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On the political economy of the welfare state.

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Resumen

Hay un sentimiento generalizado en cuanto a que los estados del bienestar están distorsionando los incentivos en mayor medida de lo que es socialmente óptimo. En este artículo, esta idea es analizada formalmente con un modelo en el cual un gobierno benevolente busca maximizar la utilidad de agentes oportunistas y aversos al riesgo. El gobierno puede redistribuir el producto desde los "afortunados" hacia los "desafortunados", proveyendo seguro. Bajo compromiso, el gobierno optimiza antes que los agentes elijan el nivel de esfuerzo. Conciente de los problemas de incentivos, el gobierno típicamente proveerá un seguro incompleto, a los efectos de inducir un esfuerzo superior al mínimo. Bajo discreción, el gobierno reoptimiza después que los agentes eligen el esfuerzo. Enfrenta, por lo tanto, un problema exclusivamente de compartir riesgos y provee seguro completo. Pero los agentes anticipan las acciones del gobierno y optan por el mínimo esfuerzo. El bienestar social podría ser inferior bajo discreción: habría sobreseguro.

Abstract ¹

There is a widespread feeling that welfare states are distorting incentives to a larger extent than what is socially optimal. In the present paper, this idea is formally analyzed with a model in which a benevolent government seeks to maximize the utility of risk-averse-opportunistic agents. The government can redistribute output from the "lucky" to the "unlucky", providing insurance. Under commitment, the government optimizes before agents choose the level of effort. Aware of incentive problems, the government will typically provide incomplete insurance, in order to induce some effort above the minimum. Under discretion, the government reoptimizes after agents chose effort. Thus, it faces a pure risk-sharing problem and provides full insurance. Agents anticipate government's actions so they choose the minimum effort. Social welfare might be lower under discretion: there would be overinsurance.

JEL: D82, G22, H42

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1. Introduction

There is nowadays a widespread concern about the distortions that the welfare state might be introducing in the system of incentives in modern economies. There seems to be an extended feeling that the welfare state has very often gone too far. Social public programs and tax pressure have risen dramatically during the last decades in many countries. New and larger social benefits have reduced the losses that individual agents must bear in the face of bad outcomes. As a consequence, the welfare states might have reduced the incentives individual agents have to take due care of their duties. The increase in distortionary taxation that has accompanied the rise of social programs might also reduce incentives to work.

There is an empirical issue concerning the evaluation of the actual distortions introduced by the welfare state. Even though the social programs might introduce some distortions, they also provide some benefits, in terms of increased social welfare. The balance is not a priori obvious and it should be carefully assessed. An important contribution in this direction is the recent book edited by Atkinson and Mogensen (1993) that presents a comparative study of the welfare state in four european countries.

But there is also a related theoretical issue. Even if social programs and taxes distorted incentives, it might simply be the unavoidable counterpart of insurance in the presence of moral hazard. In principle, the governments should be aware of these distortions and choose the right amount of social programs. Then, why might they have gone too far? Why might so many governments in different countries have organized social programs to such an extent that the social balance could become negative? It does not seem very likely that the distortions that are currently concerning so many economists and politicians are the result of simple mistakes. The coincidence of the problem in many countries also points out towards deeper causes. The aim of this paper is to provide a definition of what "too far" could mean and to present an explanation of how and why the welfare state might have gone too far.

The paper is organized as follows. In section 2, the main arguments are presented in an informal way. Section 3 contains a simple model of state insurance, under the assumptions of separable utility functions and two effort levels (the extension to the continuous effort case is briefly discussed). The notion of "overinsurance" is defined and an explanation of how it could arise is provided. In section 4, the analysis is extended to the case of non-separable utility functions. The repeated version of the game is analyzed in section 5. Some concluding remarks end the paper in section 6.

2. The arguments

Consider an economy populated by a large number of individuals. All of them produce the same consumption good, incurring in some effort. Individuals do not know with certainty which amount of output they will get, but they know that the probability of a good outcome can be raised by working hard. Individuals like consumption and dislike effort and risk.

