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Comments welcome

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THE STRATEGIC INTERACTIONS BETWEEN CENTRAL AND LOCAL GOVERNMENTS AND THEIR IMPACT ON LOCAL PUBLIC FINANCES

ABSTRACT

This paper provides a model of the strategic interactions among the central and a lower level government where incomplete information forces both to form expectations about the other's behaviour. Various determinants and outcomes of the strategic interaction are explored. The model generates empirical restrictions about the central government's transfer decisions and the lower government's spending behaviour. These restrictions are tested on a sample of 20 Italian Regions. Data show that bailing out expectations are a quantitatively important component of local government spending.

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1. Introduction and literature review

When and why may a local government rationally expect to be bailed out by the central government? How do these expectations affect its spending behaviour? And when and why, instead, the strategic interactions between two government levels produce equilibrium in the public finances of the local government? and at which expenditure level? These are the questions addressed in this paper, both on theoretical and empirical grounds.

The literature has so far concentrated on the first two questions. The standard response is that local governments rationally form bailing out expectations whenever soft budget constraints characterize their relationship with the central government, which enable local governments to engage in excessive spending *ex ante*. In their survey of the literature, Kornai et al. (2003, p. 1104) state that the two phenomena are essentially interrelated: "If a bailout is entirely unanticipated, there is little point in ascribing the event to a soft budget constraint. We normally say that the syndrome is truly at work only if organizations can expect to be rescued from trouble, and those expectations in turn affect their behaviour". Research has thus focused on the causes of soft budget constraints to understand the formation of bailing out expectations and excessive spending. Several motives have been identified: political expediencies, negative externalities associated with the failure of the organization in crisis, reputational incentives for the supporting organization, its need to recoup past investments, paternalism, corruption (Kornai et al., 2003; Maskin, 1999; Quian and Roland, 1998; Rodden and Eskeland, 2003). At a more fundamental level, the behavioural question to be addressed is why a supporting organization, the central government in our case, selects the costly option to bail out a subordinate organization in trouble, here the local government, over the alternative to let it fail or to help it avoid the trouble (the motives for the organization in trouble to seek help are obvious). Following Dewatripont and Maskin (1995) the issue has been generally framed as an inability of rescuers to commit to no bail out *ex ante*. This framework of analysis has lead to the development of models of soft budget constraints and bailing out from the point of view of the supporting agency (Dewatripont and Maskin, 1995; Qian and Roland, 1998; Maskin, 1999; Kornai et al. 2003) or where the central government had superior information and/or ability to act (Goodspeed, 2002). In other words, because these models have to explain the motives of a bailing out outcome, they concentrate on the behaviour of the organization that actually bails out, the central government.

Although interesting and basically correct, the commitment failure approach has probably reached the boundaries of its explanatory potential. There are two closely related issues that this class of models finds difficult to explain. First, bailing out is only one of the

possible outcome of the strategic relationship between the central and lower tiered governments. The central government may refuse to bail out, or do so with delay, and/or be selective of which local government to relieve from trouble and which to abandon to self financing through a fiscal crunch. A more complete illustration of the various outcomes of the relationship would allow answering also to the third and fourth question posed in the introduction, namely, under which conditions that strategic relationship produces equilibrium in local public finances and at which level of expenditures. Secondly, this larger variety of courses of action for the central government increases the uncertainty for the local government and makes the formation of expectations a much more complex process. Put it in different terms, a satisfactory theory of bailing out and of the formation of the related expectations must not only explain *why* the central government decides to bail out, but also *when*, as well as provide the counterfactuals. The two points do not coincide in fact, as the behaviour of the local government may drive a wedge between them. The larger set of alternative strategies that the central government may follow expands also the set of the possible responses by the local government, which in turn triggers a larger variety of possible further reactions by the central government.

The increased complexity of the strategic interaction between the central and lower tiered governments requires a change in the modelling structure typical of the commitment failure models, concentrated on the central government, in favour of a multi-centred one, where the decision-making processes of both actors are equally important matters of inquiry.

There are a few examples of such a modelling strategy in the literature. Rodden (2005) adopts a multi-centred perspective in his study of the relationship between the German Federal government and the Länder. Bordignon and Turati (2009) is another paper in this vein; it describes the strategic interactions among the Italian central and regional governments in the domain of health care financing and spending. Both models are variants of Harsanyi (1967-68) games with incomplete information. Rodden's (2005) application of the Harsanyi model to the German situation is made, however, at the expense of theoretical rigour; Bordignon and Turati (2009), on the other hand, somewhat restrict the explanatory power f the theory by making it specific to the institutional setting of the Italian health care system in the 1990s.

The present paper innovates on the existing literature by maximizing analytical rigour and generality in the examination of the strategic interaction between a central and a lower tiered government. This reduces the institutional specificity of the model, but a comparison of the empirical analysis of this paper with that of Bordignon and Turati (2009) reveal that the

theory underlying both papers can be applied to a fairly large class of strategic interactions between government levels. An important feature of the theory is that the modelled interaction leads to a variety of financial outcomes – immediate bailing outs, deferred bailing outs, *ex ante* and deferred fiscal responsibility by the local government, as well as "failure" of the local government[2] – with respect to which the local government has to generate rational expectations. Interestingly, the model also shows that in certain cases soft budget constraints exist even if no bail out operations are put in place, for example when the central government avoids a deferred bail out by giving in immediately. The generality of the results is obtained by considering a variety of plausible payoffs structures and strategic alternatives for the actors, as well as by keeping the institutional details to a minimum. Quite importantly for the empirical test of the model, it can be shown that some empirical restrictions are invariant to all possible theoretical equilibria. These restrictions thus provide the null hypotheses tested in the econometric part of the paper, on a sample of 20 Italian Regions between 1996 and 2007.

The key issue of the empirical analysis is the representation of the expectations, as they are in principle unobservable. The empirical literature offers a set of alternative techniques for the purpose; they are all adopted here to verify the robustness of the estimated results. In particular, expectations are specified both through the IV strategy proposed by Pettersson-Lidblom and Dahlberg (2003) and Pettersson-Lidblom (2008), as well as through an autoregressive forecasting procedure, as in Holtz-Eakin and Rosen (1993), Rattsø (1999) and Rodden (2005).

The rest of the paper is organized as follows. Part 2 presents the theoretical model. Part 3 discusses the main features of the Italian system of intergovernmental relations. The empirical strategy is described in part 4, and the results are discussed in part 5. Part 6 draws the main conclusions of the analysis.

2. Theoretical model

2.1. The complete information game. The following game theoretic model analyzes the strategic interactions between the central government and the lower tiered government levels, describes how they form their expectations about the other's behaviour and provides theoretical grounds for the specification of the empirical model of section 4.

[2] Insolvent local governments generally do not go bankrupt like private corporations. Their "failure" is therefore to be intended as a refusal by the central government to bail them out that forces the local government to implement a tight fiscal policy and/or to face political consequences, depending on the institutional features of the country.

Consider a simple economy with two governments, a central and a local one. In this first version of the model, no government level enjoys an informational advantage on the other, so there is no uncertainty. Although insufficient to explain the formation of expectations, this game theoretic structure is a useful first step to the more complex setting where information is asymmetric. It also approximates the case where the relationship between the central and the local governments are tightly regulated, to the point where no room is left for discretionary behaviour.

Figure 1 represents the complete information case in a tree-form. The central government moves first and sets the level of resources to be given to the local government for the next period, **r**, which can be either high (R) or low (r), so that vector **r**=$\{r,R\}$, where $R>r>0$. These revenues can be thought of as transfers or revenue sharing schemes; for simplicity, the local government is supposed to have no fiscal autonomy. Upon observing **r**, the local government selects an expenditure level from vector **e**. Again for simplicity it is supposed that also the local government can only choose between two levels of expenditure, low or high, **e**=$\{e, E\}$, where $E>e>0$. With no loss of generality, the funding and expenditure levels are assumed to be symmetric and equal, so that when both government levels play "high" or "low", the local government budget is in balanced: $(R-E)=0=(r-e)$. Furthermore, if the central government is "generous", i.e., it sets R at the beginning of the game (upper branch at M1), it is assumed that the local government can only decide an expenditure level equal to E, as the budget rules forbid cashing in the difference between expenditure and funding[3]. In this case (squared ending nod of the upper branch) the payoff for the central and the local government are, respectively, $U^C(R, E)$ and $U^L(R, E)$.

Suppose instead that the central government is "stingy", i.e., it sets r at the first stage of the game (lower branch at M1). If the local government reacts by setting e (lower branch at M2) the game is again over and the payoffs for the two agents are respectively $U^C(r, e)$ and $U^L(r, e)$. But the local government may also select E and run a deficit (upper branch at M2). If so, it is again the central government's turn to move; choosing among two alternative courses of action: it may be "tough" and impose a hard budget constraint on the local government (lower branch at M3); or it may be "weak" and impose a soft budget constraint (upper branch at M3). By imposing a hard budget constraint, the central government refuses to accommodate the increased expenditure by the local government, forcing it to take care of the

[3] In the light of the literature on the flypaper effect, the case where the local government actually runs a surplus or lowers other revenues (excluded from the model), beside being factually irrelevant, adds nothing to the present analysis.

deficit through a fiscal crunch; in this case the utility levels of the two agents are respectively $U^C(r, E)$ and $U^L(r, E)$. If, alternatively, the central government places a soft budget constraint on the local one, at M3 it will accommodate the increased local spending by increasing transfers. In this case the utility levels of the two agents become $U^{Cb}(R, E)$ and $U^{Lb}(R, E)$, where the superscript *b* stands for "bailing out".

In the model, the following assumptions on payoffs are made:

A1) $U^C(r ,e)>U^C(R,E)$;

A2) $U^C(r ,e)>U^{Cb}(R,E)$;

A3) $U^L(R,E)\geq U^{Lb}(R, E)>U^L(r, e)>U^L (r, E)$;

A4) $U^C(r ,e)+U^L(r, e)>max [U^C(R,E)+U^L(R,E); U^{Cb}(R,E)+U^{Lb}(R,E)]$.

Assumptions A1) and A2) say that the central government is essentially "stingy", i.e., it prefers low financing and low expenditure to high financing and high expenditure, both when the bailing out occurs and when it does not. Assumption A3) asserts that the local government prefers high expenditure and high financing (and the earlier the better), but that if it had to finance itself the deficit in the case of low financing, it would prefer to cut expenditure immediately. Assumption A4) guarantees that it is indeed Pareto efficient to constrain financing and expenditure at the low level. In light of the positive literature on the politics of transfers from central to local governments (Padovano, 2010 for a survey) all these assumptions seem plausible.

The payoffs of the central government determine the equilibria of this game. In particular, it can be easily shown that, in this case of perfect information, the only subgame perfect equilibria of this game are:

E1) If $U^C(r, E)>U^{Cb}(R, E)$, i.e., the central government is stingy and places a hard budget constraint, it then plays *r* at M1, the local government selects *e* because of A3 and the game ends.

E2) If $U^C(R,E)>U^{Cb}(R,E)>U^C(r,E)$, i.e., the central government is generous, it plays *R* at M1, the local government reacts by selecting *E* at M2 and the game ends.

E3) If $U^{Cb}(R,E)>U^C(R,E)>U^C(r ,E)$, i.e., the central government is possibly stingy but can place only a soft budget constraint on the local one, then it plays *r* at M1, the local government knows the payoff structure of the central government and reacts by selecting *E* at M2. The central government ends by bailing out the deficit of the local government at M3.

Assumption A4) ensures that the first best equilibrium is E1, when the central government can credibly commit not to bail out local deficits. If it cannot, then either the central government gives in immediately and sets a high financing level (equilibrium E2), or it gives

in later, deciding for a low level of financing in the first period and then bailing out the local deficits later (equilibrium E3). Although both second best, E2 and E3 are also interesting cases in themselves, for different reasons. E2 shows that, contrary to what the literature generally maintains, soft budget constraints problems may appear in the form of excessive funding and excessive expenditure, with no formal bailing out. In that case, the central government knows *ex ante* that it cannot be tough on local government spending, and gives in immediately. E3 instead shows that the central government may actually find it convenient to initially underfund the local government and still end up with a bailing out. This may happen because, in a bailing out situation, the central government may discriminate more easily which local governments to save with respect to the case where it gives in immediately. It may in fact be the case that bailing out allows the central government to target the local government which are politically friendly (alignment effect, as in Arulampalam et al. 2009) or more politically rewarding (e.g., the "swing" local governments, as in Dixit and Londregan, 1998) and reap higher political gains. Else, the central government may simply wait for the least costly period to bail out the local governments in trouble, i.e., it discriminates across time periods. The empirical literature (Padovano, 2010; Bordignon and Turati, 2009) shows that both scenarios are factually relevant. By giving in immediately the central government funds all local governments; bailing out allows it to discriminate, across governments and through time.

