Redistributive Constitutions and Self-Enforced Coordination

D. Filipovich J. Sempere
CEE, El Colegio de Mexico

This version: February 5, 2003

Abstract

Bös and Kolmar(2002) and Kolmar(2000) emphasize the self-enforced, coordinating role of constitutions. The present model illustrates how coordination can achieve real commitment -in the sense that agents initial choices actually lock them into a certain course of action later on. It also illustrates how stability might conflict with efficiency, and how from this tension, a strong bias towards progressive redistribution might result.

1 Introduction

Recently there has been some discussion on the role of constitutions as commitment devices[1]. An important question then is how this commitment is achieved or, in other words, how are constitutions enforced. In this sense Kolmar (2000) argues that constitutional rules should not be assumed to be enforced exogenously[2]. They should be self-enforced[3]. Kolmar goes on to

[1] Azariadis and Galasso (1998, 2002) study constitutions as commitment devices to achieve efficiency. In particular, they work with an overlapping generations model and a fiscal constitution is aimed at ensuring efficient intergenerational transfers.

[2] Kolmar (2000) criticized Azariadis and Galasso (1998), arguing that those authors' begged the central question as to how constitutional rules are enforced.

[3] In a similar vein, Barbera and Jackson (2002) study the choice of voting rules by means of voting rules (they call a rule that 'chooses itself' self-stable).The same idea can be found in Elster (1990).

argue that the key to the self-enforcement of constitutional rules lies in their "ability to coordinate expectations on a certain equilibrium"[4].

A model incorporating this intuition was developed in Bös and Kolmar (2002). In that work, a constitution is, basically, an equilibrium selection in an game with multiplicity of equilibria. Those authors point out one difficulty with their approach: Theirs is a theory in which initially unequal agents agree on a ex-post product redistribution in order to compensate the losers in an ex-ante reassignment of property rights aimed at enhancing efficiency. Even though, ex-post, the whole transaction (property reassignment plus transfers) leaves everyone at least as well off, this does not prevent initially unequal agents from having conflicting preferences over the set of Pareto improving equilibria. Hence, equilibrium selection is not a trivial issue, yet they do not model this choice explicitly.

The present work is complementary to Kolmar' work on constitutions in several ways. We subscribe Kolmar's view that the essence of constitutional stability is self-enforcement via coordination. However, we avoid the problem of equilibrium selection, and our equilibrium concept will capture in a different sense the concept of self-enforcement by coordination of Constitutions[5].

More specifically, we have a large population (a continuum) of ex-ante identical risk-neutral agents who collectively agree on a redistributive scheme (or fiscal constitution) subject to certain conditions meant to capture its self-enforced nature. In the light of the redistributive scheme chosen, agents individually choose how much effort to spend today. These individual efforts interact with the average effort level and, identically and independently across agents, translate into high or low incomes next period. After incomes are realized, either constitutionally mandated transfers take place, or a subset of agents of an exogenously given critical size form a coalition in order to violently expropriate those not in the coalition. This expropriation we call a revolution. The violent nature of the expropriation is reflected in the loss of a proportion of the total product in the economy. This critical size and the proportion of the total product lost in any violent revolution define a

[4] Kolmar (2000), p.373.

[5] We avoid the problem of equilibrium selection by taking a Rawlsian approach in which ex-ante identical agents agree on a redistributive scheme under a "veil of ignorance" induced by uncertainty. Our treatment departs from conventional Rawlsian models, however, in that we take agents to be risk-neutral. Redistribution results in our model not from insurance motives, but in order to, first, avoid conflict (as in Acemoglu and Robinson, 2000, and Grossman, 1995), and, second, counteract effort spillovers.

"technology of revolution"[6].

The alternative to constitutional stability is to enter into what we call a power equilibrium, i.e., an equilibrium with no transfers which might or might not entail revolutionary expropriation.

A rough intuition for how self-enforcement through coordination is achieved here, is as follows: Should agents agree on a stable constitution, they will expect it to be enforced (by definition of stability), and will choose efforts accordingly. These choices must then be such that they result in an income distribution which makes it, ex-post, both feasible and desirable for the constitutionally mandated transfers to take place, thus validating the initial effort choices. Commitment is achieved via today's coordinated effort choices. These result, in turn, from the shared and correct expectations induced by the act of constitutional agreement itself. Note, however, that there is real commitment here, in the sense that, at date 2, agents will be locked into a certain course of action.

This contrasts with the way things work in Bös and Kolmar: There, "commitment" is mostly achieved via bootstrapping in folk-theorem fashion. The equilibria are fully forward looking, and the only sense in which agents have committed is in the unmodelled but non-trivial "choice" of equilibrium. To put it more pointedly, in Bös and Kolmar, at any given date, agents could in principle "choose" to coordinate their beliefs differently, regardless of the equilibrium they "chose" to start with. There is nothing which locks agents into their original equilibrium choice.