It is immediate that there will be some room for risk sharing in such an economy. However, in the presence of moral hazard, the market solution might be socially suboptimal. If the insurance companies could impose exclusive contracts by which individuals are compelled to buy insurance from a single provider, the equilibrium would normally entail rationing, incomplete insurance and some positive effort. If the companies could not restrict the amount of insurance that each agent buys, the market equilibrium might not exist. If it still existed, it would involve full insurance and low effort (Arnott and Stiglitz, 1988).

Agents would be better off if they could commit to high effort before signing the insurance contract. With commitment, the incentives problem disappear and so does the reason for insurance incompleteness or even non-existence. Thus, moral hazard is a distortion that, in the most favorable case (in the presence of exclusive contracts), put the economy in a second best -high effort but incomplete insurance-, (the first best being represented by high effort plus full-insurance).

Consider now a government. It can levy taxes and distribute subsidies. Assume that this is a benevolent government, in the sense that it maximizes a weighted average of individuals' utilities. A key assumption in what follows is that the government can change the tax-subsidies system at very short notice. In particular, it can decide the taxes each agent will pay and the subsidies he will receive **after** the agent has chosen the level of effort. This assumption is crucial, since it implies that ex-post the government faces a pure risk sharing problem, without any incentive consideration. As a consequence, it provides full-insurance. Agents know it, so they choose low effort.

There might be an overinsurance in this economy, in the sense that the ex-ante optimal policy could be to provide incomplete insurance. However, this policy would not be credible. So agents choose low effort and ex-post the government's best policy is to fully insure them. As in other policy games analyzed in the new political economy, the government tries to move from the second best (high effort plus incomplete insurance) to the first best (high effort plus complete insurance) but ends in the third best (low effort plus complete insurance). If the government could commit to provide incomplete insurance, the second best would be implementable.

A related idea has been recently proposed to provide a rationale for social security systems (Vergara, 1991). If governments were unable to commit not to help old people if they did not save enough when young, there might be less savings than what is socially optimal. The social security system makes savings compulsory, eliminating the problem. In the present paper, the focus is on activities in which agents' actions are not observable, so that the government cannot directly command agents to perform the desired action.

3. Time inconsistency and the overprovision of state insurance

Consider an economy populated by a continuum of individuals indexed by 'i', ranging in the real interval [0,1]. All of them produce the same consumption good, incurring in effort (a_i), which, for the sake of simplicity, can take just two values: high (H) and low (L) effort. Each agent gets an amount X with probability $P(a_i)$ and x with probability $(1-P(a_i))$. Just to fix ideas, assume $X > x$ so that $P(a_i)$ is the probability of "being lucky". This probability is a function of the individual's action. The probability of getting the good outcome is higher when the agent chooses to put in high effort ($P(H) > P(L)$). Probabilities of different individuals are independent. In this environment, there is individual but not aggregate risk. Ex ante, individual output is only probabilistically known while total output is known with certainty.

Individuals seek to maximize expected utility functions, which are increasing and concave in consumption ('C' in the good state and 'c' in the bad state; $u' > 0$, $u'' < 0$) and decreasing in effort. For the sake of simplicity, it is assumed in this section that utility functions are additively separable. Non-separable utility functions are introduced in the following section.

$$U_i = P(a_i) \cdot u(C) + (1 - P(a_i)) \cdot u(c) - a_i \quad (1)$$

Agents dislike effort: $H > L > 0$.

It is immediate that there will be some room for insurance in this economy. Without it, i's expected utility is given by (1) with $C=X$ and $c=x$. If instead, individuals were offered a zero-cost-full-insurance scheme, agent i would get $C = c = P(a_i)X + (1 - P(a_i))x$ in both states of nature. Due to risk aversion, expected utility with insurance is higher, for each action. Thus, a benevolent government concerned about citizens' welfare might provide insurance.

To be more specific, assume that the government maximizes a social welfare function that is the summation of individuals' expected utilities. Using taxes and transfers, the government determines consumption allocations in both states of nature. Individual output is observable, so that the government can make consumption allocations contingent on it. Agent 'i' receives W_i when he gets high output and w_i when he gets low output.

