Market failures within poor institutions:
the effects of bureaucrats rent-seeking activity

Davide Infante, Janna Smirnova
d.infante@unical.it, smirnova@unical.it
Department of Economics and Statistics, University of Calabria
87036 Arcavacata di Rende (CS) – Italy

Abstract

This paper develops a model which describes the interaction between the strength of institutional environment and the optimal allocation of resources in a context where the State intervenes to correct for market failure. The changes in the strength of the institutional environment is treated using a parameter that accounts for the rent-seeking activity of bureaucrats and the administrative capability of government. The model demonstrates that in a weak institutional environment, bureaucrats' rent-seeking activity may represent, through adequate State policies, a mechanism which can be used to stimulate the adoption of good production technology, increasing social surplus and to neutralize market failure with less distortions.

JEL classification: H3; H11; P3
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1. Introduction

Recent research on the role of institutional environment on economic performance has demonstrated that institutions play a fundamental role in economic development. The establishment of an appropriate institutional infrastructure has been shown to be essential for achieving economic development. In fact, the presence of solid institutions such as constitutional order, political and financial stability, market securities, competition policies, solid legal systems etc. are necessary components for successful economic growth in developed countries as well as in those undergoing development.

Empirical research has shown that institutional quality continues to improve among developing countries, mainly in transition economies (Havrylyshyn and Van Rooden 1999, Campos 2000, Djankov 2002, and others). Likewise, recent studies (Campos 2000, Recanatini and Ryterman 2000, EBRD 2002, Di Tommaso, Raiser, Weeks 2007) have demonstrated that institutions should be considered as important determinants of economic activity since high institutional quality sustains and improves economic performance. However, while there is much agreement regarding the importance of establishing strong institutions for successful economic outcomes, the question on how a better institutional environment might be created and what should be its characteristics remains undefined. In fact, many developing countries are still unable to establish strong institutions which can surpass the embedded poor institutional environment. As some authors argue (Djankov et al. 2003, Acemoglu 2006, Rajan and Zingales 2006), societies may continue to harbour weak institutions for various reasons, such as unsuccessful institutional transplantation, poor initial distribution of factor endowments or the persistence of the elites' preferences for a poor institutional environment. In such weak contexts characterised by institutions which are incomplete

and working poorly and where the markets suffer distortions which hinder the achievement of the first best allocations, mechanisms, which would otherwise not function for strong economies, could actually improve economic outcomes. One such controversial mechanism is the positive effect of rent-seeking activities during institutional development. While, rent-seeking is normally considered harmful for economic performance, some theoretical and empirical models (Shleifer and Vishny 1994, Acemoglu and Verdier 2000, Meon and Sekkat 2005, Infante and Smirnova 2007) have demonstrated that activities such as bribing, red tape and corruption may actually play a positive role when the economic conditions are weak.

In fact, rent-seeking activities are frequent when a weak government attempts to implement its objectives, as the asymmetric information between the State and its agents leaves lot of room for opportunistic behaviours. However, despite the high opportunistic costs, State interventions are clearly necessary, particularly, in the presence of market failures or in the process of public goods submission. In these situations government failure, e.g. corruption, lobbying, bribing, red-tape, etc., may be tolerated. The issue is therefore not so much the elimination of such opportunistic activities, but about establishing equilibrium between State inefficiencies and market distortions.

This paper discusses the beneficial contribution of rent-seeking activity on economic performance within a weak institutional environment. In particular, we analyze how rent-seeking mechanisms may influence the allocation of resources in State and production sectors in an institutional environment where the bureaucrats enjoy discretional powers when the State attempts to correct for market failures. The model presented here is based on two strands of literature, one dedicated to institutions and their role in economic relations and the other to the effects of rent-seeking activities during State intervention in the economy.

The importance of institutions for economic performance, is quite a new area of research with much empirical work carried out, but little from the theoretical point of view. The main difficulties that theoretical research dealing with institutions faces lie in what constitutes an institution and the complexity of the relationship between various institutions and economic concepts, making it complicated to introduce institutional indicators into models (Nelson and Sampat 2001). In fact, the majority of the theoretical papers studying institutions analyze a single institution or a set of similar institutions within an economic framework. One approach is to analyse the organizational aspect of institutions. A good example is the study by Huang and Xu (1999) who presented a model which shows how economic growth rates depend on whether the financial institutions are organised as merged or centralized bodies. Using equilibrium investment levels, the authors found that higher economic growth rates are attained when institutions are centralized. A similar approach is the analysis of the quality of a single institution. Likewise, Skaperdas and Syropoulos (2001) modelled economic performance as a function of a single institution, such as trade security, which can be considered an informal institute necessary for economic development. The authors showed how various trade regimes differ from each other in terms of trade security comparing the levels of social welfare. The model also identified various conditions under which countries may impose trade restrictions because of high levels of trade insecurity, representing an unusual insight to the link between international trade and institutions, a connection which is rarely explored in the economic literature.

Another way to evaluate functionality of institutions is to analyze how efficiently they have been introduced into economic system. Using this approach, Jack (2002) demonstrated the effect the introduction of a new institution has on social welfare in transition economies, analysing the interaction between operating enterprises and a new institute which has been introduced by government and comparing the levels of welfare. It was demonstrated that the presence of effective public institutions in transition economies leads to a closure of ineffective government enterprises. The actual development of new institutions was considered by Grossman (2001) from the point of view of the creation of property rights. The two models presented used a general equilibrium approach where agents allocate time and effort to the creation of property rights. While in the first model the agents appropriate the common resources, in the second the agents already have the initial claims and create their effective property rights. The author identified the first order conditions for agents' consumption function to achieve equilibrium allocation between the time and effort required for creating property rights.