As mentioned, a further difference with Bös and Kolmar is that redistribution in their formalism is motivated primarily by efficiency considerations, while in the present work redistribution serves a dual purpose: Besides enhancing efficiency (by counteracting effort spillovers), redistribution also helps avoid revolutionary expropriation. Note that while revolutionary expropriation is costly, both directly (since it wastes income), and indirectly (since it distorts effort incentives even further), the aims of stability and efficiency do not fully coincide: Stability might necessitate a level and/or direction of transfers different from those dictated by efficiency considerations. Hence, a conflict between efficiency and stability arises. The role of a constitution (i.e., the redistributive scheme agreed upon) is consequently more complex: It coordinates decisions in a self-enforcing way, but it also

[6]The technology of revolution we work with, is closely related to the one posited in Roemer (1985).

helps enhance efficiency, with the goals of stability and efficiency conflicting under certain circumstances.

It is interesting to note that a bias towards progressive redistribution results endogenously from the dual goals of stability and efficiency. Regressive redistribution turns out not to be stable under the postulated revolutionary technology. Progressive redistribution, on the other hand, either achieves full efficiency, or exceeds the efficient level. It can never happen that stability requires less than efficient redistribution.[7]

The rest of the paper ir structured as follows. Section 2 presents the model. Section 3 contains a full characterization of our equilibrium concept. In section 4 we compare constitutional equilibria with power equilibria and discuss the possible role of constitutions. Section 5 discusses the concept of self-enforced coordination. Finally, section 6 concludes the paper.

2 The Model

The horizon is two periods. There is a unit interval of agents indexed by i. There is a single (non-storable) good in the economy. An agent's utility is defined over levels of consumption of this good and effort levels, and takes the separable form

$$U_i(x, e) = x - v(e)$$

Effort e generates disutility $v(e)$, with $v' > 0, v'' > 0$. Consumption x enters linearly, i.e.,we are assuming risk neutrality. If we worked with risk-averse agents instead, we would be introducing an additional trade-off between risk-sharing and incentives, and unneccessarily complicating the analysis.

In the first period ($t = 1$), agents simultaneously decide how much effort $e \in [0, \overline{e}]$ to invest in an activity which the following period yields, identically and independently across agents, a random output $y \in \left\{y^S, y^F\right\}$, with $y^S > y^F \geq 0$. We refer to those agents who obtain a high income as 'winners', and denote them by an index w, while we refer to those who obtain a low income as 'losers', and denote them by an index l.

The probability that the activity results in high output (the probability of success), p, depends on the individual effort, e, as well as on the

[7] In those cases where full efficiency cannot be achieved via constitutional means, the choice between power equilibria and constitutional stability is one between two second-best options, and, as such, is far from clear cut.

average level of effort in the economy, e^{avg}. We assume that $p(0,.) = 0$, $p_1(e, e^{avg}) > 0$, $p_{11}(e, e^{avg}) < 0$, $p_{22}(e, e^{avg}) < 0$. Here p_j denotes the derivative of $p(e, e^{avg})$ with respect to the jth argument $(j = 1, 2)$, and p_{jk} is the cross derivative of $p(e, e^{avg})$ with respect to the kth and jth arguments $(k, j = 1, 2)$.

We will consider both the case in which $p_2(e, e^{avg}) \leq 0$ (the **'rent-seeking' case**), and the case in which $p_2(e, e^{avg}) > 0$ (the **'productive' case**). In either case we will assume that $p_{12}(e, e^{avg}) < 0$.

We assume further that inputting an interior, positive level of effort is efficient, so

$$p'(e^*, e^*)\left(y^S - y^F\right) = v'(e^*) \Rightarrow e^* \in (0, \overline{e})$$

Besides these individual decisions, agents make various kinds of "collective decisions". First, prior to their individual effort decision, agents agree on a 'constitution'. Since agents are ex-ante identical, agents will do so unanimously. In the final period, agents have to decide whether to form a coalition in order to 'revolt'.

A **constitution** is a mapping $\tau(.)$ specifying a transfer to the individual as a function of that individual's income[8].

Of course, the government budget constraint has to be satisfied[9], i.e., total realized transfers must cancel out.

$$p(e, e^{avg})\tau\left(y^S\right) + (1 - p(e, e^{avg}))\tau\left(y^F\right) = 0$$

It is convenient to distinguish between an **interim distribution of income** and the **final distribution of income.** The interim distribution is the one that results after the uncertainty is resolved, but before transfers take place (constitutionally mandated or as a consequence of a revolution). The final distribution is the one that results from constitutionally mandated transfers or from a revolution[10].