Consider now the timing. Unlike private companies, which must set the conditions of the insurance contract before agents choose actions, the government can reoptimize in any moment. Thus, two potentially different optimal policies must be considered. The government's optimal policy in period 1, before agents choose effort, would be the solution of the following program:

$$\text{maximize} \int_0^1 [P(a_i) \cdot u(W_i) + (1-P(a_i)) \cdot u(w_i)] \cdot a_i \quad (2)$$

$$w_i, a_i \geq 0$$

$$\text{s.t.} \int_0^1 [P(a_i) \cdot (X+W_i) + (1-P(a_i)) \cdot (x + w_i)] \cdot di \quad (3)$$

$$\text{argmax}_{a_i} P(a_i) \cdot u(W_i) + (1-P(a_i)) \cdot u(w_i) \quad (4)$$

Equation (3) is the whole economy resources constraint and equations (4) are the incentive compatibility constraints. Notice that the fact that the government is maximizing agent i's utility does not make condition (4) redundant. It says that the action a_i must be **ex-post** optimal for the agents.

In a symmetric Nash equilibrium, the government will provide all agents the same consumption pair. Thus, the economy resource constraint (3) boils down to:

$$(a_i) \cdot (X+W_i) + (1-P(a_i)) \cdot (x + w_i) = 0 \quad ; \quad \in \quad (5)$$

This is an equilibrium condition and it does not generally hold out of equilibrium. Consider, for instance, the strategy profile in which the government provides full-insurance-high-level consumption and all but one agents work hard. The free rider, the agent that put in low effort, receives more than his expected output, so that equation (5) does not hold. This is precisely what causes that full insurance with high effort is not an equilibrium. Thus, while equation (3) is a constraint that cannot be violated, equation (5) must only hold in equilibrium.

The government's best policy in period 1 is the pair (w_i, W_i) that, solving the system (4)-(5) for each and all agents, provides maximum expected utility. The incentive compatibility constraint (4) determines a partition of the w_i - W_i space in two regions, the high-effort and the low-effort regions. The maximization of (2) subject to (3) is computed for high and low effort respectively. These programs, that have "well-behaved" convex indifference curves and linear constraints, yield one point for each region. The government finally picks the one that provides the overall maximum utility.

In this simple model with only two actions, there are two possible types of ex-ante equilibria. One with incomplete insurance and high effort and one with full insurance and low effort. A graphical representation of

these equilibria is presented in figure 1. ²

Figure 1

Consider now the government's problem in period 2. Ex-post, after actions have been taken, the government faces a pure risk-sharing problem. Actions are given, so the incentive compatibility constraint does not hold. Maximization of (2) subject to (3) yields full-insurance, no matter whether agents have put in low or high effort. The first order conditions of this program imply that:

$$u'(W_i) = u'(w_i) \quad ; \quad \forall i \quad (6)$$

$$\frac{u'(W_i)}{u'(W_j)} = \frac{u'(w_i)}{u'(w_j)} = 1 \quad ; \quad \forall i, j \quad (7)$$

Equation (6) implies full insurance and equation (7) implies that all agents receive the same. Economic agents are aware of government incentives. They know that the government will provide full insurance, so they choose low effort. With $W_i = w_i$, the solution of (4) is $a_i = L$. These conditions, together with the resources constraint, give the set of consumption allocations in the discretionary equilibrium. ³

Now compare the optimal ex-ante and ex-post policies. In the case depicted in figure 1a, they coincide. But in the case of figure 1b, the ex-ante optimal policy is no longer optimal after agents have chosen effort. Thus, in the second case, the incomplete insurance policy is non credible, due to time inconsistency. It would be credible only if the government had the ability to commit not to reoptimize ex-post. Without commitment, the government would be ex-post tempted to remove the distortion provoked by moral hazard and provide full insurance. In terms of figure 2, the government would try to move from A to B, i.e. from the second to the first best. But agents are aware of these incentives, so they choose low effort and the economy ends in C, which is a third best.

Figure 2

Full insurance and low effort might have completely different meanings in the commitment and the discretionary equilibria. Under commitment, a full-insurance-low-effort equilibrium would be a first best. Under discretion,

2. See the appendix for an explanation of the figure.

3. If the government weighted individual utilities in a non-uniform fashion in its objective function, the full-insurance result would still hold. The only difference with the uniform weights case considered above would be that individuals with different weights would get different average consumption.

the full insurance and low effort outcome would arise even if the ex-ante optimal policy involved incomplete insurance, as in figure 2. This discretionary equilibrium would be a third best. In the first case, it is just a matter of preferences. In the second, there is a loss of social welfare. In point C there is overinsurance.