2.2. The incomplete information game. To examine how central and local governments form expectations about each other's behaviour, uncertainty must be introduced in the strategic relationship described in the first version of the model. To this end, the assumption of perfect information must be relaxed. That implies the following variations of the previous game, along the lines of the Harsanyi (1967-68) model. Let the payoff functions of the local government and the timing of the game remain as above, but suppose now that there are two "types" of central government, one which bails out local ones and the other that does not. Also suppose that, while the payoffs of the local government in the different outcomes of the game are common knowledge, the information about the type of central government is its private information. The local government has only some *a priori* on the "type" of central government. Formally, suppose that the local government now expects the central government to be "tough" with some probability π (Figure 2-4, upper branch at M1) and to be "weak" with probability $1-\pi$ (Figure 2-4, lower branch at M1). It is now possible to formally define the two types of central governments, which could not be done in the previous version of the game. A "tough" central government prefers not to bail out the local government in the event

of a deficit: $U^{CT}(r, E)>U^{CbT}(R, E)$. A "weak" central government, instead, always prefers to bail out the local government in the case of a deficit: $U^{CbW}(R,E)>U^{CW}(r,E)$. There the superscripts *T* and *W* refer to the type of government. Both types of government still prefer low expenditure and low financing to high expenditure and high financing (i.e. $U^{CT,W}(r,e)>U^{CT,W}(R,E)$), i.e., they are essentially stingy as before.

As this is a dynamic game with incomplete information, one must look for perfect Bayesian equilibria. The game is always solved by backward induction, although a variety of cases must be considered, depending to the payoff structures of the two government levels.

Figure 2 illustrates the outcomes common to all payoff structures. Recall that if the central government sets *R* in the first period, then the local government can only set *E* by assumption and the game ends (Figure 2, upper branches at M2 and M3). If the central government sets *r* in the first period, and the local government reacts by setting *e*, the game is also over (Figure 2, lower branches at M2 and M3). Thus we have to consider only the case where the central government sets *r* at M2, and the region reacts by setting *E* (Figure 2, upper branches departing the second and forth nod from the top at M3). In this case, in the final period, given our assumptions on the payoffs of both types of governments, the best strategy for the tough government is to play "not bailing out", while the best strategy for the weak government is to play "bailing out". The final outcome will then be (r, E) in the first case and (R, E) in the second case, with the associated payoffs of agents (squared nods at M4).

Having solved the last stage let us then move back to the first period and study the optimal strategies of the two types of central government. Consider first the tough type. For this type, setting *R* at M2 is a dominated strategy (dominated strategies are represented by dotted lines); whatever the beliefs of the local government, if the central government sets *R*, the local government can only respond with *E* and for the tough type this outcome is worse with respect to any other alternatives: $U^{CT}(r, e)>U^{CT}(r, E)>U^{CT}(R,E)>U^{CbT}(R, E)$. Hence, the tough type certainly plays *r* in the first period. Consider now the weak type. There are two alternatives, A) the case where the central government prefers bailing out later to giving in immediately ($U^{CbW}(R, E)>U^{CW}(R, E)$ in Figure 2) and B) the case where the central government prefers giving in immediately ($U^{CW}(R, E)>U^{CbW}(R, E)$ in Figure 3-4). In case A), it is easy to see that setting *R* at M2 is a dominated strategy for the weak type too (upper branch starting from the lower nod at M2); for if the central government sets *R*, the local government can only respond with *E* by assumption, and whatever beliefs the local government holds upon observing *r*, even in the worst possible case where the local government reacts by setting up *E* (upper branch starting from bottom nod at M3), the weak

government is better off by bailing out than by giving in immediately: $U^{CbW}(R, E)>U^{CW}(R, E)$. In other words, as r is the dominant strategy for both the tough and weak government, the local government will learn nothing about the type of government by observing r in the first period; it will still assume that this move comes from a tough government with probability π, which can therefore be interpreted as the *ex ante* probability of the central government being "tough" or, likewise, the *ex ante* credibility of the central government's threat not to bail out in the future the local governments in deficit. Thus, the local government will choose E if $\pi U^{L}(r, E)+(1-\pi)U^{Lb}(R, E)>U^{L}(r, e)$ and e if the inequality is reversed. Solving the above equation for the value of π at which the local government is indifferent, π', we prove the following Proposition 1:

PROPOSITION 1 Suppose it is common knowledge that $U^{CbW}(R, E)>U^{CW}(R, E)$. Then, there is a *pooling* perfect Bayesian equilibrium in pure strategies of the game. In this equilibrium, both types of government set r in the first period, the local government's posterior beliefs coincide with its *a priori* beliefs, and the local government chooses E if $\pi<\pi'$, and e if $\pi>\pi'$ (it is indifferent if $\pi=\pi'$), where $\pi'=[(U^{Lb}(R, E)-U^{L}(r, e))/(U^{Lb}(R, E)-U^{L}(r, E))]<1$.

Consider next the case B), represented in figure 3, where $U^{CW}(R,E)>U^{CbW}(R,E)$. In this situation, under complete information, the central government would simply give in immediately, setting up a high level of financing. Under incomplete information, however, the weak government can try to take advantage of local government's uncertainty and mimic the "tough" type. If the central government manages to convince the local government that it is "tough", it might attain the first best equilibrium. Formally, let us then define a *separating equilibrium* (in pure strategies) as one where each central government type plays in the first period a different optimal strategy; and a *pooling equilibrium* as an equilibrium where both central government types play the same strategy in the first period. We begin by establishing the following:

LEMMA 1 Suppose it is commonly known that $U^{CW}(R,E)>U^{CbW}(R,E)$. Then, there is no separating equilibrium in pure strategies in the game.

To prove the lemma, consider that, in a separating equilibrium, the weak type of government plays R and the tough type plays r at M2. Given these equilibrium strategies, the

local government then rationally concludes that if the government plays *R* is of the weak type and reacts by setting *E* at M3, while if the government plays *r* is of the tough type, and reacts by setting *e* instead. But the latter cannot be equilibrium. Given these posterior beliefs of the local government, at the stage of considering the optimal strategies for the two types, the weak government would always be better off by playing *r* at M2 and having the local government answer with *e* at M3, because $U^{CW}(r,e)>U^{CW}(R,E)$. This is an optimal deviation for the weak type, which breaks the separating equilibrium. In this kind of game the weak government always finds it convenient to mimic the tough government. To see when this pooling behaviour can be supported in equilibrium, the following assumption about the local government's out-of-equilibrium beliefs with respect to the pooling equilibrium strategies must be introduced. Since the tough type will never play *R* at M2 out of dominance, while the weak type could play *R* under some solutions of the game, we assume that if the local government observes that *R* is played at M2, it rationally concludes that this move can only come from a weak government. This assumption made, one can state the following:

LEMMA 2 Suppose it is commonly known that $U^{CW}(R,E)>U^{CbW}(R,E)$. Then, under the above assumption about the out-of-equilibrium beliefs, for $\pi\geq \pi'$ there exists a unique pooling equilibrium in pure strategies. At this equilibrium, both types of government choose *r* at M2, and the local government optimally selects *e* at M3.

In order to prove the lemma, consider that, at the pooling equilibrium strategies for the two types, both types of central government play *r* at M2. Hence, the posterior belief of the local government equals the *a priori* and, for $\pi\geq\pi'$, viz., if the *ex ante* credibility of the central government's threat not to bail out future local deficits is high enough, the optimal reaction of the local government is to set *e* at M3, by assumption A3. Note that this is equilibrium; the tough government always plays *r* by dominance, and under the out-of-equilibrium beliefs assumption, if the weak central government deviates and set *R* at M2, the local government selects *E* at M3, and this outcome is worse for the weak government than the equilibrium outcome, because in case B) $U^{CW}(r,e)>U^{CbW}(R,E)$ still holds. Hence, if π is sufficiently high, the weak government can successfully imitate the tough government. Although the local government expects this, the probability that the government be in fact tough is too large for the local government to be willing to run the risk of deviating and selecting a high level of expenditure, as it would then face the risk of failure with a large deficit to self finance. This proves the lemma.

Matters are quite different if, on the other hand, π is lower than the threshold level π'. In such case, the pooling equilibrium in pure strategies of lemma 2 cannot be sustained. The local government would expect the choice of r to come from a weak government with higher probability and would then rationally react by choosing E at M3. Expecting this, the weak government would then be better off by choosing R immediately, again because $U^{CW}(R,E)>U^{CbW}(R,E)$. Neither could the resulting separating equilibrium in pure strategies be sustainable, as lemma 1 proves, as at the separating posterior equilibrium beliefs the weak government would always be better off by mimicking the tough type. The solution is then to look for mixed strategies equilibria, namely, to equilibria where the weak government plays r with some equilibrium probability and the local government reacts by selecting e with some other equilibrium probability. The next lemma and figure 4 describe this equilibrium.

LEMMA 3 Suppose that it is commonly known that $U^{CW}(R,E)>U^{CbW}(R,E)$. Then, under our assumption above on out-of-equilibrium beliefs, for $\pi<\pi'$ there exists a unique pooling equilibrium in mixed strategies. At this equilibrium, at M2 the tough government always chooses r, and the weak government chooses r with probability ρ^* and R with probability $1-\rho^*$. The local government, upon observing R, always chooses E, and upon observing r selects e in the second period with probability σ^* and E with probability $1-\sigma^*$. The equilibrium beliefs of the local government are such that, upon observing R, it assigns zero probability to the central government being of the tough type, and upon observing r it assigns probability $\pi^\circ(\rho^*)\equiv\pi/[\pi+(1-\pi)\rho^*]$ to the government being tough. Finally,
$\rho^*=\{\pi[U^L(r,e)-U^L(r,E)]/(1-\pi)[U^{Lb}(R,E)-U^L(r,e)]\}$ and
$\sigma^*=\{[U^{CW}(R,E)-U^{CbW}(R,E)]/[U^{CW}(r,e)-U^{CbW}(R,E)]\}$.

In order to prove this lemma, suppose the local government expects the weak government to play r at M2 with probability ρ. The tough government always plays r by dominance. Then, by Bayes rule, upon observing r at M2, the local government concludes that, with probability $\pi^\circ(\rho^*)\equiv\pi/[\pi+(1-\pi)\rho^*]$, the government is tough. The local government will then be indifferent between playing e or E upon observing r provided that $\pi^\circ(\rho^*)\times U^L(r,E)+(1-\pi^\circ(\rho^*))\times U^{Lb}(R,E)=U^L(r,e)$. Substituting for $\pi^\circ(\rho^*)$ and then solving for ρ, this gives ρ^*. In turn, for the weak government to be willing to randomise between playing r and R in the first period, it must also be indifferent in expected terms between the two strategies. This occurs if the local government, upon observing r in the first period, plays e with probability σ^*, where

σ^* is implicitly defined by the equation: $U^{CW}(R,E)==(1-\sigma^*)U^{CbW}(R,E)+\sigma^* U^{CW}(r,e)$. Note that the proposed strategies and beliefs indeed constitute a perfect Bayesian equilibrium; by construction, no other strategies would make any agent better off, given the strategies played by the other agents, and the beliefs of local government are derived by using Bayes rule, given the equilibrium strategies of the two types of government. Finally, note that this equilibrium is also unique, as we have shown that, for $\pi<\pi'$, there is neither a separating nor a pooling equilibrium in pure strategies.

Finally, combining Lemma 1, 2 and 3, we get the following Proposition 2.

