from the mere existence of lobbying, in the absence of perfect commitment or credit markets. In this sense, it does not depend on how "democratic" the political process turns out to be.[23]

As a final note on our results, let us point out that they remain valid in the case of expenditures focused to the poor ($\alpha = 0$): it is easy to show that the political equilibrium would feature

$$\frac{k_R^0}{g^0} = \frac{\lambda_P(p)}{\lambda_R(p)} \frac{k_P^0}{s^0} \tag{4'}$$

while the efficient allocation would require

[22] To use the terminology of Esteban and Ray (2000), our model features "allocational losses". But if one is willing to think of political contributions as being socially wasteful, our model also features the conventional "conflictual losses" that are typical of rent-seeking models, for equilibrium contributions must be positive - if they were zero the government would be maximizing social welfare.

[23] Formally, this result stems from the envelope theorem: when the government considers the impact of a change in the composition of expenditures, the effect on the agents' welfare - the "democratic" component - vanishes because of the first-order condition for agents' optimization. This is clearly a consequence of the concept of truthful equilibrium.

$$\frac{k_R^*}{g^*} = \left[\frac{B}{A}\right]^{\frac{1}{1-a}} \frac{k_P^*}{s^*}. \qquad (3)$$

This shows that our result does not depend on the additive component of the production function (1), but solely on the existence of a decision on the composition of government expenditures.

3.2.2 Distribution and efficiency

Having characterized the inefficiency of the political equilibrium in a precise manner, let us now turn our attention to the impacts of wealth distribution on such inefficiency. Wealth distribution is fully described, in our model, by two parameters: p, the proportion of poor in the economy (or equivalently the relative size of the two groups), and $d \equiv \overline{w} - \underline{w}$, which can be thought of as a measure of inequality within the model. Let us now do some comparative statics concerning the effects of changes in d or p on θ. Starting with the former, it may seem at first that inequality has no impact on the magnitude of the inefficiency, as θ is not functionally dependent on d. This conclusion, however, depends crucially on the nature of such change in d, given the nonconvexity of the production set: a decrease in inequality that gives the poor access to the more productive technology, without leading the rich to become poor, takes the economy automatically to the efficient allocation, for any conflict of interests vanishes. Symmetrically, any increase in inequality that turns some rich into poor will lead to an inefficiency. It can thus be seen that the effects of changes in inequality are discontinuous: a marginal change can have a large impact if it happens to fit one of the above cases. This is a feature that our model shares with many imperfect-capital-markets models (Galor and Zeira, 1993; Banerjee and Newman, 1993) - as pointed out by Banerjee and Duflo (2000) -, which is obviously linked to the existence of the nonconvexity within a context of capital-market imperfections.

On the other hand, a significant change in inequality could have no effect whatsoever, and which case would prevail would depend on the initial point. In fact, *inequality will only lead to inefficiency as long as it leads to the formation of groups with antagonistic interests*, for it is the political interaction of such groups that generates a distorted allocation. It is the distributive conflict that is associated with inequality - and that manifests itself through the political process - what links it to a negative impact on economic performance. However, in our model this link does not stem from any inherent property of redistribution - contrary to what happens in the usual political economy literature (Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Bénabou, 2000): it could be the case that we had either more or less redistribution in equilibrium, in the sense that the poor could end up with more or with less public capital than what would be efficient. What happens here is that the political process itself gives rise to an economic cost, by distorting incentives to production. Inequality interferes with efficiency as long as it puts such process into motion, or stops it: it is the political mechanism itself what matters to economic performance.