Notice that ex-ante optimization is more demanding for the government, for it requires precise knowledge of the states of nature and their probabilities, while ex-post optimization only requires an assessment of the marginal utility of consumption in each realized state of nature. The government might even ignore which are the possible states of nature and decide after the shocks took place. Indeed, it does not make any difference in this setup whether the government optimizes before or after the shock. Before the shock, the policymaker maximizes (2) subject to (3), picking a contingent consumption allocation. After the shock, it solves the following program:

$$\text{Maximize } \int_0^1 [u(W_i) \text{ \& } a_i] di \quad (8)$$

$$W_i >$$

$$s.t.: \int_0^1 [P(a_i) \cdot X + (1-P(a_i)) \cdot x] di \leq \int_0^1 W_i di \quad (9)$$

where the resources constraint has been reorganized to make it clear how little information the government needs to solve the ex-post problem. The left hand side in the resources constraint is aggregate output, something that the government observes. But maximization of (2) subject to (3) is the same as maximization of (8) subject to (9), as it becomes clear when the condition $W_i = w_i$, obtained from the FOCs of the first program, is substituted back into (2) and (3).

Thus, in the case of "true uncertainty", in which probabilities or even the states of nature are not known (Knight, 1921), ex-post optimization might be the only thing the government can do. Furthermore, if ignorance were shared by private companies, private insurance would not exist. Thus, ex-post insurance would be the only available option, and it might still be welfare improving.

The overinsurance result extends to the continuous effort case. First, the government's ex-post problem is the same as before: maximization of (2) subject to (3). Thus, in the discretionary equilibrium, the government provides full insurance and agents choose minimum effort. Second, ex-ante optimization usually implies incomplete insurance and a level of effort above the minimum. This is a standard result from agency theory (see, for instance, Holmstrom, 1979; Grossman and Hart, 1983; and Rogerson, 1985). Thus, even though the ex-ante optimal policy would generally be to provide some but not full insurance, a government that is not able to commit

not to reoptimize ex-post would always provide full insurance.

4. Non-separable utility functions

The model presented in the previous section is special in that utility functions are assumed additively separable in consumption and effort. In this section, the analysis is extended to the case of non-separable preferences. For the sake of simplicity, just two effort levels are formally considered. The main results are as follows. First, there is one equilibrium under commitment. As before, it could involve either full insurance and low effort or incomplete insurance and high effort. Second, the discretionary policy may exhibit multiple equilibria. There always exist an equilibrium in pure strategies with full insurance and low effort (point C in figure 2). There could also be other equilibria in mixed strategies with incomplete insurance and some, but not all, agents working hard. Third, the commitment equilibrium (weakly) Pareto dominates the discretionary equilibria.

With non-separable utility functions, the discretionary policy is not as simple as it was under the assumption of separability. The new issue is that the government now cares about effort. Even though in the second period effort is a given, it matters because the marginal utility of consumption depends on it. But the government does not observe effort. Still, it might infer something from observing output, for a high level of output is more likely if the agent worked hard than otherwise. Thus, the government can maximize the sum of expected utilities conditional on observed outcomes:

$$\max_{w_i} \int_0^1 [Prob(H/x_i) \cdot u(w_i, H) + (1 - Prob(H/x_i)) \cdot u(w_i, L)] di \quad (10)$$

$$s.t.: x^A = \int_0^1 [Prob(X/a_i) \cdot X + (1 - Prob(X/a_i)) \cdot x] di \quad \int_0^1 w_i di \quad (11)$$

where:

- i) **Prob(H/x_i)** is the probability that the government attaches to the event that agent i has worked hard, after having observed agent i's output (which can be either X or x).
- ii) **x^A** is aggregate output. (Notice that the government does not need to know a_i in equation (11), for it directly observes aggregate output).

The first order conditions of this program yield:

$$\begin{aligned}
 & \text{Prob}(H/X) \cdot u_1(W, H) \% (1 + \text{Prob}(H/X)) \cdot u_1(W, L) \quad (12) \\
 & \text{Prob}(H/x) \cdot u_1(w, H) \% (1 + \text{Prob}(H/x)) \cdot u_1(w, L)
 \end{aligned}$$

where $u_1(\cdot)$ stands for the first derivative in the first argument. The subindex in (w, W) has been dropped, because the same condition holds for all agents.