PROPOSITION 2 Suppose it is common knowledge that $U^{CbW}(R,E)<U^{CW}(R,E)$. Then:

1) for $\pi \geq \pi'$ there exists a *pooling* perfect Bayesian equilibrium in pure strategies, where both the tough and the weak type of government choose r at M2, the local government's posterior beliefs coincide with *a priori* beliefs, and the local government optimally responds with e at M3;

2) for $\pi<\pi'$ there exists a unique perfect Bayesian equilibrium in mixed strategies. At this equilibrium, at M2 the tough government always chooses r, and the weak government chooses r with probability ρ^*, and R with probability $1-\rho^*$. The local government, upon observing R chooses E and upon observing r selects e at M3 with probability σ^* and E with probability $1-\sigma^*$. The equilibrium beliefs of the local government are such that, upon observing R, it assigns zero probability to the government being tough, and upon observing r, it assigns probability $\pi^\circ(\rho^*)\equiv\pi/[\pi+(1-\pi)\rho^*]$ to the government being tough. Finally one can define:

$\rho^*=\{\pi[U^L(r,e)-U^L(r,E)]/(1-\pi)[U^{Lb}(R,E)-U^L(r,e)]\}$ and

$\sigma^*=\{[U^{CW}(R,E)-U^{CbW}(R,E)]/[U^{CW}(r,e)-U^{CbW}(R,E)]\}$.

The crucial implication of Propositions 1 and 2 is that, under incomplete information, the "weak" government can try to take advantage of local government's uncertainty by mimicking the "tough" type. The reason for doing so is that if it can convince the local government that it is "tough" it might reach the first best equilibrium. Of course, the local government anticipates this but, at the equilibrium, it still expects with some positive probability that the government be "tough". This leads in some cases the local government to optimally respond to a low level of financing with a low level of expenditure. Hence, the "weak" central government can now achieve the first best equilibrium, which was impossible under perfect information.

2.3. Empirical restrictions. The incomplete information version of the model offers a number of interesting empirical restrictions. Quite importantly, these predictions are common to all the different payoff structures, used to represent different institutional scenarios, as they all revolve around the key theoretical variable π, the *ex ante* credibility of the central government's threat not to bail out in the future local deficits. Time related factors that affect the value of π would make the theoretical model generate the following empirical restrictions:

H1) *Coeteris paribus*, it should be more likely to observe a low level of *ex ante* financing when π (the expected probability that the central government is tough) is high than when π is low. For instance, under perfect information in the case E2 the central government immediately gives in and sets a high level of financing. Conversely, in the same case under incomplete information, the central government sets a low level of *ex ante* financing with at least some positive probability, and this probability is increasing in π[4].

H2) Having observed a low level of *ex ante* financing, the local government is more likely to react with a low level of expenditure when π is high than when π is low. In other words, when π is high, a low level of financing is a more reliable signal that the government is indeed "tough"; therefore, the local government reacts by choosing a low level of expenditures. For example, under perfect information in case E3 the government sets r at the beginning of the game, but the local government does not believe the implied threat, and reacts by choosing a high level of expenditure. On the contrary, in the same case under incomplete information, upon observing r the local government reacts by choosing a low level of expenditure if π is sufficiently high (see Propositions 1 and 2).

H3) Another implication of the model can be found by further modifying the structure of the game. In the above model, if the local government chooses the high level of expenditure E, the weak government would always reveal itself by bailing out local deficits. But this feature is simply the result of having analysed a single shot of the financing–expenditure game. If we repeated the game several times, we would find equilibria where at least in the early stages, even the weak government would find it convenient not to bail out the local government in the event of a deficit, in order to build a reputation of being "tough" for future periods (as in the reputation models *à la* Kreps and Wilson, 1982). This extension of the game is not worked out here. But there is an obvious prediction of the repeated version of the model that seems nonetheless worth exploring empirically; if the local government has observed a large amount of bailing out in the past by the central government, it should

[4] Recall from Proposition 2 that ρ^* is an increasing function of π, and $\rho=1$ in the limiting case where $\pi=\pi'$.

rationally predict that the same government is weak with larger probability. That is, after a bail out of past deficits by the current government, the *ex ante* credibility of its threats of no further bailouts (π in the model above) should be, *coeteris paribus*, lower. This also implies that one should observe higher level of *ex ante* financing and current expenditure.

3. The Italian institutional framework

A short description of the vertical organization of the Italian public sector and of its main financial features illustrates why the strategic relationships between the central government and the regions provides an appropriate testing ground for the theoretical model of section 2.

The vertical organization of the Italian public sector features three main tiers of government: central, regional (which includes the regions and the local health units[5]), and local (including provinces and municipalities), plus the nationwide social security system (pensions and unemployment insurance). There are 15 ordinary statute regions (*Regioni a Statuto Ordinario*, RSO), five special statute regions (*Regioni a Statuto Speciale*, RSS), 109 provinces, and more than 8100 municipalities ranging in size from some 30 inhabitants (Morterone in Lombardy) to more than 2,5 million (Rome). The most important "horizontal" institutional difference is between the RSO and the RSS. Geographical, cultural, and economic lead to the establishment, recognized at the Constitutional level, of five autonomous regions (Valle d'Aosta, Trentino Alto Adige and Friuli Venezia Giulia in the North; Sicily and Sardinia in the South) with special statutes. They have broader spending powers than the ordinary statute regions and correspondingly larger financial transfers from the central government (Brosio et al., 2003). The RSO, though foreseen by the Constitution, were implemented only in 1970.

The Italian public sector is quite large by international standards: government total outlays were 50.1% of GDP in 2005. Gross of intergovernmental transfers, nearly half of both expenditures and revenues can be imputed to the central government, while the rest can be divided roughly equally between sub-national governments and social security institutions. Budgets are near balance for all government levels. Table 1 shows, however, that this picture changes dramatically when intergovernmental transfers are netted out. The expenditures of both sub-national governments and social security institutions greatly exceed their own revenues (by 6.5 and 3.5 percentage points of GDP, respectively), while the opposite holds for

[5] The so-called ASL, *Aziende Sanitarie Locali*.

the central government. This means that the deficits of sub-national governments and social security institutions are essentially covered by central government transfers. Table 2 reports the composition of the financing of public expenditure (gross of transfers) by the various fiscal instruments (taxes, social security contributions, transfers, other revenues, deficit) for each level of government. Even after the massive decentralization process of the 1990s (Arachi and Zanardi, 2004), grants from other levels of government still provide a very substantial share of total revenues of sub-national governments and social security institutions. Table 2 shows also how limited are the dependence of local governments on the regions: the bulk of their transfer revenues come directly from the central government. While it would be an interesting and ample testing ground, the financial data about the 8100 Italian municipalities are still of poor quality. The analysis of intergovernmental transfer schemes will then focus on the relationships between the central government and the 20 regions.

The organization and size of the Italian public sector find an important motivation in the stark and persistent structural and economic disparities between the regions that have characterized the country since its unification in 1861. The traditional strong centralization of the Italian public finances is in fact grounded on the idea that the central government is better positioned to orchestrate the fluxes of redistribution needed to reduce the levels of economic development among the regions (Brosio et. al. 2003). Table 3 present some of the main features of these regional disparities as they are today. The Italian regions differ widely in surface area (a relevant feature for economies of scale in public production), in population density and age structure: the population is substantially younger in the South than in the North, with obvious impacts on healthcare and pension expenditures. Moving from the northern to the southern regions, the probability for an individual of being poor increases four times and per-capita GDP is cut in half, with the inevitable impact on fiscal capacity. Recent analyses by the Bank of Italy confirm this result for average family income and wealth for the 1995-2000 time interval (Cannari and D'Alessio, 2003; Figure 5). This geographical dualism explains the particular emphasis on inter-regional redistribution in the Italian political debate. Sinn and Westermann (2001) have clearly shown that such disparities find no match in other European countries.

The regions have the main responsibility of health care provision, plus some spending programs related with education, transport, social assistance and culture. In quantitative terms, health care expenditures represent more than 50% of all regional outlays in RSOs and almost 40% in RSSs, making for a national average around 50% (Turati, 2003). While health care provisions are decided at the regional level, funding is mandated by the central government.

The Italian National Health Service (*Servizio Sanitario Nazionale*, SSN) was instituted in 1979 and, until 1998, expenditures were decided by the regional government and deficits were covered through grants by the central government, with the predictable endemic problems of soft budget constraints. Following the political and economic turmoil of the beginning of the 1990s, a number of reforms were implemented with the aim to harden the local budget constraints and to improve accountability and responsibility of local governments. Regions in particular moved from being financed by tax revenue for only about 15% in 1990 to over 50% of their budget, as Figure 6 shows. Of course, these numbers have to be taken with care, as they mix up own taxes (where local governments can at least vary the rates) with local shares of central taxes (where autonomy is none). But the main jump in Figure 6 does coincide with the introduction of a major tax on value added (net of depreciations) raised at the firm's level, the IRAP (*Imposta Regionale sulle Attività Produttive*) entrusted to the regions and, until 2001, earmarked to finance health expenditures (since then regions can freely dispose of the revenues). The central government has also tried to progressively substitute transfers to the RSOs with a participation to the revenues from the value added tax (IVA, *Imposta sul Valore Aggiunto*), a process that should be completed in 2013. Both measures may be interpreted as an increase of the tax autonomy of the regional governments; yet it is always the central government that regulates the tax bases, the tax rates and the special provisions of the fiscal instruments attributed to the regions, whose powers to decide autonomously in fiscal matters are quite limited: in the case of the IRAP, for instance, all that a region can do is varying the rate by ±1%. Finally, since the year 2000 the distribution of grants to RSOs was explicitly restricted to purposes of income equalization, according to a specific formula that takes into consideration each region's per capita fiscal capacity and health care spending needs relative to the national average (Brosio et al., 2003). Although the implementation of this stricter regime is phased out in 13 years, already in 2002 and 2005 the central government was forced to accept derogations to the transfers foreseen by the formula. This strong resilience of discretionary power *vis à vis* rule based decisions, as well as the regional governments' revealed preference for bilateral bargaining over transfers with the central government with respect to being entrusted with greater fiscal autonomy confirms the importance of examining the issue of the strategic relationship between the central government and the regions that involves the financing of the regional expenditures by the central government.

4. The empirical analysis

4.1. Data sources. The dataset spans 21 cross section unites (19 Regions, plus the two autonomous provinces of Trento and Bolzano) in the time interval between 1996 and 2007, for which consistent financial data about transfers are available. ISTAT and the Ministry of Economic Development started to collect financial data about the decentralized government levels (except municipalities) since 1996; consistent data about the financial and economic relationships between the central government and the regions are thus available from 1996 to 2007[6]. The overall sample totals 240 observations per variable. Appendix A describes the data sources of the dependent and independent variables.

4.2. Modelling expectations. A crucial problem for the analysis is to link the theoretical model with observable variables, so to ensure consistency between the theory and its empirical test. In this respect, the crucial role is played by the variable π, i.e., the assessment that regional governments make about the "toughness" of the central government. There are basically two kinds of proxies of the changes of regional expectations about the central government toughness: time varying proxies (vector **TPROXY**) and region specific ones (vector **RPROXY**).

The elements of the vector **TPROXY** vary only through time, thus affect all regions in the same way. Proxies of this kind are indexes of the tightness of the central government budget, such as the ratio between the consolidated deficit of the Italian central government and the average EU15 deficit (*DDPIL*). We have also explored the impact of the loosening of the Growth and Stability Pact in 2005 by means of a dummy centred on that year (*EASE95*), but it never showed a significant explanatory power due to its proximity to the end of the sample. Other candidates are the presence of elections at the national level, *ELN*, which takes the value of 1 in year *t* if national elections are held in the second half of that year, or 1 in year *t* and *t-1* if elections fall in the first half of the year *t*, and 0 otherwise. This variable captures political budget cycle effects that could potentially ease the budget constraint of all regions. To make sure that we are actually finding a cycle, i.e. that the budget expands before the elections and contracts in the year after, we have also included a one forward lag of *ELN*. Outside the electoral periods, the electoral strength of the national government is correlated with its need to resort to transfers as a means to acquire votes locally. We proxy the electoral strength by the vote margin between the government majority and the opposition, *NDIF*; it should be negatively related with the amount of transfers distributed. Furthermore, in a

[6] The connection with the previous series on regional expenditures is problematic because of differences in classifications.

parliamentary system like Italy governments change often during the legislature and can be supported by (slightly) different majorities. That affects the concentration of the government majority, measured by the Herfindhal index of its parliamentary seats *HM*, and offers another measure of the government "strength". This indicators captures the probability of internal wars of attrition that may weaken the government, reduce its expected life and force it to implement vote-buying strategies such as the distribution of transfers to regional governments (Alesina and Drazen, 1991; Padovano and Venturi, 2001). Finally, we include also a linear trend (variable *TREND*) common to all regions that mimics the so-called "historical expenditure" dynamics, an incremental value mechanism *à la* Wildavsky (1964) by which Italian regions could expect to receive every year an incremental value of the current transfers obtained in the previous year so long as their total expenditures kept rising.