Finally, an alternative way to include institutions in theoretical models is the introduction of indicators that reflect not a single institution, but a set of them. This approach makes it possible to undertake a broad analysis of the role of institutional environment in the economy. Using this approach, Brezis and Verdier (2003) constructed a model that studied the diffusion of democracy as well as the process of privatization among former socialist countries, introducing parameters which measure the effectiveness of a "repression apparatus". The model showed that where effectiveness is low, the optimal action of authority is the relinquishing of political power. Similary, Esfahani (2002) introduced a parameter representing the strength of the institutional environment and showed a way by which institutions influence the relationship between State intervention and enterprises. The analysis demonstrated how institutional factors such as evaluation of public funds by private agents, reliability of government policies, corruption etc. influenced the ownership of enterprises and the degree of State intervention in the industrial sector. Further developed structural growth model (Esfahani and Ramı´rez, 2003) examined the mutual effects of infrastructure and economy, using an institutional parameter that encompasses the variables that influence the adjustment rate for capital and infrastructure. The model was tested empirically, introducing variables that reflected the effectiveness of different institutions.

The second strand of literature, we base our research on, regards the theoretical considerations of how the presence of rent-seeking activities influences the relationship between the State and the market. Many studies have examined the effect of rent-seeking in the context of State interventions, studying the appearance of rent-seeking, government control over rent-seeking behaviours, the interaction of rent-seeking on different levels of hierarchies, and the implication of rent-seeking in State-market relationship. This latter is of great interest to economists who have generated an abundant amount of empirical evidence and theoretical demonstrations regarding the negative effect of rent-seeking on government intervention. However, there is some work showing that rent-seeking, in certain circumstances, may have a positive influence on the economic performance. These studies are mainly based on situations regarding correction of market failures, submission of public goods and other processes where State intervention in the market is required.

An interesting model demonstrating the positive effects of rent-seeking was offered by Auriol and Benaim's (2000) who analyzed the consequences of public sector

corruption in a growth model. The model undertook a stable equilibrium approach and demonstrated how corruption influences the income redistribution. The authors showed that equilibrium with corruption may be preferred over one where corruption is absent as corruption mechanisms bypass bureaucratic red tape.

Guriev (2004) presented a model that deals with market failures, introducing corruption and red-tape and evaluating the mechanism of their integration. The author showed that, at general equilibrium, the level of red tape is above the social optimal level due to the presence of corruption. It is demonstrated that, even though corruption may have positive effects, its overall effect is destructive and decreases the social welfare. A similar result is obtained by Infante (1999) who presented a growth model in which the presence of rent-seeking is determined endogenously and depends on the different reward structures of the technologies used in the production and rent-seeking sectors. Analyzing the allocation of agents between the two sectors, it was found that rent-seeking may generate positive effects but can not represent an ever-lasting positive mechanism. In fact, in the long-run rent-seeking produces negative externalities and detracts resources from the production sector.

As rent-seeking usually appears in the relationship between the principal and the agent, with the former being more often the victim of corruption due to the financial gains the agents obtain from the principal. However, Olsen and Torsvik (1998) presented an alternative model demonstrating that the prospective corruption can actually benefit the principal. The authors showed that corruption may represent a commitment mechanism that leads to an immediate negative static effect, which, however, has a positive dynamic effect that is evident in the long run.

Corruption in both private and public sectors was considered by Acemoglu and Verdier's (1998) general equilibrium model where the State has a role of reinforcing the contracts in the private sector. As the authors showed, preventing corruption can actually be very costly and optimal allocation may involve some degree of corruption. This result, as they argue, confirms the experience of underdeveloped countries that do not have sufficient sources to prevent rent-seeking activities. Successively Acemoglu and Verdier (2000) developed a model that describes State intervention in the market in an attempt to correct for market failure, and considered the allocations of agents in the presence and absence of corruption. In the model the government neutralizes market failure by allocating agents between the State and productions sectors, providing the entrepreneurs with the incentive to choose good production technology.

The framework of Acemoglu and Verdier (2000) model has been adopted in our work, introducing a mechanism that also reflects the influence of institutional environment. The defining characteristic of our approach is the ability to capture the interaction between changes in the institutional environment and resources allocation, using a single parameter that reflects how the level of bureaucrats' rent-seeking activity is correlated to the administrative capability of the State (Esfahani 2000). Our model can therefore determine optimal resources allocation when state officers are able to enjoy high rent when institutions are weak as opposed to when little rent can be derived when institutions are strong.

The results of our model confirm that the rent-seeking activities of state officers may indeed contribute to the correction of market failures by improving the second-best allocation of agents within State and production sectors. We show that, in a weak institutional environment, rent-seeking not only stimulates the agents to opt for good production technology but also enlarges the range of positive externality generated by

good technology adoption, increasing social surplus. In addition, our research demonstrates that rent-seeking activities in a poor institutional context become beneficial only when the State can perceive and utilize the opportunistic behaviour of the agents to improve economic performance. We therefore delineate a set of key policies in the form of taxes and subsidies that enable the State to create efficient conditions within poor institutions, so that rent-seeking actually works to increase social welfare.

The remainder of the paper is organized as follows. In section two we discuss how institutional environment is introduced into the model of Acemoglu and Verdier (2000) and the transformations which were necessary for such a modification. The basic model is presented in section three and section four discusses its implications and derives some prepositions. Section five extends the model, analyzing the outcomes when rent-seeking activities from different sources is incorporated. Section six concludes.

2. Settings of the model

We start by constructing a model based on that of Acemoglu and Verdier (2000), where the government aims to neutralize market failure by introducing bureaucrats into the production sector. Market failure occurs due to the fact that entrepreneurs opt for bad technology as good production technology is more costly. As a consequence, the positive externality that would have been produced through the use of good technology is not generated.

To induce the production sector to adopt good technology, some of the agents become bureaucrats when called on by the government to monitor and report on the technology choices made by entrepreneurs. The government in turn imposes taxes on the entrepreneurs who use the bad technology and, at the same time, transfer subsidies to those who use the good technology, modifying their pay-offs. This mechanism establishes an allocation of agents such that positive externality is generated and thus social surplus increased.

At this point we introduce into the Acemoglu and Verdier (2000) model a parameter that reflects the institutional environment to analyze how changes in the strength of the institutions influence allocations of agents and production of positive externality. To provide the analysis, however, some of the settings in the original model must be modified.