The government can appeal to Baye's rule to determine the conditional probabilities:

$$\text{Prob}(H/x_i) = \frac{\text{Prob}(x_i/H) \cdot \text{Prob}(H)}{\text{Prob}(x_i/H) \cdot \text{Prob}(H) + \text{Prob}(x_i/L) \cdot (1 + \text{Prob}(H))} \quad (13)$$

The probabilities of high and low output, conditional on effort, are common knowledge. The unconditional probability that someone has worked hard ($\text{Prob}(H)$) is also the proportion of individuals that has worked hard.⁴ This variable is not observable, but it can be estimated from the number of individuals that got high output (N):

$$\text{Prob}(X/H) \cdot \text{Prob}(H) \% \text{Prob}(X/L) \cdot (1 + \text{Prob}(H)) \quad (14)$$

The discretionary policy or the government reaction function can be computed solving the system (11) to (14) (with (11) holding as an equality). It is a mapping from the number of individuals that got high output to the set of feasible consumption allocations.

In the first period, agents choose effort to maximize expected utility (program (4)). They know the government reaction function, so that they can, in principle, anticipate the government's policy. However, as it was argued above, the discretionary policy depends on what private agents do. Thus, in order to make a rational choice, each agent has to foresee other agents decisions.

Agents' actions have been constrained to be high or low effort, by assumption. But even in this very simple setup, agents might decide on a continuum of strategies, since they can randomize. Thus, in general, each agent can pick up a certain probability of putting in high effort. If they choose 0 or 1, they play pure strategies, otherwise they play non-degenerate-mixed strategies.

A **discretionary equilibrium** is a set of consumption allocations and individual probabilities of working hard such that: i) both the government and private agents are optimizing, taking others' strategies as given; and ii)

4. In the previous section, the probability of getting high output for an agent that worked hard was denoted by $\mathbf{P(H)}$. In this section, the same probability is denoted by $\mathbf{Prob(X/H)}$, to avoid any possible confusion with the unconditional probability that someone has worked hard.

private agents' forecasts about other agents choices are on average correct.

Proposition 1: The discretionary policy game always exhibit an equilibrium with full insurance and low effort (zero probability of working hard). Moreover, this is the only symmetric Nash equilibrium in pure strategies.

Proof: First notice that output conveys no information in a pure-strategies-symmetric-Nash equilibrium. If agents chose high effort with certainty, the government's prior in (13) would be one, so that the posterior would also be one for all agents, independently of realized individual output. Conversely, if agents chose low effort with certainty, the posterior would be zero. In both cases, equation (12) implies that the government provides full insurance. As a consequence, agents put in low effort. QED.

The intuition behind this result is straightforward. If agents chose pure strategies, realized output would be completely uninformative about effort ($\text{Prob}(H/X) = \text{Prob}(H/x)$). Thus, the government would have no reason to make any difference between individuals.

Proposition 2: The discretionary policy game might exhibit mixed-strategies-symmetric-Nash equilibria with incomplete insurance and some, but not all, agents working hard.

Proof: In a non-degenerate-mixed-strategies equilibrium, private agents randomize, choosing high effort with probability strictly larger than zero and lower than one. These strategies would not be optimal if agents were not indifferent between high and low effort. Thus, these equilibria must lie on the incentive compatibility line: ⁵

$$\begin{aligned}
 & u(w, H) - u(w, L) = (1 - \text{Prob}(X/H)) \cdot u(w, H) - \\
 & \text{Prob}(X/L) \cdot u(w, L) = (1 - \text{Prob}(X/L)) \cdot u(w, H) - \text{Prob}(X/L) \cdot u(w, L)
 \end{aligned}
 \tag{15}$$

Equation (15) implies that a non-degenerate-mixed-strategies equilibrium must involve incomplete insurance, i.e. $W > w$.

In a symmetric equilibrium, all private agents choose the same strategy, so that the probability with which each agent picks high effort is also the proportion of individuals working hard in the population ($\text{Prob}(H)$).