The second variant of proxies shows variability also across regions, and represents changes of expectations due to region specific events (vector **RPROXY**). Variables of this kind are the alignment effect between the central and the regional government, which summarises the comparatively lower political cost for the central government to bailing out a "friendly" regional government – and the expectations that regional governments attach to such a fact. Another relevant factor is the vote margin of the regional governments over the opposition; although this variable, *RDIF*, is constructed in the same way as the national counterpart, the underlying relationship with the distribution of grants is more difficult to interpret. On the one hand, probabilistic voting models *à la* Dixit and Londregan (1996) predict that central government directs grants in marginal or "swing" regions, which should result in an inverse U-shaped relationship between regional vote differences and transfers. Alternatively, as Cox and McCubbins (1987) first suggested, risk adverse politicians in the central government might use grants to reward local politicians for electoral success and consolidate their local constituencies. In this case we should observe a positive linear coefficient on *RDIF*. The statistical significance of the coefficient on the square of the *RDIF* variable discriminates among these two competing theories. The distribution of grants by the central government may also be modelled as a rent seeking game, with the various regions characterized by different lobbying skills. Efficient lobbying requires that regional politicians (often the governors themselves) establish connections with the central government politicians and top bureaucrats, chiefly in the Ministry of Economics and Finance, build personal prestige and political weight. As these endeavours require time, it is plausible that regional governments that are in charge since longer time (variable *YEARS*) are likely to be more effective at lobbying and will thus obtain more transfers (Padovano, 2010). Finally,

Pettersson-Lidbom (2008) and Pettersson-Lidbom and Dahlberg (2003) refer to the dynamic structure implicit in any soft budget constraint problems and argue that the history of past bailing out should be the best predictor for expectations of future bailing out. We account for this argument by means of a $i \times t$ matrix of dummy variables *BOUT* that takes the value of 1 when region i in year t is the beneficiary of a special transfer of resources from the central government, reported in the financial bill (*Legge Finanziaria*).

4.3. The empirical strategy. The first test is related to Proposition 1 of the model, namely, that a low level of financing should be more likely observed when π is high than when it is low (H1). To this end, one must first check that all the time- and regional-varying proxies for bailing out expectations affect the financing decision of the central government. According to the model "weak" central government are also tempted to reduce financing in the first place, as they can anticipate the shift in expectations held by regional governments. Furthermore, to verify the generality of the model, financing is measured in three alternative ways: real total transfers per capita from the central to the regional government, *TR*/*POP*, and their disaggregation between transfers earmarked to current spending (*TRC/POP*) and capital spending (*TRK/POP*), always from the central government to the regions and in real per capita terms. We then proceed to test Proposition 2, namely that, having observed a low level of financing, a regional government is more likely to react with a low level of expenditure when π is high than when it is low. To this end, we must verify how the proxies for bailout expectations, conditional on financing, affect regional expenditure levels. The theoretical model in fact implies that regional expenditure should be more tightly constrained by financing when the probability of having a tough central government is high, as the regional government should expect less bailing out in the future.

There are different ways to test this idea. The conditional nature of the hypothesis suggests the use of a multiplicative interaction model (e.g., Brambor et al., 2006), by simply interacting the proxies for π with the measures of funding. The estimated coefficients on these interaction terms should be positive, meaning that the effect of financing on observed expenditure should be larger when regions expect the budget to be harder. The theory however, suggests that funding is not exogenous but is influenced by expectations; this implies that the interaction model might produce biased estimates. To overcome this problem, we adopt an alternative methodology, which involves introducing our estimates for expected financing (i.e., the fitted values of the best performing model in terms of information criteria) in the expenditure regression and checking that the sign, the magnitude and the statistical significance of the estimated coefficient be consistent with the predictions of the theoretical

model. The basic idea is that it is financing conditional on regional expectations on π that affects regional expenditure, rather than observed transfers. However, this substitution method has its shortcomings too. In particular, if the behavioural equation of the central government is not correctly specified, we may not make a correct inference on the causal relationship between expected financing and expenditure.

5. Estimates

5.1. Financing equations. Our empirical analysis is based on Italian regional expenditure and funding over the years 1995–2007[7]. We begin our empirical analysis by defining a model for ordinary (ex-ante) financing, which does not consider the proxies for expectations listed above. In this first attempt, we consider only variables suggested in the welfare economics literature, which appear in formulas for equalization transfers (Brosio et al., 2003). The first is the size of the regional population *POP*, to capture scale effects in redistribution of resources, which may determine lower per capita transfers (β_1<0 is the expected sign). The second are indicators of the state of the region's economy and fiscal capacity, beginning with the regional unemployment rate *U*, lagged once due to the slow-adjustment nature of the variable, which should be associated with higher per capita transfers (β_2>0 is expected). Alternative indicators of economic stance that have been considered are the difference between region *i*'s per capita output growth and the national average (*DGGDP*) and the region's output per capita (*GDP/POP*). For these two variables a negative correlation with per capita transfers is expected. As it is often found in this sample (Padovano, 2010), the unemployment rate carries the greatest explanatory variable among these indicators of fiscal capacity; only the results with this variable are therefore reported[8]. Finally, we include regional fixed effects a_i, aimed at capturing historical differences in the level of expenditure across the regions, and year fixed effects δ. The model then is specified as follows:

$$\mathbf{F_{it}} = \sum_i a_i + \sum_t \delta_t + \beta_1 U_{it-1} + \beta_2 POP_{it} + \varepsilon_{1,it} \qquad (1)$$

Table 4 reports the results, for per capita total transfers (model 1), current per capita transfers (model 2) and capita per capita transfers (model 3), respectively. In model 1, the

[7] Since we have only a short time series (t = 12), testing for the presence of unit root and cointegration is impossible. Standard unit root tests are only asymptotically valid and results heavily subject to test specification (Maddala and Kim, 1999; Karlsson and Löthgren, 2000; Gerdtham and Löthgren, 2000). It should also be noted that cointegration implies the idea of a long-run relationship between the variables under scrutiny, which is clearly inappropriate in our case. Expectations are indeed influenced by short-run variations in the proxies for π.

[8] The estimates with the *DGGDP* and *GDP/POP* covariates are available upon request.

estimated coefficient for lagged unemployment is positive and statistically significant at the 1% level, remains positive and loses over-dispersion when the correlated with transfers earmarked for current spending (model 2) and turns to negative while remaining significant at the 1% level when transfers earmarked for capital spending are examined (model 3). This pattern of results is quite plausible, as current transfers finance spending in social security programs, the most sensitive to employment conditions, which are administered by regional governments and mandated by the central government. Capital transfers, to finance infrastructures and similar projects, are instead concentrated in more developed regions where unemployment is lower. The negative β_2 coefficient thus depends on the nature of these transfers. The negative coefficient on the size of the population reflect economies of scale in the distribution of the transfers, which again by the nature of the spending programs to which these funds are earmarked, are concentrated in current transfers and are absent in capital transfers. The diagnostics reveal a high precision of the estimates, but a rather low explanatory power, with an adjusted R^2 ranging from 0.38 in model 1 to 0.54 in model 3. Clearly, there is some important explanatory factor omitted here.

We then proceed to augment equation (1) with the proxies for changes in expectations. To verify the stability of the coefficients we first only the time-varying proxies and then also the region-varying ones:

$$\mathbf{F_{it}} = \sum_i a_i + \sum_t \delta_t + \beta_1 U_{t-1} + \beta_2 POP_{it} + \beta_3 \mathbf{TPROXY}_{it} + \varepsilon_{2,it} \qquad (2)$$

$$\mathbf{F_{it}} = \sum_i a_i + \sum_t \delta_t + \beta_1 U_{t-1} + \beta_2 POP_{it} + \beta_3 \mathbf{TPROXY}_{it} + \beta_4 \mathbf{RPROXY}_{it} + \varepsilon_{3,it} \qquad (3)$$

Some of the time proxies may show a dynamic relationship with central government financing, so lagged terms should be used. Table 5 reports the results. The *TREND* variable reveals the importance of the historical expenditure in determining the level of transfers allotted to the regions. It is to be stressed the "historical expenditure" is a general criterion related to current expenditures (capital expenditures are financed according to different criteria) that was embedded (until quite recently) in all the yearly financial bills of the general government; as such it should affect the incremental value of the funds distributed to all regions in the same way. This institutional arrangement is reflected in the estimates, as the coefficient on *TREND* is statistically significant only in funds for current expenditures, not in those for capital expenditures. The stringency of the budget constraint is captured by the *DDPIL* variable, and the positive estimated coefficient reveals that when the Italian deficit was large relative to the EU15 average, transfers to regions – effectively, a central

government outlay – increase, with the one year lag that separates the moments when resources are appropriated and spent. The coefficient is, however, barely significant, probably due to the contrasting relationship between the two types of grants (positive for current expenditures, negative for capital ones) that again reflect the different time pattern of these expenditure types. The political time varying proxies are generally consistent with the hypotheses. Stronger central governments, denoted by a larger parliamentary majority (variable *NDIF*) are less needful to buy votes by distributing grants to regional constituencies, especially those earmarked to current spending of redistributive nature. These governments, on the other hand, feel more confident about their re-election and are thus more prone to distribute funds for long-time projects like capital spending, as shown by the positive estimated coefficient with respect to the *TRK* regressand. The same pattern of results is found for government cohesion, *HM*; in both cases, the estimated coefficients are always significant at the 1% level[9]. Finally, transfers to regions appear sensitive to the timing of national elections, as they increase in the pre-electoral year and are contracted in the year after. Again, as predicted in signalling models à la Rogoff (1990), the cyclical behaviour is more pronounced in current than in capital transfers. The variables already considered in equation (1) retain their signs and significance levels; the overall precision of the estimates are quite high (F statistics significant at the 1% level) while the explanatory power of the estimates are higher than in equation 1, ranging from 58% in model 2 to 78% in model 3.

We then proceed to the estimate of equation (3), which includes also the region-specific proxies of the vector **RPROXY**. The results are reported in Table 6. A widely held view is that, because in Italy transfers to subcentral governments are dictated by a formula (Brosio et al., 2003), expectations concerning them should not be sensitive to anything that is not included in the formula (Bordignon and Turati, 2009), especially lobbying activities. We challenge that view (Padovano, 2010) and verify whether the years in power of the regional governor – variable *YEARS*, a proxy for lobbying efficiency in the spirit of Olson's (1982) work on lobbies' penetration – affect the region's ability to obtain funds. The simultaneous consideration of the linear trend ensures that the variable *YEARS* is not capturing incremental dynamics phenomena like the historical expenditure. The positive and statistically significant

[9] We have also tried two other variables to test the same hypothesis war of attrition hypothesis, the number of days that each government was in charge (*GOVDUR*) and the overall duration of consecutive governments with the same Prime Minister (*PRIMI*), to check for effective government changes. The results, available upon request, are basically the same. We report those on the index of concentration of the government majority because it is an *ex ante* measure of government duration, thus more in line with the war of attrition theory (Padovano and Venturi, 2001).

coefficients in model 1 and 2 reveal that there is more in the distribution of transfers than just the formula and that lobbying is particularly important in the domain of current grants. The estimated coefficient on *YEARS* in the regression for capital grants has also a positive sign but it is not significant, possibly because of the longer time lags of these types of financing instruments. There is no sign that regional elections affect the distribution of transfers, possibly because they are often held in the same year as the political elections. Once the *ELN* variable is removed from the right hand side of the equation, *ELR* picks up some significance. The vote margin between the party of the governor and the largest one of the opposing coalition (covariate *RDIF*) confirms, however, that regional electoral politics does play a role in the distribution of grants. This estimated coefficient is positive and statistically significant in a linear specification, whilst its squared value, when added in, is never significant. This pattern of results supports the prediction of the Cox and McCubbins (1986) model over the Dixit and Londregan (1996) one, suggesting that politicians in the central government prefer to direct transfers to safe regions, rather than to marginal, 'swing' ones. Incidentally this result confirms in the electoral domain what has been found for lobbying, namely that strength and endurance at the local level is what matters to obtain funds from the central government. As in the majority of the political regressors, this effect is detected only for total and current transfers, as theory itself holds. Finally, we fail to find evidence of an alignment effect (Arhulampalan et al., 2009), although the covariate *SAME* comes close to borderline significant in model 2 for current transfers. This lack of significance may be due to multicollinearity with the regional fixed effects, or with other variables explicitly included in the model. As for the regressors already included in equations (1) and (2), they retain their signs and significant levels, with the only exception of the rate of unemployment, which now appears to be positively and significantly correlated with funds for current expenditures.