It is necessary to first suppose that when the institutional environment weakens, bureaucrats are prone to practice rent-seeking activity. To introduce rent-seeking into the model it is assumed that the government gives subsidies and collects taxes through the bureaucrats, giving them direct access to the funds and allowing bureaucrats to extract a "premium" or personal rent during the transfer of the public funds to/from a production sector. As discussed in the first section, this mechanism was proposed by Esfahani (2000) who argues that, for self interested bureaucrats, each dollar under government control is worth more than a dollar, because it can be utilized for private purposes and thus increases the bureaucrats' rents. According to Esfahani (2000), the size of the premium depends on various institutional factors, such as financial and economic stability, efficiency of the legal system, market security etc.; poor institutional quality permits the extraction of high rents by bureaucrats, while within strong institutions, rent is negligible or null. Premium level also reflects the administrative

capability of the government which refers to a set of bureaucratic institutions developed to control and promote the activities of the entrepreneurs. If the government is administratively capable, it collects taxes and releases subsidies with less distortions and bureaucratic costs, decreasing the volume of the premium.

For the sake of simplicity, in our model, the premium is expressed as in terms of the delay in the transfer of specific taxes from bad technology entrepreneurs to the government and of the subsidies from the government to the good technology entrepreneurs. Hence, the subsidies and the taxes become available after a delay[1], with a short delay considered welfare increasing. Therefore, the bureaucrats represent an institute that transfers subsidies to the entrepreneurs who use good technology and collects taxes from those utilizing bad technology. They are self-interested and extract rent from the subsidies and taxes which influences their pay-offs. The amount of rent that bureaucrats can extract depends on the strength of the institutional environment. In a weak institutional environment, where the government is not administratively capable and institutional quality is poor, the bureaucrats can extract a high premium, while, in a strong institutional environment, the premium is negligible.

In our model, another assumption must be added to overcome the problem of negative subsidy which was identified by Acemoglu and Verdier (2000). In fact, in their model, entries of the State budget, which were utilized to pay the wages of bureaucrats and subsidies to good technology entrepreneurs, come from the taxes extracted from bad technology entrepreneurs. Consequently, the presence of bad technology entrepreneurs is necessary to balance the State's budget. However, in the final equilibrium, bad technology is completely eliminated. Such an allocation of agents could not therefore, be supported by a State that has no funds to pay the bureaucrats and good technology entrepreneurs. To overcome this problem, Acemoglu and Verdier (2000) allowed for a negative subsidy, whereby good technology entrepreneurs were also taxed. In our model, both positive and negative subsidies can be applied to achieve a final equilibrium by introducing an additional source of entry for the State in the form of a general tax paid by the entrepreneurs. We suppose that the general tax is paid when the entrepreneurs are monitored by the bureaucrats[2], i.e. depends on the probability of bureaucrats monitoring. The State budget is therefore composed of both the specific tax paid by bad technology entrepreneurs as well as the general tax paid by the entrepreneurs.

Based on the above assumptions we can now construct a model that aims to analyze how changes in the strength of the institutional environment can influence the allocation of agents in both State and production sectors, supporting the neutralization of market failure and the generation of positive externality.

3. Model

The model considers two types of production technologies chosen by the entrepreneurs (n) of the production sector. Good production technology generates a positive externality (β) together with an output (y) that gives benefits to the other agents

[1] An example of such rent-seeking activity can be the interest rate gained from delay in payments of subsidies and in the transfer of taxes, a common practice in transition countries (Saha, 2000).

[2] The introduction of such taxes is in response to the reality surrounding weak institutions where tax evasion is common practice.

(with the total number of agents being *1*), and requires cost (*c*). Bad production technology does not produce any externality and does not require any cost, producing the same amount of output as good technology. As the entrepreneurs are interested in maximizing the pay-off that they can extract from the production and since the application of bad production technology implies a greater pay-off, they are not motivated to choose the good technology and positive externality is therefore not generated.

To incentivate the choice of good technology, the government induces some of the entrepreneurs to become bureaucrats (*1-n*) to monitor the technological choices of the entrepreneurs, transferring subsidies (*s*) to the entrepreneurs who use good technology (*x*) and collecting taxes (τ) from the entrepreneurs utilizing bad technology (*n-x*), while both types of entrepreneurs pay a general tax (*t*) to the government. Bureaucrats monitor entrepreneurs randomly with the probability given by:

$$p(n) = \frac{1-n}{n}$$

When bureaucrats monitor entrepreneurs, the pay-offs of the good and bad entrepreneurs are given by:

$$\pi_{good} = y + \beta \cdot x - c - p(n) \cdot t + p(n) \cdot s$$

$$\pi_{bad} = y + \beta \cdot x - p(n) \cdot t - p(n) \cdot \tau \qquad (1)$$

Pay-offs thus depend on the output produced, positive externality received and on taxes or subsidies paid/received once being monitored.

The government is interested in maximizing the social surplus (*SS*) that is positively correlated to the entrepreneurs' output and the positive externality:

$$SS = n \cdot y + (\beta - c) \cdot x \qquad (2)$$

With no government intervention, when entrepreneurs do not apply good technology, the allocation of agents is given by $n=1,\ x=0$. Once the government intervenes, it aims to allocate the agents such that $n=x$, so to obtain exclusively good technology adoption and thus maximizing social surplus.

Given the above settings, the following sections analyze how changes in the premium that bureaucrats put on subsidies and specific taxes influence both the allocation of agents at the second-best equilibrium point and the amount of positive externality which can be generated by good technology entrepreneurs.

3.1. The allocation of entrepreneurs between good and bad technology

We start by analyzing how the premium which bureaucrats extract from public funds influences the allocation of entrepreneurs between the good and bad technologies. To maximize the social surplus the government has the following set of constraints to respect:

1. *Liability constraint.* The total amount of the general and specific taxes paid to the government does not exceed the value of entrepreneurs' output:

$$\tau \leq y - t \qquad (3)$$

2. *Technology constraint.* To induce the entrepreneurs to use good production technology, the pay-off of good technology entrepreneurs is greater than those of bad technology entrepreneurs, implying the following inequality:

$$s + \tau \geq \frac{n \cdot c}{1 - n} \tag{4}$$

3. *Government budget constraint.* The government does not spend more than it earns, hence the amount of taxes it collects is at least equal to its total expenses:

$$\frac{1 - n}{n} \cdot (n - x) \cdot \tau + \frac{1 - n}{n} \cdot t \cdot n \geq (1 - n) \cdot w + \frac{1 - n}{n} \cdot x \cdot s \tag{5}$$

where the amount of specific and generic taxes the State collects is on the left and the value of wages paid to the bureaucrats plus the value of subsidies released for good technology entrepreneurs is on the right.