Any set $\{W^*, w^*, \text{Prob}(H)^*\}$ that satisfies the system (11) to (15) is a mixed-strategies-Nash equilibrium of the discretionary policy game. These equilibria do not need to exist and, if they do, they might not be unique. The corollary of the following proposition establishes a necessary condition for the existence of mixed-strategies equilibria.

5. In the previous section, it was assumed that on the incentive compatibility line agents choose high effort. This assumption, standard in agency theory, helps in getting rid of an economically non-substantive existence problem. Now the assumption is modified to allow for mixed strategies.

Proposition 3: In a mixed-strategies equilibrium, the marginal utility of consumption, in both states of nature, must be strictly larger for an agent that put in high effort than for an agent that put in low effort. Formally:

$$w^L, L) < u_1(w^L, H) \quad ; \quad u_1(W^L, L) < u_1(W^L, H) \quad (16)$$

Proof: From equation (12):

$$\begin{aligned} & (w^L, H) & u_1(w^L, H)] \% (1 \& P_1) \cdot [u_1(W^L, L) & u_1(w^L, L) \\ & \quad \cdot (P_1 \& P_2) \cdot [u_1(w^L, L) & u_1(w^L, H)] \end{aligned} \quad (17)$$

$$\begin{aligned} & (W^L, H) & u_1(w^L, H)] \% (1 \& P_2) \cdot [u_1(W^L, L) & u_1(w^L, L) \\ & \quad \cdot (P_1 \& P_2) \cdot [u_1(W^L, L) & u_1(W^L, H)] \end{aligned}$$

where: $P_1 = \text{Prob}(H/X)$ and $P_2 = \text{Prob}(H/x)$.

In a mixed-strategies equilibrium, the unconditional probability of high effort ($\text{Prob}(H)$) is strictly larger than zero and lower than one. It follows that the probability of high effort conditional on realized output is higher when realized output is high and it is strictly larger than zero and lower than one ($0 < P_2 < P_1 < 1$).⁶ In proposition 2, it was shown that in mixed-strategies equilibria the government chooses incomplete insurance: $W^* > w^*$. These two strict inequalities imply that the left hand sides in equations (17) are negative. For the right hand sides to be negative, proposition 3 must be true. QED.

Corollary of proposition 3: (necessary condition for the existence of mixed-strategies equilibria). For mixed-strategies equilibria to exist, there must be at least one pair (w, W) for which condition (16) holds.

This corollary shows that equilibria in mixed strategies might not exist. That would be the case if, for instance, the marginal utility of consumption were for any consumption level higher when the agent put in low effort than when he put in high effort.

6. Realized output is, for the government, a signal of effort. In the present context, high output is said to be *more favorable* than low output, for the posterior probability of H conditional on X is larger than the posterior of H conditional on x. In a more general framework, with many effort levels, the distribution of a_i conditional on high effort dominates the corresponding distribution conditional on low effort, in the sense of first order stochastic dominance (see Milgrom, 1981).

The intuition behind these results is as follows. Agents might be willing to work hard with non-zero probability, if they got more consumption when output is high. Without commitment, the government will associate a higher consumption to high output if and only if two conditions are fulfilled: i) high output must be a signal that high effort is more likely; and ii) the government must find it optimal to give more output to those that have worked hard. Condition i) implies that there cannot be a pure-strategies equilibrium with high effort in the discretionary policy game. Thus, if an equilibrium with non-zero probability of high effort existed, it should be in mixed strategies. Condition ii) might not be fulfilled. This is the case, for example, of separable utility functions. In this case, the low-effort-pure-strategy equilibrium is the only equilibrium of the discretionary policy game.

Proposition 4: The commitment equilibrium weakly Pareto dominates the discretionary equilibria.

Proof: The government's option set in the discretionary game is properly contained by the government's option set in the commitment policy game. It follows that if the government picks a different consumption allocation in both regimes, it must be because the one chosen in the commitment regime provides higher utility. QED.

An example may help to get the intuition behind the multiple discretionary equilibria. The results of a numerical simulation are summarized in figure 3 (see the appendix for the details). The "government policy" line is the projection of the tridimensional government's reaction function on the w - W space. It is the locus of (w, W) such that the government is maximizing, conditional to an observed aggregate outcome. It touches the full-insurance line twice: the low (high) one corresponds to the lowest (highest) aggregate output, that occurs when everybody put in low (high) effort. In neither of these extreme cases, corresponding to agents playing pure strategies, the government has any reason to make differences between agents, so it provides full insurance. Being on the full-insurance line, both points are in the low effort region. Thus, only the low one is an equilibrium. In this example, the government line crosses the incentive compatibility line twice. These points are mixed strategy equilibria, provided agents choose the "right" randomization.