We now turn to the impacts of changes in the relative size of the groups, which is captured by the parameter p. To this purpose, we will first state the following:

Lemma 6 *The effect of an increase in the proportion of poor in the economy on θ can be divided into:*

(i) efficiency-effect, $\frac{1}{1-\alpha}\left[\frac{p}{1-\alpha(1-p)}\right]^{\frac{a}{1-a}}\left(\frac{B}{A}\right)^{\frac{1}{1-a}}\frac{1-\alpha}{[1-\alpha(1-p)]^2}>0;$

(ii) political effect, with two components:

(ii) a) participation-effect, $-\frac{\lambda_P(p)}{\lambda_R(p)}\frac{1-\alpha}{[1-\alpha(1-p)]^2}<0;$

(ii) b) coordination-effect, $-\frac{p}{1-\alpha(1-p)}\left[\frac{\lambda_P\prime(p)}{\lambda_R(p)}-\frac{\lambda_P(p)}{\lambda_R(p)^2}\lambda_R\prime(p)\right]>0.$

The first effect embodies the impact of an increase in the proportion of poor on the efficient allocation: as the size of a given group increases, efficiency requires more public capital to be directed toward that group. Such an impact exists because the redistributive variable that is being decided within the political process actually plays a direct role in production. The second effect refers to the influence on the political equilibrium allocation: the participation-effect comes from the fact that an increase in a group's size leads to a larger influence on the political process, as a result of the larger number of individuals; the coordination-effect reflects the diminishing ease of coordination that comes with greater size, which tends to reduce the group's political power.

What each of these effects will mean in terms of efficiency, however, will vary according to whether the economy is at a poor-friendly or a rich-friendly equilibrium. This will happen not only due to the fact that the meaning of a change in θ depends entirely on the nature of the equilibrium - an increase of θ moves the economy closer to the efficient point if we are at a rich-friendly equilibrium, and the opposite holds at a poor-friendly equilibrium -, but also to the fact that the relative magnitude of the three effects will vary with it.

The key to understanding the last remark lies on a comparison between the efficiency and participation effects. These two have their influence linked to the term $\frac{p(1-p)}{(1-p)[1-\alpha(1-p)]}$, which we have already interpreted as the ratio of the marginal cost to the poor and the marginal benefit to the rich that are associated with an increase in g. The first effect goes through the impact of an increase in p on this ratio, pondered by relative productivity in production, while in the second it is pondered by relative productivity in lobbying. A rich-friendly equilibrium is precisely a situation in which the relative productivity of the poor is greater in production than in lobbying, which means that the efficiency-effect will prevail over the participation-effect. Conversely, the latter will tend to be dominant in a poor-friendly equilibrium, which is a situation in which the poor are relatively more productive in lobbying.[24]

[24] This dominance of the participation-effect will be verified provided that public capital is not too productive. This must be the case because in the efficient allocation the cost-benefit ratio will appear in a convex manner, while it appears linearly in the political equilibrium. This will give an extra-strength to the efficiency-effect that may counteract that tendency. That difference will appear because in the efficient outcome the decisions over public capital are separate from those over private capital, and the marginal productivity of the latter is a

As the coordination-effect goes in the same direction of the efficiency-effect, in a rich-friendly equilibrium the efficient allocation is pushed farther away from the political equilibrium in response to an increase in p. In a poor-friendly equilibrium, on the other hand, as long as private capital is productive enough the dominance of the participation-effect will also increase the distance between the two allocations, provided that the coordination-effect is not so great as to generate a total effect that goes in the opposite direction. Intuitively, in a rich-friendly equilibrium an increase in the proportion of poor will tend to make the political equilibrium more favorable to them, but will make efficiency require the allocation to be even more favorable: the overall effect will increase inefficiency. In the poor-friendly outcome, the change in participation will tend to make the political equilibrium more favorable to the poor, which will increase inefficiency, provided that the increasing difficulty in coordination of the poor does not end up causing the overall effect to go in the opposite way. The following proposition formalizes the above discussion, and therefore summarizes the qualitative results of an increase in the proportion of the poor concerning economic efficiency:

Proposition 7 *An increase in the proportion of poor in the economy will:*

(i) increase the inefficiency of the political equilibrium, if it is rich-friendly;

(ii) have an ambiguous effect on the inefficiency of the political equilibrium, if it is poor-friendly: it will increase it only if private capital is productive enough (relatively to public capital) and if the groups' ease of coordination is not too sensitive to their size.