[8] This corresponds to the notion of fiscal constitution in Persson and Tabellini (1996). In principle, one could define a constitution more generally as a mapping from income levels **and** identities into transfer lotteries.

[9] Note that this condition is not formally equivalent to budget balance in partnership problems. For partnership results to apply here it would have to be the case that transfers cancel out at each income realization.

[10] Strictly speaking, we should distinguish between two types of interim distributions: One that results after the uncertainty is resolved, and one that results after constitutionally mandated transfers are implemented but before an eventual revolution takes place. Since we will only consider revolution-proof constitutions, this distinction will turn out to be irrelevant.

A **revolution** takes place when a coalition of agents $C \subseteq [0,1]$ decides to expropriate those outside the coalition. We follow Acemoglu and Robinson (2000) in assuming that a coalition succeeds in expropriating those outside the coalition if and only if the coalition is of at least size r^c. Also, following the same authors, we assume that any revolutionary movement leads to a proportional loss of $1-\lambda$ in aggregate output.

For simplicity, we will consider only two coalitions, the richest and the poorest. We will assume that if a coalition involves only part of an income segment, then every member of that income segment is equally likely to belong to the coalition.

A key feature of the technology of revolution is how the 'boot' is distributed after a successful revolution. Here, we consider **populist revolutions**, i.e., revolutions that distribute the 'boot' (i.e., the total product outside the rebel coalition net of the loss in output) evenly amongst the members of the rebel coalition.

A valid constitution will have to meet three requirements: *Renegotiation-proofness, revolution-proofness* and *status quo-proofness.*

Definition 1 A distribution of income is **revolution-proof** (RP) if there is no coalition of size at least r^c such that all its members derive a higher utility from revolution than from this distribution. A **revolution-proof constitution**[11] is one that results in a revolution-proof distribution of income.

Definition 2 A constitution specifying strictly positive transfers from rich to poor is **progressive status quo-proof** if the interim distribution of income is not revolution-proof. A constitution specifying non-zero transfers from poor to rich is **regressive status quo-proof** if it does not pay for the poorest coalition to revolt but it does pay for the richest coalition to do so.

Definition 3 A constitution is **renegotiation-proof** if it is efficient amongst all revolution- and status-quo proof constitutions.

[11] Revolution proofness seems closely related to the coalitional core approach. That approach lets the value of a coalition depend on the whole partition, rather than only on its membership. This allows one to model external effects amongst coalitions. Here also, the value of a coalition and its complement are not independent (if a rebel coalition succeeds, its complement gets 0 value).

The first and third requirements seem self-explanatory. The second might not be: It ensures that the agents will not be able to refuse to go along with the constitution ex-post. The idea in the case of progressive transfers being that only a credible threat of revolution induces the winners to part voluntarily with some of their income. In the case of regressive transfers, it is necessary not only that the poor do not have the option to revolt, but also that the rich can force the poor to comply with the constitution (by credibly threatening violent expropriation).

Summarizing the timing of decisions: A constitution is agreed on. Then, given this constitution, effort levels are chosen individually and simultaneously. After this, the uncertainty resolves, resulting in winners and losers.. Now, agents decide whether to comply with the constitution. If they go along with the constitution, transfers are implemented; else the original distribution is retained. Finally, agents decide whether to form a revolutionary coalition in order to expropriate those not in it. If a revolution takes place, part of the product is destroyed, and the remainder is distributed along populist lines.

Definition 4 A **stable constitutional equilibrium** is a vector of efforts $e(i)_{i\in[0,1]}$, and constitution, τ, such that

i) τ is revolution-proof

ii) τ is renegotiation-proof

iii) If τ is different from zero, then it is status quo-proof

iii) $e(i)$ maximizes i's utility under the prevailing constitution, given the effort decisions of other agents.

As a benchmark, we need to say what happens if no constitution is agreed upon

Definition 5 A **power equilibrium** is a vector of efforts $e(i)_{i\in[0,1]}$ such that each $e(i)$ maximizes i's expected utility, given the efforts of the remaining agents, assuming that the subversive coalition which gets to draw at $t = 2$ is the poorest.

Note that a power equilibrium need not be revolution-proof. Further, note that the definition of progressive status-quo proofness incorporates the idea that the poorest coalition has precedence when it comes to mounting a revolt (i.e., if there is more than one coalition for which it pays to revolt, the one that actually rebels is the poorest amongst them).

3 Characterizing Stable Constitutional Equilibria

3.1 The Set-Up Without Revolutions: First Best versus Equilibrium Efforts

This section establishes a simple benchmark result to be used in describing stable constitutional equilibria. Besides characterizing first-best efforts, both in the "productive" and in the "rent-seeking case", we look at equilibrium efforts in the absence of revolutionary technology.