Figure 3

Multiple symmetric Nash equilibria necessitate strategic complementarity (Cooper and John, 1988). In the present game, the change in expected utility that each agent get by working hard might be an increasing function of other agents' own probabilities of working hard. This complementarity is introduced by the government's Bayesian inference about effort.

Mixed-strategies equilibria do not look very likely. Nothing compels players to choose the "right" randomization. Besides, coordination problems are huge. Still, history might provide a sort of coordination

mechanism or a focal point for agents to choose the "right" strategies. These equilibria look very tenuous, but moral rules might play a role in turning them more robust. In this sense, the model leaves room for non-economic explanations of different economic performance. As Calvo (1988) pointed out, multiplicity of equilibria might not be just the consequence of an incomplete theory but it could account for more fundamental issues taking place in the real world.

5. Reputation

As in many other policy games, reputation could serve as a substitute for commitment in the infinitely repeated version of the game. In the present context, reputational equilibria do not seem very likely. Still, the topic is briefly discussed, basically because it might help to get more intuition about the nature of the one-shot game problem. To this end, the simple model with separable utility functions is considered.

In the one-shot game, the problem is created by the temptation the government has to forgive a free rider that has put in low effort. Thus, a strategy that supports the second best point as a subgame perfect equilibrium must punish the government when it is too forgiving.

Consider the following simple strategy profile (in the sense of Abreu, 1988):

π_0 = Government chooses consumption allocations corresponding to point A in figure 2 (call them (w^A, W^A)).
Agents choose high effort.

π_1 = Government chooses consumption allocations corresponding to point C and agents put in low effort for one period. In the following periods, the government comes back to A and agents to high effort.

Players start in path 0 and continue there, unless one or more players deviate. If the government deviates, all players move to path 1. Each time the government deviates from any path, all players restart path 1. No punishment paths for private agents are specified, for they have no incentives to deviate, provided the government plays the above mentioned strategy. Still, to have a complete specification of the strategies, assume that all players continue in path 0 after a private agent chose low effort.

It is easy to verify that, for a sufficiently "patient" government, this strategy profile is a subgame perfect equilibrium (or a sequentially rational equilibrium; see Persson and Tabellini, 1989). First, it is a Nash equilibrium. Agents have no incentives to deviate from the cooperative path (π_0). The government has a short run incentive to deviate, providing full insurance (W^B), but such behavior would trigger path π_1 and submit the government to a loss in the following period. The government would not deviate if the discount factor were larger than a certain threshold, as indicated by equation (18).

$$* > \frac{U^B \& U^A}{U^A \& U^C} \quad (18)$$

Where $U^B > U^A > U^C$, are the one-period expected utilities in the points indicated in figure 2 (corresponding to the first, second and third best).⁷

Second, players have no incentives to deviate from path π_1 . Thus, the specified strategy profile is also a Nash equilibrium in the subgame that starts with the punishment of the government.

Repeated interaction might be more helpful if the government recorded past individual output and based consumption allocations on average performance. The literature on dynamic interaction in principal-agent relationships shows that the risk the principal must hold the agent to bear to secure the desired behavior can be reduced substantially by conditioning the reward to average performance (Radner 1981, 1985). In the special case of infinite horizon and no discounting, the principal does not need to impose any risk on the agent to induce the desired action. Equivalently, in the case of infinite horizon and no discounting, the government would be able to implement the first best.

The reputational equilibrium faces huge coordination problems in the present context with so many individuals. Besides, this equilibrium concept assumes that all agents develop strategic behavior, something that does not look very sensible for atomistic agents.

6. Concluding remarks

1. Full insurance and low effort might be provoked by at least three different causes. The first is just that agents prefer this life style (case of figure 1a). The second one is that the lack of the ability to commit by the government provokes overinsurance (case of figure 2). The third reason is that there is "true uncertainty", so that it is not possible to design a formal insurance scheme ex-ante.