This result once again sheds light on the importance of the political process in intermediating the effects of wealth distribution on economic performance: if it features a rich-friendly bias, then a negative impact of an increase in the proportion of poor on efficiency will be assured.[25] Moreover, what emerges here is a remarkable wealth of possible interactions between distribution and efficiency, which comes from the fact that the former affects both the efficient and the equilibrium allocations. One may point out that the most comprehensive case turns out to be similar to the typical results of the literature relating distribution and efficiency by means of capital-market imperfections (e.g. Galor and Zeira, 1993; Banerjee and Newman, 1993): the greater is the proportion of individuals subject to productive constraints due to their initial wealth, the less efficient is the economy. However, here this is closely related to the political process, and that is why its validity is not as general as usual: it is essentially the coordination-effect, which is peculiar to our model, the reason behind the ambiguous results in the poor-friendly case. Intuitively, in this case, if the groups'

convex function of the public-private capital ratio; in the political outcome those decisions are entangled, which leads to a linear behavior because of the linearity of the technology on both types of capital taken together. If public capital is not too productive, such extra-strength will not be enough to overshadow that tendency. Intuitively, the more important public capital is, the more it will have to vary in order to keep efficiency in response to a change in p, hence the greater will be the efficiency-effect.

[25] This is somewhat similar to what happens in Bénabou (2000), where the existence of wealth-bias within the political process is a necessary condition to many of the most important results obtained.

ease of coordination is too sensitive to their size, an increase in the proportion of poor may end up leading to greater efficiency, for it may cause the equilibrium to be less biased towards the poor.

As a general point, the model allows for a distinction between three different aspects of a political process based on the interaction of pressure groups trying to influence the composition of government expenditures: the productive characteristics of each group, its proportional size, and its ease of coordination. The literature on the political economy of redistribution and its links to economic performance usually take into account only the second of those aspects, the one we call participation-effect: it is the agents' "numerical" weight within the political system that is the essential mechanism linking distribution and efficiency. For instance, we can say that models such as those in Alesina and Rodrik (1994) or Persson and Tabellini (1994) are analogous to our poor-friendly equilibria, in which the participation-effect tends to increase inefficiency; while models such as Bénabou (2000) give room to the rich-friendly case, in which there is less redistribution in equilibrium than what would be efficient, and in this case the participation-effect runs in the opposite direction.

The two remaining effects, on the other hand, are directly related to our assumptions concerning the political system and the nature of the redistributive variable. The efficiency-effect comes precisely from the fact that the latter, the composition of government expenditures, has an essential role in production, besides being related to wealth distribution. The coordination-effect is obviously linked to the fact that the political process considers the existence of pressure groups. As both of these effects are opposite to the participation-effect, it is possible that our results be different from those that usually appear in the literature.

Anyway, as far as either the effects of inequality or those of the relative size of the groups are concerned, the links between wealth distribution and efficiency in our model are basically related to the proportion of individuals subject to productive restrictions. In this sense, if we think of the level of capital that separates the rich from the poor, k^*, is an absolute one, not being relative to the mean or median of the distribution, we are thus talking about the degree of *poverty* in the economy: the feature of the distribution that is actually relevant for efficiency is the poverty incidence index (also known as P(0)) (Foster, Greer and Thorbecke, 1984), which is exactly the proportion of poor in the economy. Thinking of k^* as a poverty line, the parameter p in the model is nothing but P(0). This is a subtlety that is widespread within the capital-market-imperfection literature: inequality matters for economic performance, which is how it is usually put, but only as long as it affects P(0). When this point is made, as in Esteban and Ray (2000), however, it serves as starting point for a discussion on the different effects of inequality in "rich" and "poor" economies.

This discussion may be rendered pointless within our framework - and, as a matter of fact, within models with production set nonconvexities - by making use of the concept of poverty as related to the access to "capabilities", as in Sen (1983): if production is thought of as being a "passport" to effectively taking part in the activities of one's community, which is one of the capabilities emphasized by this concept, one may regard the production set nonconvexity as actually establishing a poverty line in the economy, and a much less arbitrary one than usual. The threshold between the two technologies in the context of our model may be thought of, still following Sen (1983), as being absolute in the space of capabilities - for it represents the access to the relevant capability in an absolute manner -, while being relative (in time and in space) in the space of commodities. In this sense, what matters is the degree of poverty in the economy, but thinking of it in terms of a relative poverty line (in the space of commodities, which is where poverty lines are usually drawn) we can apply the model's results in similar fashion to economies with distinct degrees of development. Put another way, having access to a more productive technology can mean being able to afford a plough, or to acquire the level of education that allows one to master computer programming. Which one is the relevant allegory will depend on the context, but the overall idea still applies.