4. *Allocation of talent constraint.* To induce some agents to become bureaucrats the pay-off of a bureaucrat is greater than the pay-off of a good technology entrepreneur:

$$w + \beta \cdot x + \left(\frac{1 - n}{n} \right) \cdot (s + \tau) \cdot \gamma \geq y + \beta \cdot x - c - \frac{1 - n}{n} \cdot t + \frac{1 - n}{n} \cdot s \tag{6}$$

where on the left there is the wage and the positive externality a bureaucrat receives plus the premium a bureaucrat extracts from specific taxes and subsidies.

Substituting the above inequalities and solving them for *x*, we obtain the entire set of constraints the government must respect:

$$x \leq \frac{y \cdot (1 - n)^2}{n \cdot c} + \gamma \cdot (1 - n) \tag{7}$$

This constraint defines the allocation of entrepreneurs between good and bad technology and clearly shows that the number of good technology entrepreneurs is positively related to the premium which the bureaucrats can extract from subsidies and taxes.

3.2. The allocation of agents between State and production sectors

To analyze how the premium extracted by bureaucrats affects the allocation of agents between entrepreneurs and bureaucrats, we first consider a State which is attempting to neutralize market failure given constraint (7). The constraint set is nonconvex in *x* and social surplus is linear in *x*, so that the maximization of social surplus has two solutions. The first solution is given by *n=1* and *x=0*, where none of the entrepreneurs uses good technology. This solution gives the level of social surplus that presumes market failure is inevitable:

$$SS_{MF} = y \tag{8}$$

The second solution corresponds to equality *n=x,* where all the entrepreneurs use good technology. In this case the social surplus is given by:

$$SS = n \cdot (y + \beta - c) \tag{9}$$

Clearly, the State intervenes in the production sector only when $SS_{MF} \leq SS$.

As optimal outcome from State intervention requires *n=x*, in substituting *x* for *n* in (7) we obtain the second-best allocation of agents (n_E):

$$n_E = \frac{\left(-2 \cdot y + c \cdot \gamma + \sqrt{4 \cdot c \cdot y + c^2 \cdot \gamma^2} \right)}{2 \cdot (c - y + c \cdot \gamma)} \tag{10}$$

Since $\frac{dn_E}{d\gamma} \geq 0$ is valid, the premium on public funds (γ) is positively related to the dimension of the production sector at the second-best allocation point. Clearly, the level of social surplus that corresponds to this allocation is also positively related to the premium.

3.3. The level of positive externality produced by good technology entrepreneurs

Here we analyze the relationship between the level of positive externality produced by the adoption of good technology and the premium. To do this we compare the level of social surplus in case the market failure has been neutralized (*SS*) to that with the market failure (SS_{MF}) and define the *threshold* level of positive externality (β_{TH}) over which any level of β gives a level of social surplus that is greater than SS_{MF}:

$$\beta_{TH} = \frac{\left[c \cdot y \cdot \gamma + c^2 \cdot \gamma + (c - y) \cdot \sqrt{4 \cdot c \cdot y + c^2 \cdot \gamma^2} \right]}{\left(-2 \cdot y + c \cdot \gamma + \sqrt{4 \cdot c \cdot y + c^2 \cdot \gamma^2} \right)} \qquad (11)$$

Since $\frac{\partial \beta_{TH}}{\partial n_E} \leq 0$ and $\frac{\partial n_E}{\partial \gamma} \geq 0$ then $\frac{d\beta_{TH}}{d\gamma} \leq 0$. As a result, a higher premium the bureaucrats put on subsidies and specific taxes actually decreases the threshold level of positive externality over which State intervention in the economy is optimal.

4. Analysis of the model's outcome

The above results now allow us to derive some propositions. We first suppose, that institutional environment becomes weaker (γ increases) around the time the state intervenes in the production sector by introducing some bureaucrats, so that the bureaucrats can have more discretion power and thus extract higher rents. Inequality (7) suggests that the increase in γ leads to an upward shift of the constraint curve (Figure 1). While point *n=1, x=0* (that defines market failure) remains unchanged in such a shift, the point of second-best solution moves up along the line *n=x*, passing from E_1 to E_2, demonstrating that there is an increase in the number of good technology entrepreneurs (n_E) in accordance with (10). Therefore, the increase of γ leads to a better agents allocation ($n_{E2} > n_{E1}$), reaching a new second-best point, E_2.

We can now analyze the mechanism of government intervention in detail. In order to operate with parameters the government can control, (10) can be re-written as:

$$n_E = \frac{\gamma \cdot (\tau + s) + (t + s)}{\gamma \cdot (\tau + s) + (s + t) + 2 \cdot \tau} \qquad (12)$$