2. The policy implications are very different in each case. In the first one, nothing should be done. There is no motive for concern. Under true uncertainty, it might be convenient to invest in gathering more information. Only in the second case, institutional reforms to reduce the government's discretion would be advisable. This is the case in which the welfare state might have gone "too far". Still, simply dismounting formal welfare institutions might not be the solution. It should be carefully assessed whether the new institutions would help to raise the government ability to commit. Otherwise, they would not induce changes in private agents behavior.

3. When agents simply prefer full insurance and low effort, a reduction of the welfare state might do no harm if the private sector could do the job. But if any of the many possible causes of market failure were present (Arnott

7. The punishment might be harsher, and then the required discount factor would be lower. It is immediate that as the punishment tends to last infinite periods, the threshold tends to be:

$$* > \frac{U^B \& U^A}{U^B \& U^C}$$

which is lower than that in (18).

and Stiglitz, 1988; Barr, 1992), the government would not be substituted by the private sector, and welfare would decrease.

4. In the case of true uncertainty, ex-post state insurance is the only thing that it could be done to deal with uncertainty. It is not possible to say in general whether this intervention would be welfare improving or not. Agents might be better off with no insurance at all. But nobody would know it in advance, due to the extreme lack of information. Thus, even if institutional reforms to reduce ex-post state insurance were available, it would be difficult to say whether they should be implemented.

5. Ex-post optimization does not mean that the discretionary regime cannot exhibit formal welfare institutions. In the presence of formal institutions, the rules of state insurance would be explicit before current generations took their decision about effort. Still, it might not mean that the government is optimizing ex-ante. Lasting welfare institutions might simply be the result of a lasting unsolved time inconsistency problem.

6. The welfare state might be very informal, in the sense that no typical welfare institutions might exist and still the government might be very active in insurance activities. This would be specially the case under "true uncertainty". The policy would look unpredictable and casuistic. There would be a "lack of clear rules of the game". But the government would have strong social welfare reasons to do what it does. It seems more likely that the welfare state takes this informal and rather chaotic form in LDCs, in which states are usually weak and information is scarce.

7. The government's inability to commit might not only reduce welfare but it could also introduce a basic indeterminacy in the economy. The economic performance might be any of several possible levels, being the government unable to drive the economy to any of them.

Appendix

Derivation of figure 1

Full insurance is represented by the 45° line, since $W_i = w_i$ on that line. Any point out of this line implies incomplete insurance. The incentive compatibility constraint is binding when the following condition holds:

$$u(W_i) \geq u(w_i) \quad , \quad \frac{H \& L}{P(H) \& P(L)} \quad (19)$$

This condition defines an **incentive compatibility line** in the w_i - W_i space, located to the west of the full insurance line and with slope larger than 1. Consumption allocations to the west (east) of the incentives line induce agents to put in high (low) effort.

Agents' preferences are represented by a map of **indifference curves** in the w_i - W_i space, with slope given by:

$$\frac{dW_i}{dw_i} \Big|_{\text{indiff.c.}} \cdot \left(\frac{1 - P(a_i)}{P(a_i)} \right) \cdot \frac{u'(w_i)}{u'(W_i)} \quad (20)$$

The indifference curves exhibit a discontinuity in slope (not in level) on the incentive compatibility line: they are steeper in the low effort region. Thus, the indifference map is non-convex, even with "well behaved" utility functions.

The **resources constraint**, equation (3), defines two straight lines, one for each effort region. They cross each other in the point (X,x). The slope of the resources line is higher in absolute value to the east of the incentives line. If (X,x) lies on the incentives line, the resources constraint exhibit no discontinuity in level. Otherwise, the resources constraint exhibit a discrete jump when it reaches the incentives line. The set of feasible consumption allocations becomes non-convex.

The indifference curves are steeper than the resources lines everywhere, save on the full-insurance line, where they have the same slope.

The example in figure 3

The example was built on the following assumptions:

$$\begin{aligned} u(w, H) &= H \cdot \ln w \\ u(w, L) &= L \cdot \ln w \quad \% \$ \end{aligned} \quad (21)$$

and parameter values: H = 2.0 ; L = 1.0 ; P(H) = 0.9 ; P(L) = 0.2 X = 1.0 ; x = 0.0 ; β = - 0.01072 .

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