4 Conclusion

Our main idea is that modeling the political process as an interaction of pressure groups trying to influence the composition of government's expenditures to their advantage, instead of looking at it as a voting process, can actually affect the results in terms of the impact of wealth distribution on economic efficiency. First of all, we derive another way by which capital-market imperfections can build a link between distribution and efficiency: not only will some individuals be constrained in their productive efficiency by not having sufficient resources to have access to a better technology, but it may also be the case that the allocation of public resources ends up being distorted in the political process. Put another way, not only will the poor be unable to afford the private education that could make them more productive, but the amount of public education being supplied will not be optimal either. Moreover, the outcome is inefficient because the political process is biased towards those who are relatively inefficient in production, who for this reason tend to spend relatively more in lobbying. Specifically, it is not because those who have more resources contribute more, without being necessarily the most productive.

Second, the impact of a change in the distribution of wealth may also be affected. Our model implies that there are three distinct channels by which this impact could happen: first, by changing the efficient composition of public expenditure, in a setup in which such expenditure matters for production; second, by changing the relative size of the pressure groups; and third, by affecting their ability to actually coordinate as effective pressure groups. Only the second of these channels is taken account of by the traditional political economy literature on the impacts of wealth distribution on economic performance, and the presence of the other two might actually change the sign of that impact, under some possible circumstances (although not under the most plausible ones). Third, the inefficiency is not linked to some intrinsic distortionary feature of redistribution, but rather to the very nature of the political process based on political contributions, in the absence of perfect capital markets that could overcome the competition for resources between production and political activities.

All of these inefficiency results were obtained within a common agency framework in the spirit of Dixit, Grossman, and Helpman (1997), which might seem surprising in light of their result concerning the efficiency of allocations in common agency games. However, we have shown that this result does not hold when a production activity is explicitly considered, as long as there is no perfect commitment technology, or perfect credit markets. We feel that this can be used in other applications of the DGH (1997) framework.

5 Appendix

Proof. Proposition 3

The choice of g that maximizes the economy's output, given p and an amount of private capital for each group, k_R^* and k_P^*, is given by solving:

$Max_g \left\{(1-p)A(g+\alpha s)^a k_R^{*1-a} + pBs^a k_P^{*1-a}\right\}$.

The first-order condition is:

$a(1-p)A(g^*+\alpha s^*)^{a-1}k_R^{*1-a}[1-\alpha(1-p)] - pa(1-p)Bs^{*a-1}k_P^{*1-a} = 0 \Longrightarrow$ $[1-\alpha(1-p)]A(g^*+\alpha s^*)^{a-1}k_R^{*1-a} = pBs^{*a-1}k_P^{*1-a} \Longrightarrow$

$[1-\alpha(1-p)]A\left(\frac{k_R^*}{g^*+\alpha s^*}\right)^{1-a} = pB\left(\frac{k_P^*}{s^*}\right)^{1-a} \Longrightarrow \frac{k_R^*}{g^*+\alpha s^*} = \left[\frac{p}{1-\alpha(1-p)}\frac{B}{A}\right]^{\frac{1}{1-a}}\frac{k_P^*}{s^*}$.

The FOC is sufficient because of the concavity of the production functions. Once the Pareto-optimality requires that the output be maximized, for there is no disutility of working and only a single period, we have that a Pareto-efficient allocation must satisfy the above equation. ■

Proof. Proposition 4

(i) Let us first note that in a political equilibrium we have $k_R^0 = (1-\tau)\overline{w} - C_R(g^0)$ and $k_P^0 = (1-\tau)\underline{w} - C_P(g^0)$. We know from Proposition 1 in Dixit, Grossman and Helpman (1997, p. 757) that an equilibrium of the common agency game is characterized by three conditions: (i) feasibility of the contributions, (ii) optimality of the policy vector to the agent within the set of feasible actions, given the principals' payment schedules, and (iii) optimality of policy and payments to every principal, subject to feasibility constraints and to the agent's individual rationality constraint (established by the possibility of ignoring any individual principal). The first condition is satisfied by assumption. If the payment schedule is truthful, the marginal contribution must everywhere exactly equate the marginal benefit derived from a policy change - which must be true, in particular, at the equilibrium. As payment schedules are assumed to be differentiable, condition (iii) requires the following FOCs:

$\frac{d\Psi_P}{dg}(g^0) = 0 \Longrightarrow -(1-p)aBs^{0a-1}[(1-\tau)\underline{w} - C_P(g^0)]^{1-a} - (1-a)Bs^{0a}[(1-\tau)\underline{w} - C_P(g^0)]^{-a}\frac{dC_P}{dg}(g^0) = 0 \Longrightarrow \frac{dC_P}{dg}(g^0) = -(1-p)\frac{a}{1-a}\frac{(1-\tau)\underline{w}-C_P(g^0)}{s^0}$

$\frac{d\Psi_R}{dg}(g^0) = 0 \Longrightarrow a\{1-\alpha(1-p)\}A(g^0+\alpha s^0)^{a-1}[(1-\tau)\overline{w} - C_R(g^0)]^{1-a} - (1-a)A(g^0+\alpha s^0)^a[(1-\tau)\overline{w} - C_R(g^0)]^a\frac{dC_R}{dg}(g^0) = 0 \Longrightarrow$

$\frac{dC_R}{dg}(g^0) = [1-\alpha(1-p)]\frac{a}{1-a}\frac{(1-\tau)\overline{w}-C_R(g^0)}{g^0+\alpha s^0}$.

Condition (ii) requires that the government's objective function be maximized. We can simplify the FOC to this problem by noticing that the second term of this function is proportional to the sum of each group's utility, and the derivative of this sum is zero, as seen above. Then we have:

$\frac{dG}{dg}(g^0) = 0 \Longrightarrow x\left[\lambda_R(p)(1-p)\frac{dC_R}{dg}(g^0) + \lambda_P(p)p\frac{dC_P}{dg}(g^0)\right] = 0 \Longrightarrow \lambda_R(p)(1-p)\frac{dC_R}{dg}(g^0) = -\lambda_P(p)p\frac{dC_P}{dg}(g^0)$.

Using the previous results, we may thus obtain:

$\lambda_R(p)(1-p)[1-\alpha(1-p)]\frac{a}{1-a}\frac{(1-\tau)\overline{w}-C_R(g^0)}{g^0+\alpha s^0} = \lambda_P(p)p(1-p)\frac{a}{1-a}\frac{(1-\tau)\underline{w}-C_P(g^0)}{s^0} \Longrightarrow \frac{(1-\tau)\overline{w}-C_R(g^0)}{g^0+\alpha s^0} = \frac{\lambda_P(p)}{\lambda_R(p)}\frac{p}{1-\alpha(1-p)}\frac{(1-\tau)\underline{w}-C_P(g^0)}{s^0}$.

The sufficiency of this FOC is assured just as in the proof of Proposition 3.

(ii) It is easy to check that $\left[\frac{p}{1-\alpha(1-p)}\frac{B}{A}\right]^{\frac{1}{1-a}} < \frac{p}{1-\alpha(1-p)}$, because of our parametric assumptions of $0 < \alpha < 1$ and $B < A\alpha^a$, which imply $B < A$. Expressions (3) and (4) could therefore be equal only if $\lambda_R(p)$ and $\lambda_P(p)$ are exactly such as to compensate for that difference. As they are simply parameters, this could only happen by coincidence: the truthful equilibrium allocation will thus be efficient only for a zero-measure set of parameters. Hence we prove that it is almost always inefficient. ■

Proof. Corollary 5

It is a mere consequence of the fact mentioned in the proof of Proposition 4, that $\left[\frac{p}{1-\alpha(1-p)}\frac{B}{A}\right]^{\frac{1}{1-a}} < \frac{p}{1-\alpha(1-p)}$. ■