First-best efforts are given by the solution to

$$e^* = \arg\max_e \; p(e,e)\left[y^S - y^F\right] - v(e)$$

Symmetric equilibrium efforts are given by

$$\overline{e} = \arg\max_e \; p(e,\overline{e})\left[y^S - y^F\right] - v(e)$$

Proposition 1 *i) If $p_{12} < 0$ and $p_2 > 0$, then both first best effort, e^*, and symmetric-equilibrium effort, $\overline{e}$, are unique and such that $e^* > \overline{e}$.*

ii) If $p_{12} < 0$ and $p_2 < 0$, then both first best effort, e^*, and symmetric equilibrium effort, $\overline{e}$, are unique and such that $e^* < \overline{e}$.

Proof. Uniqueness: The first-order condition for first-best efforts is given by

$$\left[p_1(e,e) + p_2(e,e)\right]\left[y^S - y^F\right] = v'(e) \tag{1}$$

The first-order condition for symmetric equilibrium effort is given by

$$p_1(e,e)\left[y^S - y^F\right] = v'(e) \tag{2}$$

Differentiating condition 1) totally, we obtain

$$\left[p_{11}(e,e) + p_{22}(e,e) + 2p_{12}(e,e)\right]\left[y^S - y^F\right]de = v''(e)\,de \tag{1'}$$

Differentiating condition 2) totally, we obtain

$$\left[p_{11}(e,e) + p_{12}(e,e)\right]\left[y^S - y^F\right]de = v''(e)\,de \tag{2'}$$

Since $v''(e) > 0$, while $p_{11} < 0, p_{22} < 0$ and $p_{12} < 0$, both e^* and $\overline{e}$ must be unique. If the solution $\overline{e}$ to equation 2) is plugged into equation 1), the LHS

of this latter equation will exceed (or be below) the RHS, as $p_2 > 0$ (< 0). Hence the remaining claims follow. ■

These results are intuitive and familiar from the study of coordination games[12]. The productive case corresponds to 'positive spillovers': In equilibrium, there is too little effort as agents do not internalize the positive effect of their effort on others. The 'rent-seeking' case corresponds to 'negative spillovers'. In equilibrium, there is too much effort as agents do not internalize the negative effects of their effort on others.

3.2 Ruling Out Regressive Constitutions

We start by ruling out the possibility of regressive transfers in a constitutional equilibrium. This will simplify our analysis by obviating the need to characterize regressive status-quo proofness.

Proposition 2 *Given an income distribution, if it does not pay for the poorest coalition to revolt, then it does not pay for any other coalition to do so.*

Proof. Since, given an income distribution, the cost of a revolution is the same, regardless of the direction of transfers, if not enough product is left over to compensate the poorest coalition, it cannot be possible to compensate a richer coalition either. ■

As an immediate corollary of this, we have that

Corollary 1 *No constitution can be regressive status-quo-proof.*

Since no efficiency gains can be attained via regressive transfers, and since we are interested in stable renegotiation-proof constitutions only, we normalize and set $y^F = 0$. Under this parametrization, status-quo proofness reduces to non-revolution-proofness of the interim income distribution.

3.3 Characterizing Revolution-Proofness

Under our definition of constitutions, any income distribution that results from implementing constitutionally mandated transfers consists of at most 2 income levels, namely $y^F + \tau\left(y^F\right)$ (losers' income), and $y^S + \tau\left(y^S\right)$(winners' income).

To obtain the conditions for a post-transfer income distribution to be populist revolution-proof **(PR-Proofness),** we have to consider two cases:

[12]See Cooper 1999.

First, we have to consider the case when e, p, and r^c are such that $(1-p(e,e)) > r^c$. That is, the case when there are more than enough losers to form a successful revolutionary coalition. The income to be expropriated is that of winners,

$$p(e,e)\left(y^S+\tau\left(y^S\right)\right)$$

plus that of losers outside the revolutionary coalition,

$$\left[(1-p(e,e))-r^c\right]\tau\left(y^F\right)$$

The condition for revolution-proofness is then that the sum of these two totals should exceed the cost of making a revolution,

$$(1-\lambda)\,p(e,e)\,y^S$$

i.e., that

$$(1-\lambda)\,p(e,e)\,y^S \geq \left[(1-p(e,e))-r^c\right]\tau\left(y^F\right)+p(e,e)\left(y^S+\tau\left(y^S\right)\right)$$