Equation (4) augments equation (3) with the proxy *BOUT*, to test Pettersson-Lidbom's (2008) and Pettersson-Lidbom and Dahlberg's (2003) hypothesis that the history of past bailing out should be the best predictor for expectations of future bailing out.

$$\mathbf{F_{it}} = \sum_i a_i + \sum_t \delta_t + \beta_1 U_{t-1} + \beta_2 POP_{it} + \beta_3 \mathbf{TPROXY}_{it} + \beta_4 \mathbf{RPROXY}_{it} + \beta_5 BOUT_{it} + \varepsilon_{4,it} \quad (4)$$

The estimates of this model, illustrated in Table 7, are generally not satisfactory, because the frequency and pervasion of bailing out episodes in our sample make the *BOUT* regressor almost a scale matrix, since the 0 values are quite few. Given the implication of the Pettersson-Lidbom's (2008) and Pettersson-Lidbom and Dahlberg's (2003) hypothesis, the lack of significance of the dummy that represent history of past bailing outs suggest that our

other explanatory variables provide a satisfactory model of the determinants of how regional governments form expectations about transfers to their favour. Possibly, Italian regional governments have a stable expectation that the central government will deliver something in their favour, because of the historical expenditure mechanism; what they are concerned about, which the other covariate capture, is their expectation about the change of funding above this incremental value.

5.2. Expenditure. We then proceed to examine regional expenditures. The analysis can be divided in two steps: the first considers "structural" variables that previous theoretical and empirical studies deem important determinants of expenditures; by that, as explained in the empirical strategy, we aim at a correct specification of the baseline behavioural equations of regional governments, i.e., short of expectations about the central government toughness. The second step moves to the test of the second theoretical prediction, by considering the role of funding and regional bailout expectations in the spending decisions of the regional governments. The selection of the explanatory variables takes into account that about 60% of total expenditures of Italian regions are related with the provision of health care services.

Beginning with the structural variables, and taking into account the result of the previous literature (Mueller, 2003; Bordignon and Turati, 2009), we consider five possible types of effects on expenditure: (a) a "demand effect", proxied by the proportion of the population over age 65 and below age 16 (*POP65* and *POP15*), i.e., the cohorts of the population – especially the first - who might be high demanders of health care; (b) a "demand induction effect", determined by the number of physicians per 1000 inhabitants (*PHYS*) and the number of top regional bureaucrats (directors of the public administration of class 5 and 6, according to the classification of the Ministry of the Interior) normalized by the size population, to account for expansionary effects *à la* Niskanen; (c) a "supply effect", measured by the average number of beds per hospital (*AVBEDS*), which essentially serves as a proxy for the economies of scale in the provision of health care services; (d) an "income effect", indicated by GDP per capita (*GDP/POP*), to control for Wagner law-type of phenomena; (e) a "partisan effect", to reflect the hypothesized greater parsimony in government spending of right wing regional governments over left wing ones (dummy variable *RIGHT*). Hence, the general equation to be estimated is:

$$\mathbf{E_{it}} = \sum_i a_i + \sum_i \delta_t + \beta_1 \mathbf{POPx}_{it} + \beta_2 PHYS_{it} + \beta_3 NBUR_{it} + \beta_4 AVGBED_{it} + \beta_5 GDP/POP_{it} + \\ + \beta_6 RIGHT_{it} + \varepsilon_{5,it} \qquad (5)$$

where the vector **POPx** includes the high demanders, ε_5 is a disturbance term, and a and δ are regional fixed effects and year effects, respectively. As in the case of the funding equations, regional expenditures $\mathbf{E_{it}}$ are first examined in their (real per capita) total value, then are disaggregated between current and capital expenditures. The results are reported in Table 8. Among the demand effect indicators, the estimated coefficients on the *POP65* covariate are consistently positive and significant at the 1% level and slightly larger in the case of current expenditures *vis à vis* capital ones. The elderly appear in fact the high demanders of regional expenditures, chiefly health care; the younger cohort of population *POP15* never carries any significant explanatory power and was therefore excluded from the reported estimates. Demand induced effects are found, as more doctors and regional administrators are positively correlated with the size of the regional budget. The covariate *PHYS* indicates that this effect is stronger in current expenditures (that includes the salaries of health care employees) than in the case of capital spending. Both are positive and significant at the 1% level[10]. The number of top bureaucrats is positively correlated with aggregate spending but at the 10% level only, and loses significance (still retaining a positive sign) when the components of spending are examined. The most likely cause of this lower precision of the estimates is the low frequency of the time variation of this indicator: the Minister of Interior censed the administrators only three times, in 1990, 1995 and 2001. The number of hospital beds per capita has generally a positive sign (in total and capital spending, while the coefficient on current spending is borderline not significant), indicating that economies of scale are not being exploited. That is consistent with the presence of demand induced effects in regional spending: the two results reinforce the plausibility of each. The regressor capturing income per capita confirms the presence of Wagner's Law type effects, but not in capital expenditures. This result is consistent with the literature on the growth of government (Mueller, 2003), but may also be due to the traditional Italian policy of mandating public investment projects in the *Mezzogiorno* regions, where income per capita is lower and grows less rapidly. Finally, the covariate on the ideology of regional governments reveals no significant correlation with any type of government spending[11]. The diagnostics reveal a high precision of the estimates (the F statistics are significant at the 1% level in all models); even

[10] We have also tried the specification including doctors working in public hospitals only (*PUBPHYS*); the results are somewhat less significant, possibly because in Italy hospital doctors are allowed to exercise also in the private sector and the majority of them do so (Turati, 2008). The variable PHYS seems therefore the more appropriatye to capture demand induced effects in health care expenditures.

[11] When regional politics is examined in greater detail, for instance by distinguishing between ordinary statute and special statute regions and between national and regional party lists, some evidence of greater parsimony of right wing governments emerges (Padovano, 2010).

more importantly, given our goal to have a specification of the behavioural equation as complete and as precise as possible, the adjusted R^2 grimps to values between 0.83 and 0.97.

5.3. Expectations. The specification of equation (5) may be spurious, however, as it does not account for expectations. Only the year fixed effects are possibly a loose proxy for the shift in expectations. To test if bailing out expectations are the missing determinants of the expenditure equation a different expenditure equation must be estimated. The theoretical claim H3 is that – after having observed a low level of funding – regions should be more likely to react with a low level of expenditure the higher is π, the expectation that the central government be of the tough type. To investigate this hypothesis, as explained in the description of the empirical strategy, we augment equation (5) by considering the explained component of funds transfers $\hat{F}$ from equation (3), the best fitting one in terms of information criteria. Notice that $\hat{F}$ can be thought of as representing the "expected" financing by regions given changes in π, and this provides us with a further test for our second theoretical prediction: when π is larger, conditional on expected funding, regions should be more likely to react with a low level of expenditure. This approach is close to Rodden (2005) that examines the impact of "expected" and "unexpected" revenues from the federal government on the regional expenditure in Germany, using an autoregressive forecasting model to estimate yearly expected values for revenues. The equation to be estimated then becomes:

$$\mathbf{E_{it}} = \sum_i a_i + \sum_i \delta_t + \sum_k \beta_k \mathbf{X}_{kit} + \beta_5 \hat{F}_{it} + \varepsilon_{6,it} \qquad (7)$$

where the vector **X** includes all the regressors of equation (5) and ε_6 is a disturbance term. Table 9 reports the results. The data lend empirical support to our hypothesis H3, viz., that regions tend to react with a low level of expenditure the higher is the expectation that the central government be tough. The estimated coefficient on the $\hat{F}$, lagged one period to account for the delay between appropriation and spending, is positive and significant at the 5% level, in the model with total and capital spending. The estimated coefficient on current expenditures is borderline significant, possibly because of the higher variability of this component of government spending, which is inherently more difficult to predict. The other covariates of vector **X** conserve their sign and by and large levels of statistical significance. Quite importantly in these estimates that include the contemporaneous and lagged fitted value of transfers $\hat{F}$ there is still no sign of serial correlation. The null hypothesis of zero value coefficient is rejected at the 1% level, the adjusted R^2 are between 0.96 and 0.98.

6. Conclusions

The present analysis shows that bailing out expectations play an important role in the determination of different types of spending of regional governments in Italy. First, financing is influenced by variables that may be interpreted as capturing changes in bailing out expectations, and all these variables turn out to have the expected sign. Second, we show that the link between ex-ante funding and expenditure is stronger when regional expectations of future bailing out are lower. Our results are somewhat less strong than those found by Bordignon and Turati (2009) in the context of a "natural experiment" of a shift of expectations coinciding with Italy's adhesion to the EMU and in the more limited domain of health care spending. When a larger time series and a larger variety of government expenditures are considered, as it is the case of this paper, with a more detailed set of proxies for changes of expectations, the role played by the expectations of future bailing outs are less precise, probably because the financing processes about which expectations are to be formed are more complex and thus their outcomes are more difficult to predict. In this sense the findings of the present analysis and of Bordignon and Turati (2009) reinforce each other; moreover, as the theoretical structure underlying the empirical tests of the two papers is basically the same, this paper shows that the generality of the explanatory power of the theory is greater than what suggested in the previous work. Expectations of bailing out can be modelled by considering the intergovernmental relationships, the evolution of the key determinants of public expenditure programs, when these are the result of the interaction of different levels of government.

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Figure 1. Game with complete information