Proof. Lemma 6

It is enough to take the partial derivative of θ with respect to p. The first term of θ, which corresponds to the parameter associated with the efficient allocation, has a derivative of $\frac{1}{1-\alpha}\left[\frac{p}{1-\alpha(1-p)}\right]^{\frac{a}{1-a}}\left(\frac{B}{A}\right)^{\frac{1}{1-a}}\frac{1-\alpha}{[1-\alpha(1-p)]^2} > 0$, which is the efficiency-effect. The derivative of the second term, associated with the political equilibrium, may be divided in two components, by the rule of product differentiation: $-\frac{\lambda_P(p)}{\lambda_R(p)}\frac{1-\alpha}{[1-\alpha(1-p)]^2} < 0$, which comes from differentiating $\frac{p}{1-\alpha(1-p)}$ (a term that appears in the political equilibrium because of the number of poor and rich contributing to the government and on the social welfare function), and $-\frac{p}{1-\alpha(1-p)}\left[\frac{\lambda_P{\prime}(p)}{\lambda_R(p)} - \frac{\lambda_P(p)}{\lambda_R(p)^2}\lambda_R{\prime}(p)\right] > 0$, which comes from differentiating $\frac{\lambda_P(p)}{\lambda_R(p)}$ (a term that represents the political weights associated with each group's ease of coordination). Those are the participation-effect and the coordination-effect, respectively. ■

Proof. Proposition 7

(i) From Lemma 6 we know that

$$\frac{\partial\theta}{\partial p} = \left[\frac{1}{1-\alpha}\left[\frac{p}{1-\alpha(1-p)}\right]^{\frac{a}{1-a}}\left(\frac{B}{A}\right)^{\frac{1}{1-a}} - \frac{\lambda_P(p)}{\lambda_R(p)}\right]\left[\frac{1-\alpha}{[1-\alpha(1-p)]^2}\right] - \frac{p}{1-\alpha(1-p)}\left[\frac{\lambda_P{\prime}(p)}{\lambda_R(p)} - \frac{\lambda_P(p)}{\lambda_R(p)^2}\lambda_R{\prime}(p)\right].$$

The second term of this subtraction is negative, given the assumptions on the sign of the derivatives of $\lambda_R(p)$ and $\lambda_P(p)$. As far as the first term is concerned, we know that the second term in square brackets is positive. In a rich-friendly equilibrium, we have

$\theta > 0 \Longrightarrow \left[\frac{p}{1-\alpha(1-p)}\right]^{\frac{1}{1-a}} \left(\frac{B}{A}\right)^{\frac{1}{1-a}} - \frac{\lambda_P(p)}{\lambda_R(p)} \frac{p}{1-\alpha(1-p)} > 0 \Longrightarrow \frac{p}{1-\alpha(1-p)} \left[\left(\frac{p}{1-\alpha(1-p)}\right)^{\frac{a}{1-a}} \left(\frac{B}{A}\right)^{\frac{1}{1-a}} - \frac{\lambda_P(p)}{\lambda_R(p)}\right] > 0 \Longrightarrow \left[\left(\frac{p}{1-\alpha(1-p)}\right)^{\frac{a}{1-a}} \left(\frac{B}{A}\right)^{\frac{1}{1-a}} - \frac{\lambda_P(p)}{\lambda_R(p)}\right] > 0 \Longrightarrow \frac{\partial\theta}{\partial p} > 0,$

for $\frac{1}{1-a} > 1$. Therefore, if $\theta > 0$, an increase in p increases θ, which means greater inefficiency.

(ii) The same reasoning presented above implies that $\left[\left(\frac{p}{1-\alpha(1-p)}\right)^{\frac{a}{1-a}} \left(\frac{B}{A}\right)^{\frac{1}{1-a}} - \frac{\lambda_P(p)}{\lambda_R(p)}\right] < 0$. As $\frac{1}{1-a} > 1$, $\frac{\partial\theta}{\partial p} < 0$ (which is equivalent to saying that an increase in p increases inefficiency) requires that a not be too high: private capital must be productive enough, relatively to public capital. Moreover, it also requires the second term in $\frac{\partial\theta}{\partial p}$ to be not too big so as to cause the total effect to be positive. ■

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