Consider now the case when $(1-p(e,e)) > r^c$. Now there are not enough losers to build a successful revolutionary coalition. Some winners have to take part in the revolution if a rebel coalition of size r^c is to be attained. The expropriable income is now only that of the winners who remain outside the rebel coalition, i.e.,

$$(1-r^c)\left(y^S+\tau\left(y^S\right)\right)$$

Thus, in this case, the condition for revolution-proofness is given by

$$(1-\lambda)\,y^S p(e,e) \geq (1-r^c)\left(y^S+\tau\left(y^S\right)\right)$$

Summarizing, we have:

Proposition 3 *An income distribution* $\left\{\tau\left(y^F\right),\ y^S+\tau\left(y^S\right)\right\},\ \tau\left(y^F\right) \leq y^S+\tau\left(y^S\right)$,[13] *is revolution-proof iff*

$$[1-\lambda]\,y^S p(e,e) \geq$$

$$\left[1-\max\left(1-p(e,e),r^c\right)\right]\left(y^S+\tau\left(y^S\right)\right)+\left[\max\left(1-p(e,e),r^c\right)-r^c\right]\tau\left(y^F\right)$$

[13] It can be shown that whenever $\tau(0) > y^S+\tau\left(y^S\right)$ is feasible, then $\tau(0) = y^S+\tau\left(y^S\right)$ is feasible. Hence, it is without loss of generality to concentrate on the case with $\tau(0) \leq y^S+\tau\left(y^S\right)$.

3.4 The Status-Quo Proof Constraint

As claimed, the status quo proof constraint is satisfied whenever the interim income distribution is not revolution-proof if transfers have to be realized in a Constitutional equilibrium. In other words, immediately after incomes are realized but before constitutionally mandated transfers take place, the cost of making a revolution should be smaller than the expropriable income.

As in the above subsection, we can distinguish two cases. The case when e, p, and r^c are such that $(1-p(e,e)) > r^c$. That is, the case when there are more than enough losers to form a successful revolutionary coalition. In this case, all income will be expropriable (i.e., $p(e,e)\, y^S$). Hence, status-quo proofness requires

$$p(e,e)\, y^S > (1-\lambda)\, p(e,e)\, y^S$$

which is evidently satisfied.

If $(1-p(e,e)) > r^c$, there will not be enough losers to build a successful revolutionary coalition consisting only of losers. Expropriable income in this case corresponds therefore to that of winners not belonging to the revolutionary coalition (i.e. $(1-r^c)\left(y^S+\tau\left(y^S\right)\right)$).The condition for status-quo proofness is then

$$(1-r^c)\left(y^S+\tau\left(y^S\right)\right) \geq (1-\lambda)\, p(e,e)\, y^S$$

The following proposition summarizes both conditions.

Proposition 4 *An interim distribution is status-quo proof iff*

$$p(e,e)\ \lambda\ \geq \{r^c - \min\left[1-p(e,e), r^c\right]\}$$

3.5 Constitutionally Stable Equilibrium

In addition to the two constraints just presented, a constitutionally stable equilibrium must satisfy the government budget constraint (BC). Since effort decisions are taken independently by each individual, an equilibrium must also satisfy an incentive compatibility constraint (IC).

So, a constitutionally stable equilibrium solves **program A**,

$$\max_{e,\tau(y^S),\tau(y^F)} U\left(e,\tau\left(y^S\right),\tau\left(y^F\right)\right) = p(e,e^{avg})\, u\left(y^S+\tau\left(y^S\right)\right)+(1-p(e,e^{avg}))\, u\left(\tau\left(y^F\right)\right)-v(e)$$

$i)$ $(\mathrm{Re}volution - Proofness)$

$ii)$ $(Status\,Quo - Proofness)$

$iii)$ $p'\left(e, e^{avg}\right) u\left(y^S + \tau\left(y^S\right)\right) - p'\left(e, e^{avg}\right) u\left(\tau\left(y^F\right)\right) - v'\left(e\right) = 0 \quad (IC)$

$iv)$ $\left(1 - p\left(e, e^{avg}\right)\right) \tau\left(y^F\right) + p\left(e, e^{avg}\right) \tau\left(y^S\right) = 0 \qquad (BC)$

$v)$ $y^F + \tau\left(y^F\right),\ y^S + \tau\left(y^S\right) \geq 0;\ e \in [0, \overline{e}]$

$vi)$ $e = e^{avg}$

Note that we are using a first order condition to characterize incentive compatibility ('first order approach'). This is justified since $p_1 > 0$ and $p_{11} < 0$.

4 Constitutional Equilibria and Power Equilibria

What is the role of constitutions? In order to try and answer this question, we compare constitutional equilibria with power equilibria. We start by looking at the productive case, in which constitutions have only a **stabilizing role**, as no revolution-proof constitution attains efficiency. Second, we look at the set-up without spillovers in order to illustrate what we call the **pure coordinating role** of constitutions. Finally, in the rent-seeking case, a trade-off between **efficiency** and stability obtains.