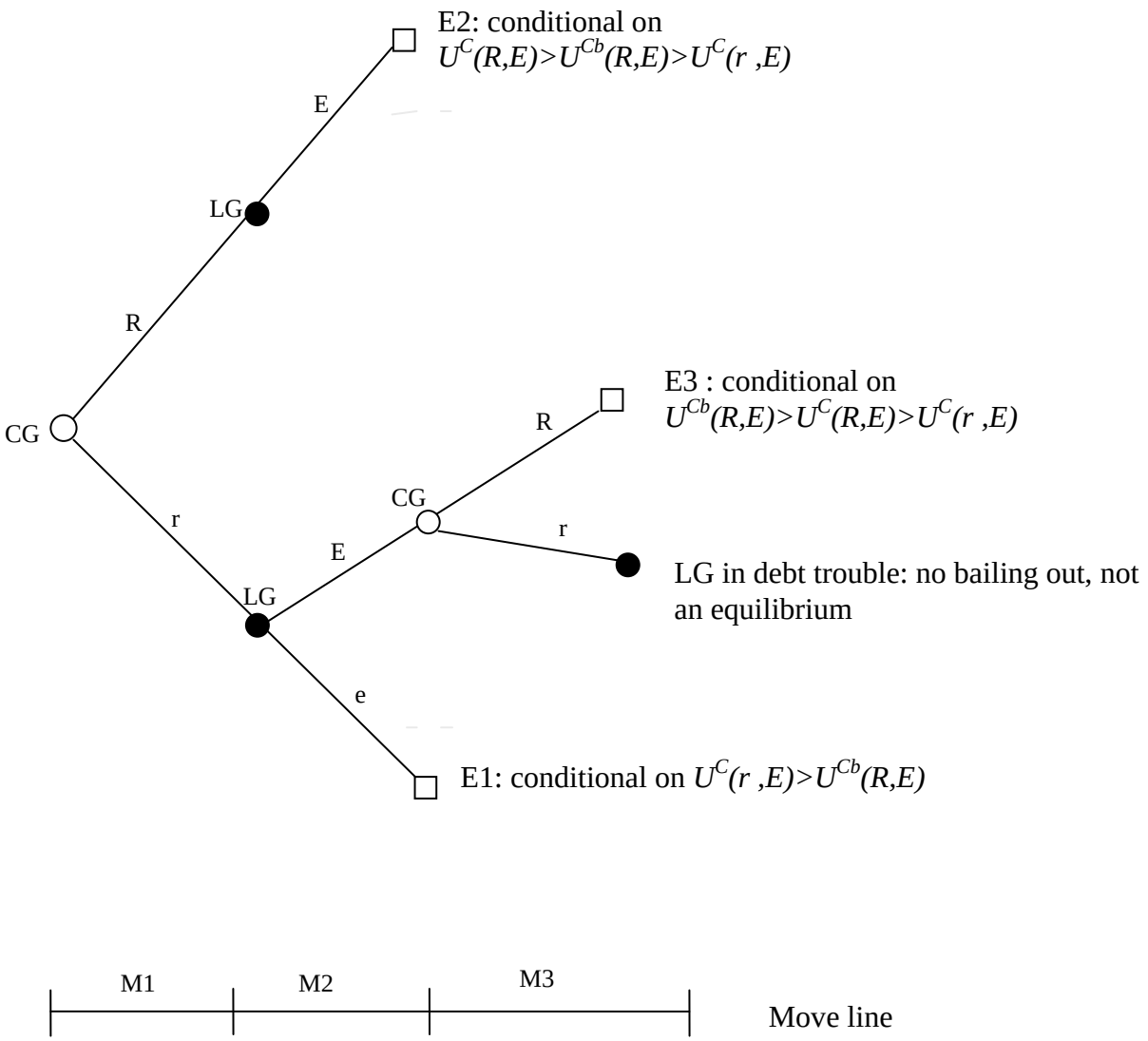


Figure 2. Game with incomplete information. Common solutions and case A).

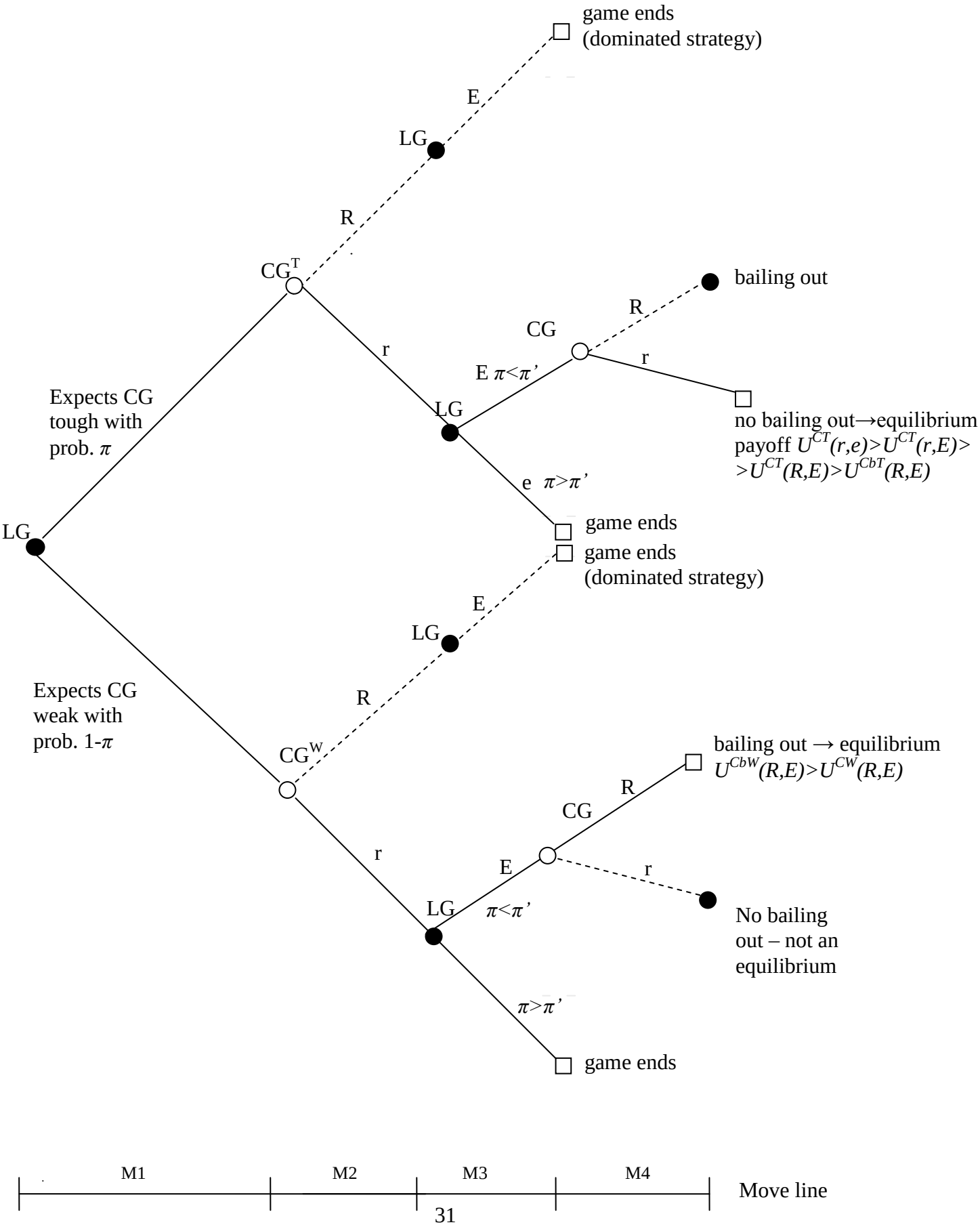


Figure 3. Game with incomplete information in pure strategies. CaseB) $U^{CbW}(R,E) > U^{CW}(R,E)$ and $\pi > \pi'$

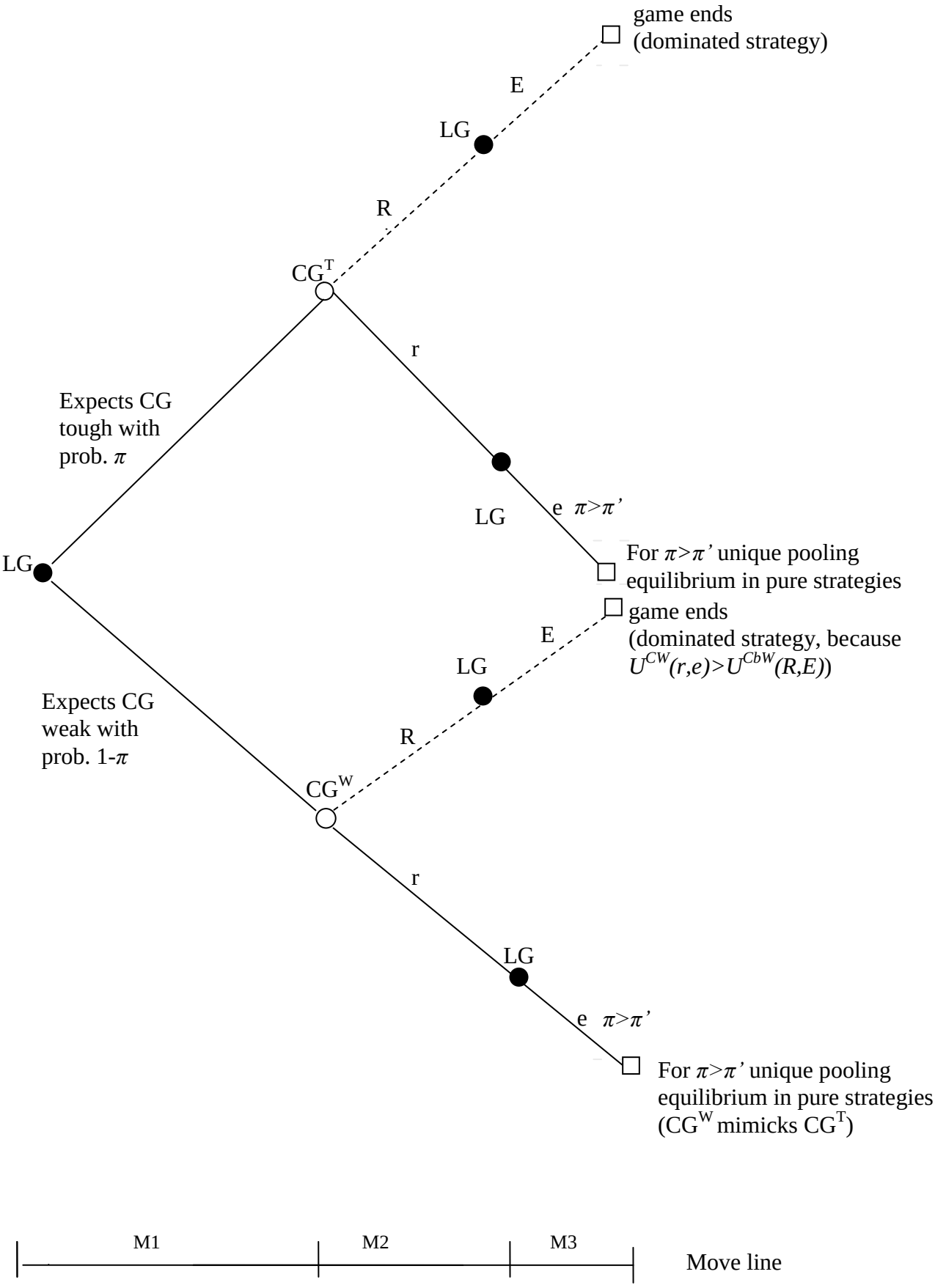
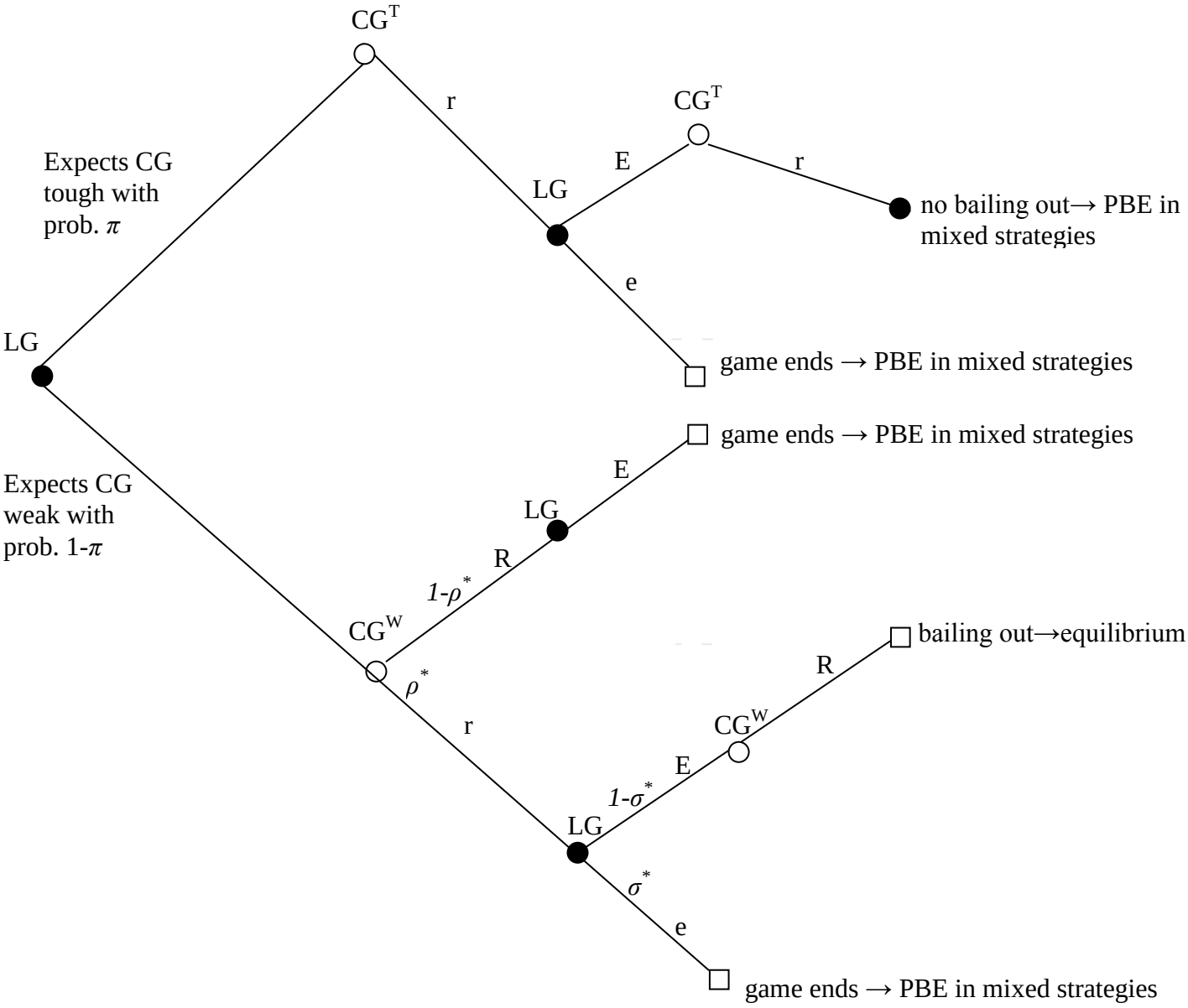


Figure 4. Game with incomplete information in mixed strategies. Case where $U^{CW}(R,E)>U^{CbW}(R,E)$ and $\pi<\pi'$



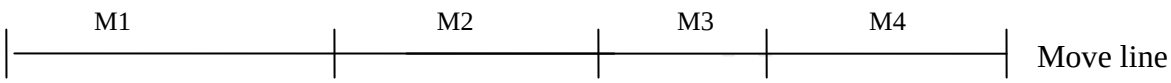


Table 1. General government financial indicators by government level, year 2002 (percentages of GDP).