Careful examination shows that since *n=x*, any increase in γ requires changes in some endogenous parameters if an increased in n_E is needed. To prove this, we rearrange the terms of the constraints the government must respect to satisfy (12). Technology constraint (4) thus takes the following form:

$$n \leq \frac{s + \tau}{c + (s + \tau)} \qquad (13)$$

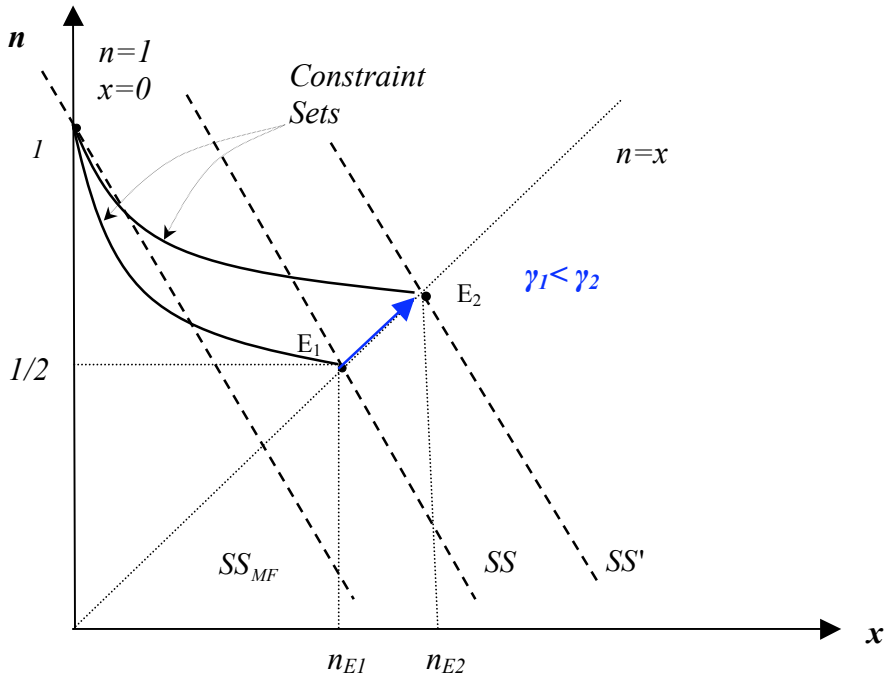

Figure 1. The second-best allocation of agents in a weakening institutional environment.

Budget constraint (5) can be presented as:

$$x \le n \cdot \frac{\tau + t - w}{\tau + s} \tag{14}$$

The talent constraint (6) becomes:

$$w \ge y - c + \left[s \cdot (1 - \gamma) - t - \tau \cdot \gamma\right] \cdot \frac{1 - n}{n} \tag{15}$$

As (15) shows, growth in γ decreases w. At the same time, from (14), it follows that the decrease in w implies higher x. Since the State searches for $n=x$, when x increases, n increases automatically. However, as (13) shows, an increase in n suggests changes in s, τ, and/or c (τ in turn depends on the levels of y and t)[3]. As a result, increasing γ in equation (12) does not suggest an automatic increase in n_E, but a change in government policy that leads to an increase in n_E.

Obviously, there is a wide range of policies the State may implement, such as changing general taxation, bureaucrats' wages, the value of subsidies etc. It is worthwhile to note that the constraint set imposes precise links between some of theses parameters and changing one of them would automatically change others. For example, with an increase in γ, one of the reasonable strategies the State may choose is to reduce bureaucrats' wages (w). In fact, in countries suffering from "institutional vacuum", the government has little control over increasing disorder and bureaucrats' rent-seeking activities become significantly profitable. Therefore, in such weak institutional contexts,

[3] Clearly, the cost of good technology (c) and the level of entrepreneur's output (y) cannot be considered under the State's policy.

government policy may use the increase in γ to lower bureaucrats' wages, increasing subsidies in the production sector.

Applying our model, we can demonstrate the application of such a policy. Using the four constraints (3, 4, 5, 6 and the requirement $x=n$), the dependence of w on γ can be obtained for the second-best point:

$$w = y - \frac{c\cdot\gamma + \sqrt{(c\cdot\gamma)^2 + 4\cdot c\cdot y}}{2} \tag{16}$$

The second term of the above equation is positive, thus confirming that increasing γ decreases bureaucrat's wage. It is now possible to evaluate whether a decrease in w can lead to an increase in s. Rearranging the set of constraints we derive the equation for s:

$$s + \tau = \frac{c\cdot\gamma + \sqrt{(c\cdot\gamma)^2 + 4\cdot c\cdot y}}{2} \tag{17}$$

which simply becomes $s+\tau+w=y$. In fact, in lowering w, the State chooses a higher s, and the remaining variables are adjusted respectively. Therefore, a decrease in bureaucrats' wages is used to support an increase in the subsidies for good technology entrepreneurs.

We have demonstrated that a policy which reduces bureaucrats' wages so to increase subsidies may represent a solution for neutralizing market failure in a weakening institutional environment. This means that, in using an appropriate response to the increase of rent-seeking activity, the government can neutralize market failure with the better allocation of agents. In fact, despite rent-seeking activities and weak institutions, it is possible to increase the number of good technology entrepreneurs employing less bureaucrats who are also paid lower wages. Fewer bureaucrats necessary for achieving a second-best allocation of agents also reduces the bureaucratic costs resulting from the loss of output produced by entrepreneurs. It is therefore possible to give the following proposition:

Proposition 1: In a weak institutional environment, the increase in rent-seeking activity of bureaucrats may enable the government, through adequate policies, to neutralize market failure with a larger production sector, smaller bureaucratic costs, thus, increasing social surplus.

Now we can analyze how rent-seeking activity influences the threshold level of positive externality produced by good technology. As shown above, a higher premium put by bureaucrats on public funds implies a lower threshold level of positive externality produced by good technology (11). This mechanism is described by Figures 2 and 3. Figure 2 demonstrates that increasing the discretion power of bureaucrats ($\gamma_2>\gamma_1$) leads to a better final allocation of agents $n_{E1}< n_{E2}$, passing from point E_1 to E_2. This change leads to a higher level of social surplus, i.e. SS_2, instead of SS_1 (Figure 3), that corresponds to a lower threshold level of positive externality ($\beta_{TH2}< \beta_{TH1}$). In fact, in Figure 3 it is easy to see that the threshold level of positive eternality, over which State intervention becomes optimal, shifts to the right with an increase in premium.