4.1 The Productive Case: A Pure Stabilizing Role

In the productive case ($p_2 > 0$), we obtained that, in a non-political setup without transfers, equilibrium effort was lower than the efficient one. Therefore, to attain efficiency gains, i.e., to incentivate additional effort, transfers from the poor to the rich would be called for. However, as argued above (Corollary 1), a constitution specifying such transfers is never stable. Hence, we have the following proposition,

Proposition 5 *In the productive case, the first-best cannot be attained via constitutional transfers.*

From the definition of constitutional equilibrium, a stable constitution will require transfers from the rich to the poor (if any). Hence, a constitution will distort effort away from the first best level. Still, such a distorting constitution might be superior to a power equilibrium, as it might be the only means to avoid a costly revolution (costly not only because part of the economy's income is directly lost in the wake of revolutionary violence, but also because the expectation that income will be fully or partially expropriated will further depress effort).

4.2 No Spillovers Case: A Pure Coordinating Role

We look here at the borderline situation in which there are no effort externalities, i.e., we assume that $p_2 = 0$. Then it is immediate that

Proposition 6 *First best effort e^* is attained at a stable constitutional equilibrium iff $\tau\left(y^S\right) = \tau\left(y^F\right) = 0$.*

In other words, efficiency requires here only that effort be fully rewarded, i.e., that winners are able to keep all of their income. The only issue is whether a situation without transfers is stable. If we take this to be the case, we have, however, the following result,

Proposition 7 *If the first-best effort level e^* can be achieved at a constitutionally stable equilibrium, it can be achieved at a revolution-proof power equilibrium.*

Does this mean that constitutions are superfluous under these conditions? The answer is no. The following example illustrates:

Assumption At e^* the interim distribution is revolution-proof.

Since $p(0,.) = 0$, we have that $1 - p(0,0) > r^c$. This means that if a revolution takes place, winners will be fully expropriated, as there will be more than enough losers to form a rebel coalition of size r^c.

Now, if at e^* the interim distribution is revolution-proof (which we assumed), this will the unique constitutionally stable equilibrium. By the preceding proposition, this effort level will also be sustainable as a power equilibrium. But there will exist **other power equilibria** besides the one that sustains efficient effort. In particular, under the previous assumption, it will

be a power equilibrium to select zero effort. To see this, note that if an agent expects all others to select zero effort, then that agent will foresee that the resulting interim distribution will not be revolution-proof. This implies, that should this agent turn out a winner in the income lottery, he or she would be fully expropriated in the ensuing rebellion (as $1-p\left(0,0\right)>r^{c}$). But then, it clearly does not pay to input positive effort.

If instead the agent expected others to input e^{*}, it would pay for him or her to do so as well. In this case, the interim distribution of income will include a large number of winners, and it will not prove possible to form a rebel coalition that can fully compensate its members using the revolutionary boot. But then, it pays to input the optimal effort level.

Finally, note that besides the two power equilibria mentioned (the efficient one and the zero effort one) there could be quite a few others. In all of which a revolution would take place, with some winners invariably included in the revolutionary coalition. But since the probability of any giving winner taking part in the revolutionary coalition, $\frac{r^{c}-\left(1-p\left(e^{R},\,e^{R}\right)\right)}{p(e^{R},\,e^{R})}$, where e^{R} is the corresponding effort level, is necessarily strictly less than one, e^{R} will always be below the efficient level.

What the constitutional process does is simply to select an equilibrium. This is what we refer to as the pure coordination role of constitutions. By coordinating effort decisions in the first period, the constitutional decision leads to a revolution-proof distribution of income in the second period, which, in turn, supports agents' effort choices. By the way, constitutional decisions are reached unanimously, as all agents are ex-ante identical. In this sense, the constitution is self-enforcing (we discuss self-enforcement further in Section 5).

4.3 The Rent-Seeking Case: Efficiency versus Stability

One should not conclude, though, that whenever the efficient effort level can be supported in a constitutionally stable equilibrium, it can be supported as a power equilibrium as well. The "rent seeking" case offers an example of a situation in which it is possible to sustain efficiency via transfers but not in a power equilibrium, even in a revolution-proof one.

Proposition 8 *Efficiency can never be achieved in a power equilibrium in "rent-seeking" situations.*

Proof. Clearly, a non-revolution proof power equilibrium can only sustain suboptimal effort. Assume instead that the power equilibrium is revolution-proof. From conditions 1) and 2) in Subsection 3.1, it is immediate that the equilibrium effort level can never be optimal. ■

Even though transfers could in principle attain efficiency, the status-quo and revolution-proofness constraints prevent this from always being possible. Intuitively, status-quo proofness requires that efficient effort not be too high, for else the interim distribution will be revolution-proof. Revolution-proofness, on the other hand, might require transfers that exceed those leading to efficient effort.