	General government	*Central government*		*Sub-national governments*		*Social security institutions*	
		Gross of transfers from/to other public institutions	*Net of transfers from/to other public institutions*	*Gross of transfers from/to other public institutions*	*Net of transfers from/to other public institutions*	*Gross of transfers from/to other public institutions*	*Net of transfers from/to other public institutions*
Total expenditures	47,4	27,4	16,9	14,7	14,7	16,1	15,9
Total revenues	44,5	24,4	24,2	13,9	8,1	17,1	12,4
Deficit	-2,8	-3,0	7,3	-0,8	-6,5	0,9	-3,5

Source: ISTAT Conti ed aggregati economici delle Amministrazioni Pubbliche, SEC95 series.

Table 2. Financing and expenditures of government levels, year 2001 (percentages of total expenditures).

	Taxes	*Social security contributions*	*Transfers from*						*Other Revenues*	*Deficit*
			(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*		
Central government (1)	78,3	0,2	0,0	0,5	0,0	0,0	0,0	0,1	10,7	10,2
Social security institutions (2)	0,0	70,1	27,4	0,0	0,0	0,0	0,0	0,4	2,0	0,0
Regions (3)	40,9	0,0	53,0	0,0	0,0	0,0	0,2	0,3	4,9	0,8
Local Health Units (4)	0,0	0,0	0,0	0,0	90,2	0,0	0,2	0,3	4,9	0,8
Provinces and municipalities (5)0	28,5	0,0	21,9	0,0	13,2	0,0	0,0	1,3	33,5	1,6
Other public institutions (6)	3,6	0,2	52,0	4,7	12,6	0,0	3,4	5,1	18,6	-0,2
Duplications	0,0	0,0	57,7	1,2	33,5	0,0	0,6	1,6	5,5	-0,1
Public sector	58,3	23,6	24,2	0,5	14,0	0,0	0,2	0,7	11,5	6,6

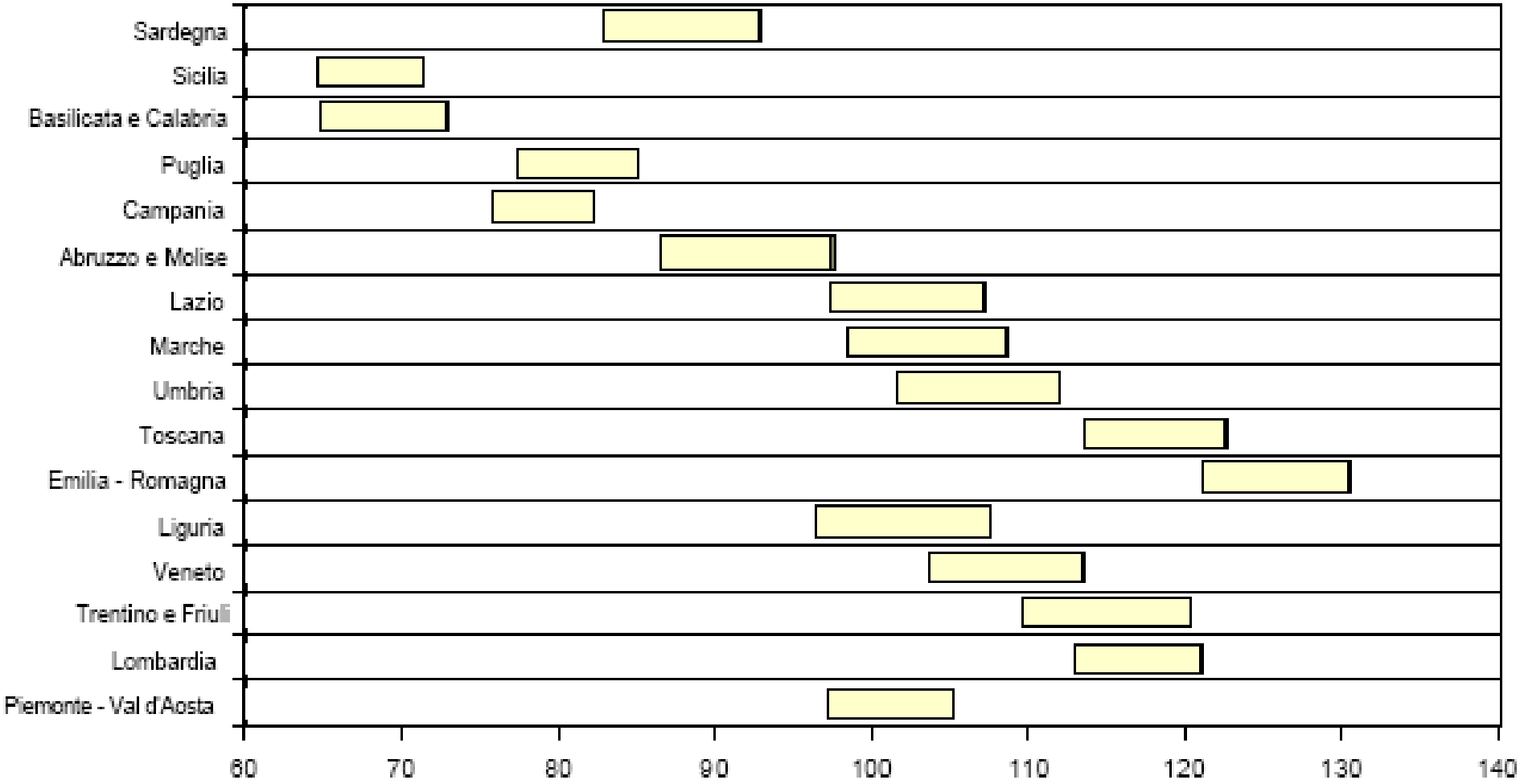
Source: Ministero dell'Economia e delle Finanze (2001), Vol. III, Appendix SP1.

Table 3. Socio-economic indicators for the Italian Regions, year 2002.

Regions	*Statute type*	*Area Km²*	*Population N*	*Population density (n/km²)*	*Population by age*		*GDP (million €)*	*GDP per capita (thousands €)*	*Incidence of poverty) (%)*	*Employment rate (14-65, %)*
					0-15 (%)	*>65 (%)*				
Piedmont	RSO	25.399	4330172	168	12,4	22,4	106200	24,9	7,1	64
Valle d'Aosta	RSS	3.263	122868	37	13,2	20,2	3374	27,6	6,8	66,3
Lombardy	RSO	23.861	9393092	388	13,6	19,4	255086	27,6	3,7	65,5
Trentino Alto Adige	RSS	13.607	974613	71	16,1	17,7	27284	28,3	5,1	67,1
Veneto	RSO	18.391	4699950	253	13,9	19,2	112520	24,2	4,5	64,6
Friuli Venezia Giulia	RSO	7.855	1204718	153	12	22,6	29683	24,8	7,2	63,1
Liguria	RSO	5.421	1592309	291	11,1	26,5	37855	24,0	5,2	61,1
Emilia Romagna	RSO	22.124	4151369	184	12,5	22,7	110659	27,1	2,5	68,4
Tuscany	RSO	22.997	3598269	155	12,1	23,2	84952	23,8	4,6	63,8
Umbria	RSO	8.456	858938	100	12,5	23,3	17458	20,6	7,3	61,6
Marche	RSO	9.694	1518780	155	13,1	22,6	32364	21,5	5,4	63,5
Lazio	RSO	17.207	5269972	303	13,9	19,1	130012	25,0	6,8	58,4
Abruzzo	RSO	10.798	1299272	119	13,4	21,3	23753	18,5	11,8	57,2
Molise	RSO	4.438	321953	72	13,4	22	5512	17,1	21,5	51,1
Campania	RSO	13.595	5788986	424	17,5	15,3	84597	14,7	27	44,1
Puglia	RSO	19.362	4068167	209	15,7	17,3	60057	14,9	19,4	44,4
Basilicata	RSO	9.992	596546	60	14,5	19,9	9261	15,5	24,5	49,3
Calabria	RSO	15.080	2009268	133	15,3	18,3	27752	13,8	23,3	44,6
Sicily	RSS	25.708	5013081	195	16,2	18	73475	14,7	30,8	44
Sardinia	RSS	24.090	1650052	68	12,9	17,6	27594	16,8	15,9	51,4
Italy		301.338	58462375	192	14,1	19,7	1259437	21,8	11,1	57,5

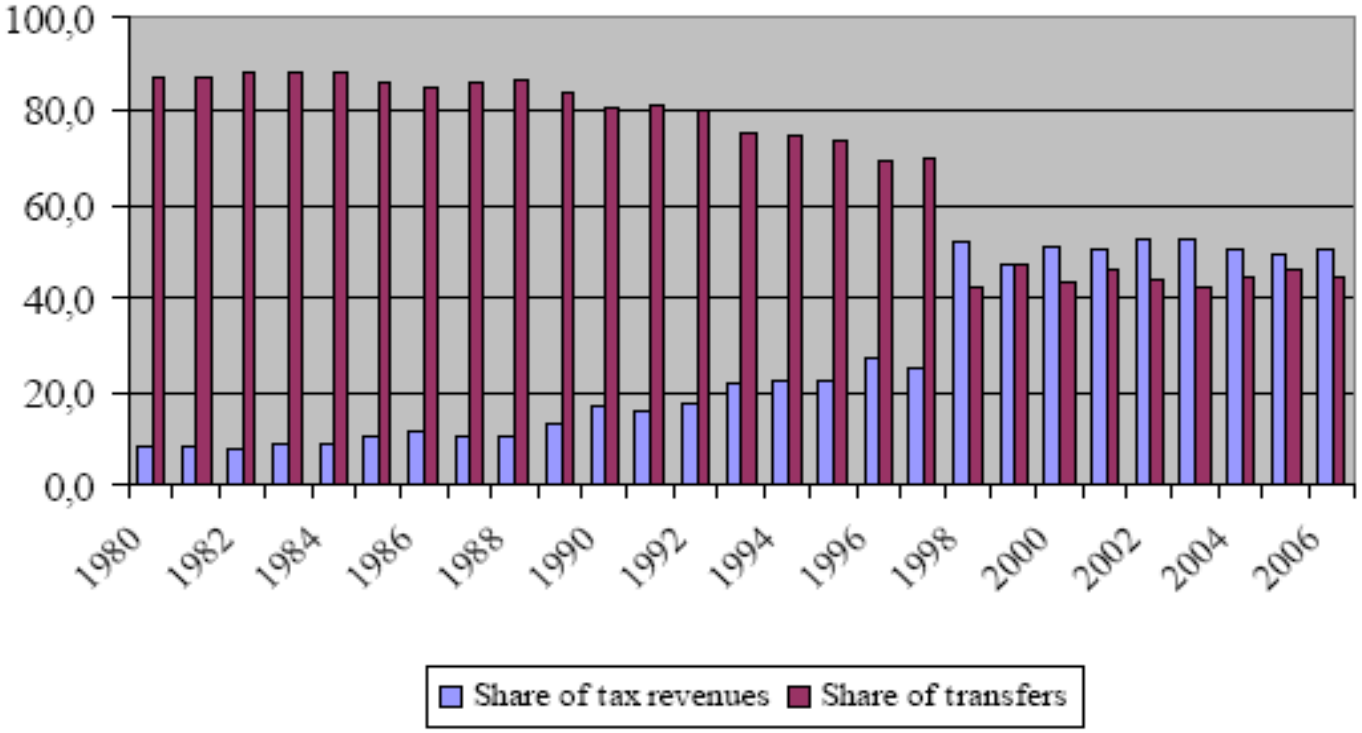
Source: ISTAT.