Hence, β_{TH2} offers a wider range of feasible good technology applications and higher social surplus with respect to β_{TH1}. The level of β_{TH}, expressed in the following way, clarifies this process:

$$\beta_{TH} = \frac{y}{n_E} - y + c \tag{18}$$

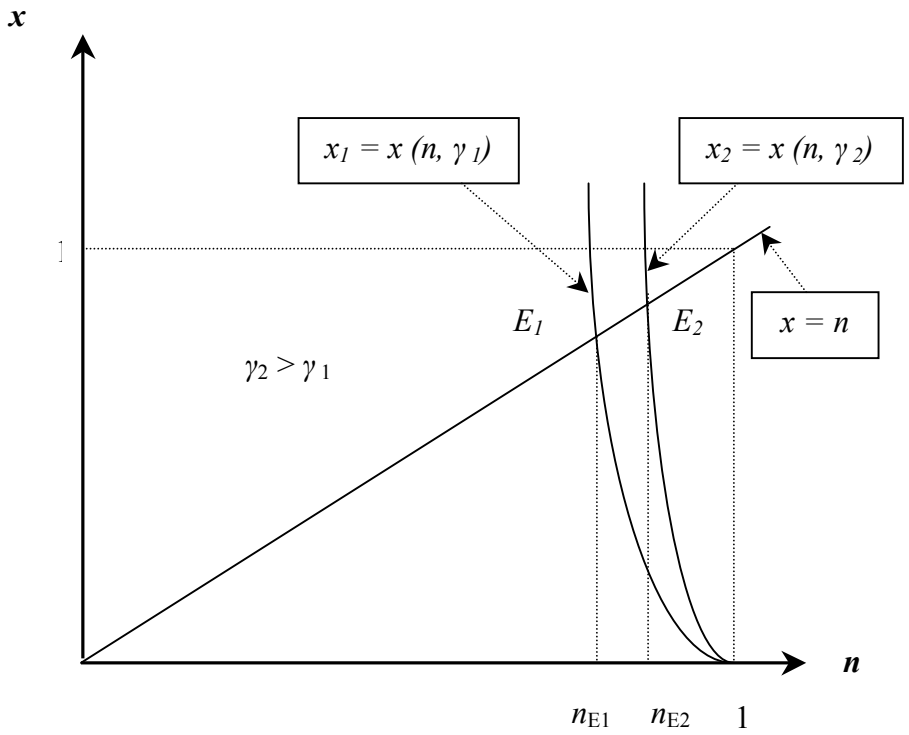

Figure 2. Allocation of agents in a weakening institutional environment.

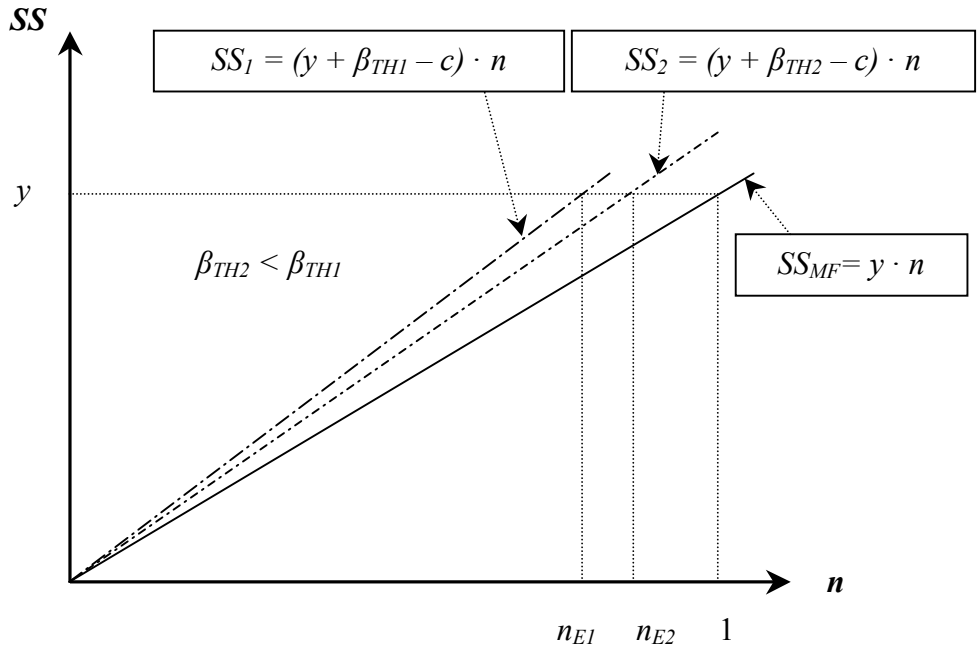

Figure 3. Production of positive externality in a weakening institutional environment.

Therefore, an increase in n_E, clearly leads to a decrease in β_{TH}. This mechanism may be explained in the following manner: even with a lower level of β_{TH}, an increase in the number of good technology entrepreneurs, resulting from an increase in premium establishes the level of social surplus beyond SS_{MF}. Hence, in a weak institutional environment it is possible to actually enlarge the range of feasible good technology which can be adopted, such that even technologies offering a low level of positive

externality become worthwhile for State intervention. The following proposition can thus be formulated:

Proposition 2. In a weak institutional environment, adequate government policies can utilize the rent-seeking activity of bureaucrats to lower the threshold level of positive externality at which State intervention in the production sector is optimal, thus enlarging the range of feasible good technology which can be adopted.

5. Extensions of the model: different premiums on public funds

In the previous section, γ was considered the sole parameter describing bureaucrats' behaviour. To obtain a more detailed analysis of the impact of the strength of the institutional environment on the allocation of agents, γ can be extended into two new parameters λ and δ that respectively represent the premium bureaucrats put on subsidies and that placed on specific taxes. Clearly, distinct premiums may represent different sets of institutions involved in the mechanism of extracting taxes or granting subsidies and may thus influence the second-best allocation of agents differently.