Proposition 9 *In a constitutionally stable equilibrium either efficiency is attainable or there are excess transfers, i.e., too much redistribution relative to what would have been efficient.*

Proof. First note that, absent transfers, for any given revolutionary technology $\{r^c, \lambda\}$, one can define a critical effort level $e^c(0)$ such that any higher effort leads to a revolution-proof distribution, while any lower effort results in a non-revolution-proof distribution. Hence, status-quo proofness, if binding, will tend to lead to lower efforts. Since lower efforts can only be induced by higher transfers to losers, we have that a binding status-quo constraint will lead to excess transfers. On the other hand, the revolution-proofness requirement, if it binds, will also force additional transfers to the poor (over and beyond those necessary to achieve the efficient effort level). To see this, define the critical effort level more generally as a function of the difference in final incomes between poor and rich, $d \in \left[0, y^S\right]$,i.e., $e^c(d)$. It is easy to verify that this function must be falling. Hence, starting out from some initial effort, if the resulting distribution at $d = y^S$ is not revolution-proof, reducing d (increasing transfers) will lead to a fall in effort as well as in critical effort. Hence, if the status-quo proofness constraint was not binding before, it will not bind now either, while eventually the critical and actual efforts must coincide (since $p(0,0) = 0$,zero effort will be revolution-proof).

■

Note that this last proposition and Corollary 1 establish an **endogenous bias towards progressive redistribution** in this sort of economies. A little reflection will suffice to see that this bias is a direct consequence of assuming that the cost of revolution is independent of the composition of the rebel coalition. In assuming this, we were trying to capture the intuition

that political power is distinct from economic power. Allowing for feedback between the rebel coalition's income and the cost of revolution would most likely lead one to qualify this previous conclusion.

Note further that the threat of revolution plays a dual role here: On the one hand, the revolution-proof constraint forces progressive redistribution in the first place. On the other hand, the status-quo constraint relies on this very same threat of revolutionary violence to enforce these transfers. By the way, it is the absence of a direct cost of revolution that forces Bös and Kolmar to rely on infinite repetition in order to enforce transfers (they only have an indirect cost of expropriation arising from the expenditure of resources on power).

5 Self-Enforced Coordination Revisited

From a game-theoretic point of view, it is not obvious what 'commitment' stands for. Presumably, commitment refers to both, features of the extensive form of a game, as well as of its equilibria. As far as we are aware, these feature have not been clearly typified. In the light of this, it seems legitimate to enquire what exactly is meant here by the expression 'self-enforced coordination'.

Going against a widely held view, Aumann (1990) has argued that Nash equilibria are not per se 'self-enforcing'. To determine whether a Nash equilibrium is self-enforcing, he sets out the following 'test': Say a game has two equilibria, each corresponding to a common action for all parties, a or b. At a pre-play stage, the parties agree to take a common action corresponding to one of these equilibria, say the action a. This agreement will only be self-enforcing if it pays for an agent to agree to this action iff he or she actually intends to take this action, assuming that the remaining players will stick to the agreement and play a. That is, if this agent intended to take action b, he should not want his or her rivals to play a. Note the logic: The mere act of agreement (before initial efforts are chosen) does not change the payoffs, hence the only way it can affect incentives is via changes in information, specifically, information regarding others' intentions. But an agreement can only signal other agents' intentions if they would not enter into the same agreement regardless of what their intentions are. We claim that constitutional agreements in the present model fullfill this condition: In the example of Section 4.2, if I agree to the efficient level of effort, it is not in my interest

to input a different effort given that all others will follow the agreement. This is a first sense in which constitutional agreements are here self-enforcing.

There is a second, intertemporal, more physical dimension to commitment in the present model: The effort decision 'binds' agents to a certain course of action in the future. In which sense do these decisions 'bind' agents? Elster (1990, p.37) has set out five criteria to determine what it means to bind oneself in this intertemporal sense. We find these quite reasonable and we want to claim that stable constitutional agreements fulfill them. The criteria are the following:

i) To bind oneself is to carry out a certain decision at time t in order to increase the probability that one will carry out another decision at time $t+1$.

ii) If the act at the earlier time has the effect of inducing a change in the set of options that will be available at the later time, then this does not count as binding oneself if the new feasible set includes the old one.

iii) The effect of carrying out the decision at t must be to set up some causal process in the external world (excludes, for example, decisions to decide).

iv) The resistance against carrying out the decision at t must be smaller than the resistance that would have opposed the carrying out of the decision at $t+1$ had the decision at t not intervened.

v) The act of binding oneself must be an act of commission, not of omission.