Figure 5. Regional distribution of per family income, 1995-2000 averages, 95% confidence intervals.



Source: Cannari and D'Alessio, (2003).

Figure 6. Fiscal autonomy of the Regions



Source: Ambosianio, Bordignon and Cerniglia (2008).

Table 4. Estimates of Equation 1

	Model 1	Model 2	Model 3
Dependent variable	*TR/POP*	*TCC/POP*	*TCK/POP*
U_{t-1}	0.002*** (2.79)	0.003*** (3.25)	-0.0008*** (-3.67)
POP_t	-5.69-10*** (-4.49)	-4.97-10*** (-3.88)	-4.02-11 (-1.39)
C	0.002*** (5.54)	0.002 (4.31)	0.0004*** (4.45)
Fixed effects	Yes	Yes	Yes
Estimator	EGLS	EGLS	EGLS
Adj. R2	0.53	0.38	0.54
S.E.R.	0.000242	0.000239	7.6-05
F statistics	11.19***	6.66***	11.87***
D.W.	1.9	1.86	2.19
Sample period	1998-2007	1998-2007	1998-2007
N.	210	210	210

Table 5. Estimates of Equation 2

	Model 1	Model 2	Model 3
Dependent variable	*TR/POP*	*TCC/POP*	*TCK/POP*
U_{t-1}	0.001 (1.01)	0.002 (1.66)	-2.39-05 (-0.13)
POP_t	-6.68-10 (-2.68)	-5.53-10 (-2.42)	-1.27-10*** (-4.46)
$DDEF_t$	-4.9-05 (-0.75)	-5.6-05 (-0.09)	-6.53-05 (-6.86)
$DDEF_{t-1}$	7.3* (1.73)	5.71-05** (-1.29)	6.25-06** (-0.65)
$TREND_t$	7.72-05 (2.99)	5.8-05** (2.26)	7.24-07 (0.14)
$NDIF_t$	-0.027** (-3.31)	-0.024*** (-2.8)	0.0038*** (2.61)
HM_t	-0.0004 (-2.65)	-0.0005 (3.43)	0.0001*** (5.47)
ELN_t	0.000246*** (3.39)	0.00014*** (2.19)	7.64-05*** (5.77)
ELN_{t+1}	-5.68-05 (-0.63)	-9.88-05 (-1.13)	7.88-05*** (5.7)
C	0.003 (4.36)	0.002*** (3.94)	-0.0004*** (-0.13)
Fixed effects	Yes	Yes	Yes
Estimator	EGLS	EGLS	EGLS
Adj. R2	0.63	0.58	0.78
S.E.R.	0.0002	0.00023	6.83-05
F statistics	11.86	9.8	23.23
D.W.	1.98	1.98	2.04
Sample period	1998-2006	1998-2006	1998-2006
N.	189	189	189

Table 6. Estimates of Equation 3

	Model 1	Model 2	Model 3
Dependent variable	*TR/POP*	*TCC/POP*	*TCK/POP*
U_{t-1}	0.001 (1.01)	0.002* (1.66)	-6.47^{-05} (-0.36)
POP_t	-5.56^{-10}* (-1.86)	-4.05^{-10} (-1.49)	-1.41^{-10}*** (-4.77)
$DDEF_t$	4.16^{-05} (-0.6)	6.49^{-06} (0.1)	-7.11^{-05}*** (-6.39)
$DDEF_{t-1}$	-7.76^{-05}** (1.89)	-6.49^{-05}** (-0.1)	-5.32^{-06}** (-0.58)
$TREND_t$	4.73^{-05} (1.57)	3.5^{-05}** (1.24)	2.2^{-07} (0.03)
$NDIF_t$	-0.02** (-2.3)	-0.019*** (-2.27)	0.004 (1.94)
HM_t	-0.0003* (-1.77)	-0.0004*** (-2.67)	0.0002*** (4.35)
ELN_t	0.0003*** (3.35)	0.00015** (2.15)	8.77^{-05}*** (5.58)
ELN_{t+1}	-3.7^{-05} (0.63)	-1.98^{-05} (-0.18)	7.74^{-05}*** (2.83)
$YEARS_t$	4.54-05** (2.3)	4.53-05*** (2.67)	3.61-05 (0.53)
ELR_t	7.4-05 (1.11)	6.56-05 (1.09)	2.06-05 (0.9)
$RDIF_t$	0.0003* (1.83)	0.0003* (1.77)	-4.08-05 (-1.57)
$SAME_t$	5.18-07 (0.02)	1.86-05 (0.76)	2.11-06 (-0.44)
C	0.002*** (2.82)	0.0017*** (2.36)	0.0004*** (4.76)
Fixed effects	Yes	Yes	Yes
Estimator	EGLS	EGLS	EGLS
Adj. R2	0.63	0.57	0.78
S.E.R.	0.0002	0.0002	6.78-05
F statistics	10.39	8.35	20.05
D.W.	2.03	2.03	2.03
Sample period	1998-2006	1998-2006	1998-2006
N.	189	189	189

Table 7. Estimates of Equation 4

	Model 1	Model 2	Model 3
Dependent variable	*TR/POP*	*TCC/POP*	*TCK/POP*
U_{t-1}	0.0009 (0.89)	0.0014 (1.3)	-5.35^{-05} (-0.3)
POP_t	-4.66^{-10}* (-1.7)	-2.95^{-10} (-1.23)	-1.43^{-10}*** (-4.82)
$DDEF_t$	0.0002** (2.07)	0.0003*** (3.27)	-8.15^{-05}*** (-4.16)
$DDEF_{t-1}$	0.0001*** (1.89)	0.0001** (2.14)	-7.49^{-06} (-0.76)
TREND	5.2^{-05}** (1.94)	3.61^{-05} (1.46)	2.91^{-07} (0.04)
$NDIF_t$	-0.029** (-3.29)	-0.028*** (-3.36)	0.005** (2.07)
HM_t	4.99^{-05} (0.25)	-7.71 (-0.42)	0.00012*** (3.11)
ELN_t	3.72^{-05} (0.41)	-0.0001 (-1.26)	9.69^{-05}*** (4.58)
ELN_{t+1}	-0.0004** (2.29)	-0.0004*** (-3.26)	9.42^{-05}*** (2.49)
$YEARS_t$	1.92^{-05}** (1.05)	1.59^{-05}*** (1.06)	4.75^{-05} (0.69)
ELR_t	1.88^{-05} (0.34)	2.29^{-06} (0.05)	2.31^{-05} (1.04)
$RDIF_t$	0.0003* (1.58)	0.0003 (1.57)	-3.9^{-05} (-1.55)
$SAME_t$	1.97^{-07} (0.73)	3.45^{-05} (1.44)	2.7^{-06} (-0.56)
$BOUT_{t-1}$	-0.0003 (-0.74)	-0.0003 (-0.56)	1.32^{-05} (0.67)
C	0.0024*** (3.33)	0.0017*** (2.36)	0.0004*** (4.76)
Fixed effects	Yes	Yes	Yes
Estimator	EGLS	EGLS	EGLS
Adj. R^2	0.6	0.56	0.78
S.E.R.	0.0002	0.0002	6.8^{-05}
F statistics	9.01	7.94***	19-53***
D.W.	2.12	2.13	2.03
Sample period	1998-2007	1998-2006	1998-2006
N.	189	189	189

Table 8. Estimates of Equation 5

	Model 1	Model 2	Model 3
Dependent variable	*EXP/POP*	*EXPC/POP*	*EXPK/POP*
$POP65_t$	0.037*** (3.94)	0.0218*** (2.85)	0.007*** (3.02)
GDP/POP_t	0.045** (1.95)	0.074*** (3.55)	0.001 (0.17)
$PHYS_t$	1.05*** (3.64)	0.683*** (2.46)	0.1588* (1.84)
BED_{t-1}	3.7^{-08}* (1.88)	2.43^{-08}* (1.37)	9.95^{-09}* (2.17)
$NBUR_t$	13.764* (1.64)	10.811 (1.33)	1.804 (0.87)
$RIGHT_t$	-2.99^{-05} (-0.52)	-8.16^{-05} (-1.49)	-2.17^{-05} (-1.47)
C	-0.008*** (-4.49)	-0.005*** (-3.41)	-0.0001*** (-3.1)
Fixed effects	Yes	Yes	Yes
Estimator	EGLS	EGLS	EGLS
Adj. R^2	0.94	0.93	0.83
S.E.R.	0.0007	0.0006	0.0002
F statistics	136.15***	122.5***	43.01***
D.W.	1.76	1.72	1.87
Sample period	1997-2007	1997-2007	1997-2007
N.	231	231	231

Table 9. Estimates of Equation 6

	Model 1	Model 2	Model 3
Dependent variable	*EXP/POP*	*EXP/POP*	*EXP/POP*
$POP65_t$	0.041*** (3.35)	0.019** (2.05)	2.159*** (3.01)
GDP/POP_t	-0.013 (-0.34)	0.071** (2.22)	-0.031*** (-2.49)
$PRPHY_t$	0.884*** (2.4)	0.411 (1.4)	0.165 (0.87)
BED_{t-1}	4.14^{-08}* (1.84)	3.38^{-08}* (1.62)	-9.89^{-09}* (-1.2)
$NBUR_t$	-0.465 (-0.06)	3.333 (0.5)	-3-378 (-0.83)
$RIGHT_t$	3.31^{-05} (0.56)	-4.20^{-05} (-0.8)	-7.85^{-06} (-0.32)
$\hat{F}_t$	0.052 (0.73)	-0.036 (-0.65)	0.033 (1.09)
$\hat{F}_{t-1}$	0.125** (1.87)	0.064* (1.07)	0.044** (1.72)
C	-0.006*** (-3.14)	-0.004*** (-2.38)	-0.0005 (-0.87)
Fixed effects	Yes	Yes	Yes
Estimator	EGLS	EGLS	EGLS
Adj. R^2	0.97	0.98	0.96
S.E.R.	0.0006	0.0003	0.0002
F statistics	218.06***	238.67***	112.38***
D.W.	2.17	2.16	2.02
Sample period	2000-2007	2000-2007	2000-2007
N.	147	147	147

Appedix A. Data sources

Economic and financial data, specifically those for the variables *TR*, *TCC*, *TCK*, *EXP*, *EXPCC* and *EXPCK*, are from *Ragioneria Generale dello Stato, Ministero dell'Economia e Finanze*, www.rgs.mef.gov.it/. Data about formal bailing out operations (*BOUT*) are collected from the financial bills (*Legge Finanziairia*) of the years 1999-2007, especially laws 129/2001, 312/2004 and DL 23/2007. *DDEF* is from Eurostat. Political variables, precisely *ELN*, *ELR*, *NDIF*, *RDIF*, *SAME*, *RIGHT* and *YEAR* are from Ministero dell'Interno. Finally, sociodemographic and health care variables are from ISTAT, respectively from www.demo.istat.it, (*POP*, *POP15*, *POP65*) www.istat.it/conti/territoriali/ (*GDP*, *U*, *RPIL*) and www.istat.it/sanita/Health/ (*AVGBED*, *PHYS*, *PUBPHYS*).