Modifying the settings of the model with respect to the talent constraint, bureaucrats' pay-off is changed as follows:

$$w + \beta \cdot x + \left(\frac{1-n}{n} \right) \cdot (s \cdot \lambda + \tau \cdot \delta) \geq y + \beta \cdot x - c - \frac{1-n}{n} \cdot t + \frac{1-n}{n} \cdot s \qquad (19)$$

Combining constraints (3) (4) (5) with this, the new constraint set is now given by:

$$x^* \leq \left[\frac{y \cdot (1-n)^2}{n \cdot c} \right] + \left[\frac{(1-n)^2 \cdot (y-t) \cdot (\delta - \lambda)}{n \cdot c} \right] + \lambda \cdot (1-n) \qquad (20)$$

The above constraint set leads to the following second-best allocation of agents between State and production sectors:

$$n^*_E = \frac{-2 \cdot y + c \cdot \lambda - 2 \cdot (y-t) \cdot (\delta - \lambda) + \sqrt{4 \cdot c \cdot y + c^2 \cdot \lambda^2 + 4 \cdot c \cdot (y-t) \cdot (\delta - \lambda)}}{2 \cdot [c - y + c \cdot \lambda - (\delta - \lambda) \cdot (y-t)]} \qquad (21)$$

This set of expressions thus presents a more complete model which allows for a more detailed analysis of bureaucrats' behaviour. The following section applies these settings to the development of State policies that aim to find the response to the rent-seeking activity of bureaucrats.

5.1. Rent-seeking as a function of premiums on public funds

Here we describe the dynamics of government intervention in the production sector to neutralize for market failure, as a function of the different premiums bureaucrats can extract from taxes and subsidies.

We first suppose, that the government controls n and x by establishing w, τ, s, t, so that (21) is satisfied and the allocation of agents can reach point E_1 (Figure 4). In the initial stage where the allocation of agents moves from point A to point B and the number of bureaucrats starts growing, these bureaucrats first face bad technology entrepreneurs who must pay the specific tax τ to the government. The increasing number of bureaucrats, through the monitoring process, augment the pay-off of good technology entrepreneurs, giving the incentive to their appearance. As seen from Figure

4, passing from point A to point B, the number of good technology entrepreneurs would thus increase from *0* to x_B.

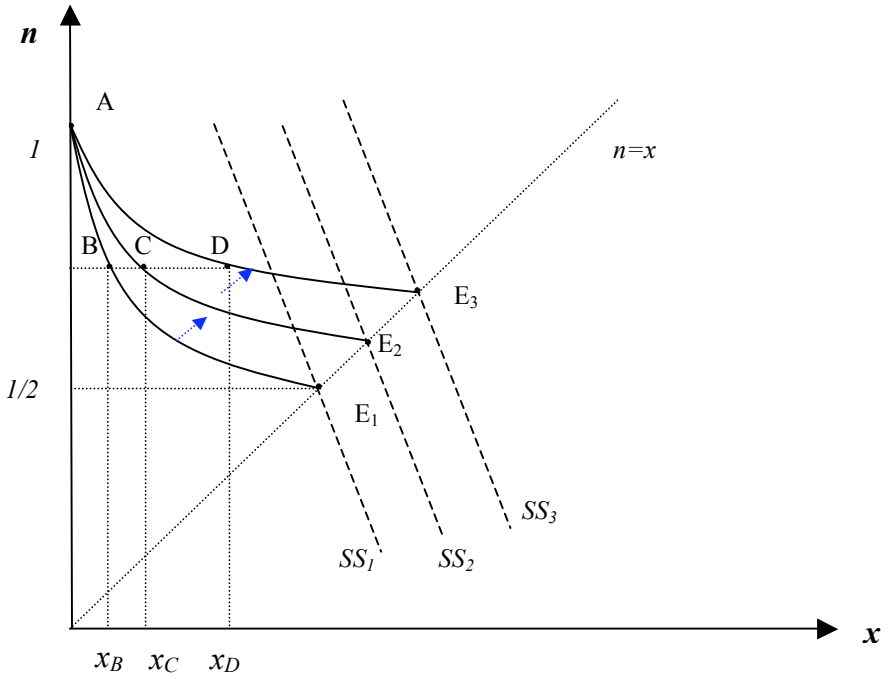

Figure 4. The second-best allocation of agents in a weakening institutional environment: a positive effect of rent-seeking, given different premiums on specific taxes and subsidies.

Subsequently, the bureaucrats increase their discretion power since the institutional environment at point B becomes weaker (i.e. δ increases). Rearranging inequality (20) to mirror this increase in rent-seeking behavior, we obtain:

$$x^* \le \left[\frac{y\cdot(1-n)^2}{n\cdot c}\right] + \delta\cdot\left[\frac{(1-n)^2\cdot(y-t)}{n\cdot c}\right] + \lambda\cdot\left[(1-n) - \frac{(1-n)^2\cdot(y-t)}{n\cdot c}\right] \qquad (22)$$

Therefore, $\frac{dx^*}{d\delta} \ge 0$ which means that the constraint curve moves forward with an increase in δ. Hence, the allocation moves to point C where the number of good technology entrepreneurs increases (x_C). The shift of the constraint curve also implies that point E_1 moves upward along line $n=x$ to the point E_2, as shown Figure 4, representing a higher level of social surplus.

Once good technology entrepreneurs appear, the bureaucrats also begin to extract rent from subsidies. Referring to equation (22) and analyzing the derivative $\frac{dx^*}{d\lambda}$, it becomes evident that the premium on subsidies may have both a positive or negative influence on the allocation of entrepreneurs. In fact, $\frac{dx^*}{d\lambda} \ge 0$ when

$$c \ge \frac{(1-n)}{n}\cdot(y-t) \qquad (23)$$

Condition (23) thus defines the interval of good technology cost that guarantees the positive impact of λ on the number of good technology entrepreneurs. Applying

appropriate substitutions, it is easy to see that (23) actually represents the condition of positive subsidy, $s \geq 0$.

The case of negative subsidy will be discussed below. In the condition where (23) is valid, an increase in λ moves up the constraint set curve and corresponds to a more intensive use of good technology which would shift the allocation of agents to point D (Figure 4). At point D, the bureaucrats continue extracting premiums λ and δ, prompting entrepreneurs to switch to the good technology that offers greater pay-off. Moreover, the State utilizes bureaucrats' rent-seeking activity to modify the exogenous parameters, allocating agents to $x_E=n_E$ and reducing the number of bureaucrats (e.g. the situation moves to point E_2). Therefore, the more intensive the rent-seeking activity of bureaucrats[4], the greater the x_E, and market failure actually becomes neutralized at a higher level of social surplus.