We claim that, taken together, the constitutional agreement and the ensuing effort decisions fulfill reasonably well all of these criteria. Clearly, effort decisions narrow down the options available to the agents in the future, hence criterium ii) is satisfied. Also, criterium iii) is satisfied, as effort decisions will cause the future income distribution to change, thus affecting the likelihood of a revolution. Criterium iv) is crucial: In our model, the fact that agents are identical in the first period makes it very easy to reach an agreement at that stage. Ex-post, agents become unequal, and, hence, are no longer in a position to easily enter into constitutional agreements (this in our view is the main shortcoming of overlapping generations' stories like Azariadis and Galasso's, 1998, 2002 : Why was it possible for the initial generation to enter into a certain agreement, but it is not possible for future young generations to do so?). The remaining criteria apply to the constitutional agreement (which, in substance, is an agreement to coordinate) rather than to the effort decisions induced by it: The constitutional agreement obviously fullfills criterium i). Criterium v) tries to exclude situations in which agents choose to remain

bound, rather than undertake actions to bind themselves (again, Azariadis and Galasso's story offers a good illustration of what criterium v) is trying to exclude: In their story, future young generations are, if anything, choosing to remain bound, rather than deliberately commiting). In our model, there is only one generation, which clearly decides to commit at the start, so the issue of 'remaining bound' as opposed to actually committing does not arise.

Summarizing, it seems to us that there are two notions of commitment at work in our story: One, the more subtle Auman notion, following which commitment can be seen as resulting from informational inferences at the constitutional agreement stage. The other, a physically mediated one, according to which agents rely on decisions aimed at changing the physical and social enviroment (here, effort decisions) to induce intertemporal commitment. These decisions, the initial constitutional agreement and the ensuing effort decision, taken together, meet all of the criteria set out in the Elster program (if we may call it so).

6 Conclusions

Bös and Kolmar (2002) and Kolmar (1998) emphasize the coordinating role of constitutions. The present work is an attempt to incorporate this way of thinking into a formal model in order to explore further how coordination might lead to stability in a self-enforcing manner.

The present model illustrates how coordination can achieve real commitment -in the sense that agents initial choices actually lock them into a certain course of action later on. It also shows how stability might conflict with efficiency, and how a strong bias towards progressive redistribution emerges from this.

References

[1] Acemoglu D. and J. Robinson (2001) "A Theory of Political Transitions", *American Economic Review* 91, 938-63.

[2] Acemoglu D. and J. Robinson (2000) "Why Did the West Extend the Franchise? Democracy, Inequality and Growth in Historical Perspective", *Quarterly Journal of Economics* 115, 1167-99.

[3] Aumann, R. (1990) "Nash Equilibria are not Self-Enforcing," in J.J. Gabszewicz, J.F. Richard, and L.A. Wolsey, *Economic Decision Making: Games, Econometrics, and Optimization*, Elsevier Science Publishers.

[4] Azariadis C. and V. Galasso (1998) "Constitutional 'Rules' and Intergenerational Fiscal Policy", *Constitutional Political Economy* 9, 67-74.

[5] Azariadis C. and V. Galasso (2000) "Reply to Kolmar's Comment", *Constitutional Political Economy* 11, 375.

[6] Azariadis C. and V. Galasso (2002) "Fiscal Constitutions", *Journal of Economic Theory, 103*, 255-281

[7] Barbera S. and M. Jackson (2000) "Choosing How to Choose: Self-Stable Majority Rules", mimeo.

[8] Bös D. and M. Kolmar (2002) "Anarchy, Efficiency and Redistribution", forthcoming in *Journal of Public Economics*.

[9] Cooper R. (1999) *Coordination Games*, Cambridge: Cambridge University Press.

[10] Elster J. (1990) *Ulysses and the Sirens*, Cambridge: Cambridge University Press.

[11] Kolmar M. (2000) "Constitutions as Commitment or Coordination Device? Comment on C. Azariadis and V. Galasso: Constitutional 'Rules' and Intergenerational Fiscal Policy", *Constitutional Political Economy* 11, 371-374.

[12] Grossman H. (2002) "Constitution or Conflict", NBER Working Paper Series #8733.

[13] Grossman H. () "A General Equilibrium Model of Insurrections", *American Economic Review* 81, 912-921.

[14] Persson T. and G. Tabellini (1996) "Federal Fiscal Constitutions: Risk Sharing and Moral Hazard", *Econometrica* 64, 623-646.

[15] Roemer, J. (1985) "Rationalizing Revolutionary Ideology", *Econometrica* 53, 85-108.