5.2. Negative subsidy for good technology entrepreneurs

In the situation where subsidy is negative, i.e. the case where (23) does not hold, modifying the constraints the government must respect (note, the liability constraint $\tau \leq y - t$ is maintained, since $s \leq \tau$), the constraint set becomes:

$$x^* \leq \left[\frac{y\cdot(1-n)^2}{n\cdot c}\right] + \delta\cdot\left[\frac{(1-n)^2\cdot(y-t)}{n\cdot c}\right] + \lambda\cdot\left[\frac{(1-n)^2\cdot(y-t)}{n\cdot c} - (1-n)\right] \qquad (24)$$

The second term in inequality (24) shows that the increase in premium on bad technology for which entrepreneurs are taxed (τ) increases the number of good technology entrepreneurs (x^*). At the same time, a raise in premium on subsidies of good technology entrepreneurs (λ) increases x^* if the third term of inequality (24) is positive. Elaborating this expression and applying appropriate substitutions, we find that, as in the above case of positive subsidy, the condition of $\frac{dx^*}{d\lambda} \geq 0$ is only possible when $s \geq 0$. Hence, regardless of whether the subsidy on good technology entrepreneurs is negative or positive, the mechanism of rent-seeking may actually contribute to achieving a better allocation of agents in the production sector when institutions are weak.

On one hand, this result confirms that of Acemoglu and Verdier (2000), showing that it is possible to apply a negative subsidy to neutralize market failure. However, our model also shows that when good technology entrepreneurs are taxed, the number of good technology entrepreneurs is reduced compared to the case where good technology entrepreneurs are given subsidy. The following equality confirms this statement:

$$n^*_E = \frac{\tau - s}{c + \tau - s} \qquad (25)$$

Therefore, using negative subsidies instead of positive subsidies with good technology entrepreneurs, the final allocation of agents is given by a lower number of

[4] The premium can not increase indefinitely to reach the first-best allocation of agents ($n=x=1$) since it would require bureaucrats to receive a negative wage. The maximum possible level of premium at the second-best allocation point is given by substituting $w=0$ the constraint set and setting $n=x$, hence: $\gamma_{\max} = \frac{y}{c} - 1$.

good technology entrepreneurs and greater number of bureaucrats. The following proposition can thus be formulated:

Proposition 3. The State may utilize rent-seeking to improve the second-best allocation of agents regardless of whether the subsidies on good technology entrepreneurs are positive or negative. In addition, a better second-best allocation of agents is obtained when the State releases positive subsidies.

5.3. Sensitivity of good technology adoption to the premiums on subsidies and taxes

Interestingly, the second-best allocation of agents behaves differently to the change of the premium on subsidies or specific taxes. To demonstrate it, from (24) we can find the ratio of the first derivative of both premiums:

$$\frac{\frac{d}{d\lambda}x^*}{\frac{d}{d\delta}x^*} = \frac{s}{\tau} \tag{26}$$

Equation (26) demonstrates that changes in λ or δ elicit a different response in x^*, indicating that the State may actually choose which premium to utilize and which policies to apply when neutralizing market failure. Such a choice could be valuable in a situation when different institutions are involved in the processes of subsidization and taxation. For example, subsidizing may be given a primary role if the State does not intend to improve the corresponding institution in the near future but intends to impose as much good technology as possible. The following proposition can thus be formulated:

Proposition 4: As a response to the bureaucrats rent-seeking activity, the State may have at its disposal various policies for correcting market failure since the second-best allocation of agents behaves differently to the change of the premium placed by bureaucrats on specific taxes or subsidies.

6. Conclusions

We have presented a theoretical model for analyzing how changes in institutional environment strength affects the allocation of resources in both State and production sectors in a situation where the government intervenes to corrects for market failure. We treat the changes in institutional environment with a single parameter that accounts for both the rent-seeking activity of bureaucrats as well as the administrative capability of the government. In constructing the model we suppose that bureaucrats, introduced to neutralize market failure, are involved in transferring subsidies and taxes to/from entrepreneurs who apply good or bad production technology, respectively, becoming, therefore, a source of rent for bureaucrats. In a weakening institutional environment, an increase in bureaucrats' discretion power influences the choice of which agents become the entrepreneurs or the bureaucrats as well as the bad or good technology type which entrepreneurs choose.

The model demonstrates that, in a weak institutional environment, the State may actually use the bureaucrats' rent-seeking activity to achieve a second-best agents allocation wherein more entrepreneurs opt for good technology. In fact, by implementing adequate State policies as a feedback mechanism to guide rent-seeking behaviours, market failure can be neutralized with lower bureaucratic costs and with

higher level of social surplus. We also show that, in a weak institutional environment, the State may utilize bureaucrats' rent-seeking activity to extend the range of feasible good technology adoption in the production sector.

The model also provides a detailed analysis that considers how differences in the rent which bureaucrats can extract from taxes and subsidies influences the second-best agent allocation. In fact, we find that the second-best allocation of agents changes as a function of the rent which bureaucrats manage from different sources. Therefore, to neutralize market failure, the State may chose among various policies, depending on the state of the institutions involved in taxation and subsidization. Finally, our model also shows that while both positive and negative subsidies can be applied to good technology entrepreneurs to neutralize the market failure, a second-best allocation of agents with the adoption of more good technology and greater social surplus is achieved when the subsidy is positive.

As shown, in a weak institutional environment, bureaucrats' rent-seeking activity can actually work as a constructive mechanism to achieve a better allocation of resources. However, the positive effect of rent-seeking is not everlasting. In fact, once the institutional environment is stronger, the search for rent becomes a negative factor that exhausts the economic resources and is detrimental to economic performance. That this cannot be demonstrated is a limit of this model. Future improvements to the model would need to consider how more sophisticated institutional parameters can be incorporated so to overcome this limit and allow for a theoretical description of how initially positive rent-seeking behaviour then becomes detrimental when the originally weak institution becomes stronger. As is, the model nonetheless offers a suitable framework for guiding an empirical cross-country research to test the propositions regarding the effect of rent-seeking on economic performance in a changing institutional environment.

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