Anonymous Markets and Optimal Policy*

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Abstract

Is there a role for anonymous markets in which trades cannot be monitored by the government? We study an economy in which agents have private information and a benevolent government controls redistributive tax policy. While unrestricted access to anonymous markets reduces the set of policy instruments available to the government in general, it also limits the scope of inefficient redistributive policies when the government lacks commitment. We adopt a Mirrlees approach to study optimal fiscal policy in various simple dynamic economies with private information. We characterize optimal allocations and tax implementation schemes when the government has commitment and when it lacks commitment. We show that the restrictions that anonymous markets impose on the optimal fiscal policy, especially on capital tax schedules and on the history-dependence of income tax schedules, can have positive welfare effects when the government lacks commitment.

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1 Introduction

Consider an economy in which agents have private information, for example, about their income. A benevolent government controls redistributive tax policy. Should the government in such an environment always collect the private information from the agents to inform its policy decisions? Do anonymity and anonymous competitive markets have an essential role in this environment? Or are they simply “constraints” on the decision problem of the government?

These questions can be readily answered in the context of the theory of optimal fiscal policy where taxes are designed to implement the optimal allocation of a mechanism design problem. In this context, when a government has full commitment, any possible policy decision can be supported by a mechanism which induces the agents to reveal their information to the government truthfully. This is an implication of the Revelation Principle.\(^1\) Moreover, anonymous markets are in fact constraints on the decision problem of the government, because they make it more difficult for the government to extract the information from the agents truthfully. In other words, the free access to anonymous markets ex-post restricts the set of incentive compatible allocations from which the government chooses ex-ante and hence restricts policy decisions.\(^2\)

But consider instead an economy in which the government lacks commitment regarding its policy decisions and therefore has to face the issue of time inconsistency, in the sense of Kydland and Prescott (1977). In this environment anonymity and anonymous markets are no longer simply “constraints” on the decision problem of the government. The optimal redistribution policy of a benevolent government without commitment illustrates this point. Such a government cannot commit not to exploit all the information in its possession, e.g., information contained in previous tax reports or information about an agent’s assets, to redistribute resources across the agents in the economy. Such an ex-post redistribution policy might have ex-ante welfare costs for a benevolent government. This is the case, for instance, if it reduces the agents’ ex-ante incentives to exert effort in their production activities, or if it distorts agents’ consumption-savings decisions. Giving agents access to anonymous markets may limit the information that the government has ex-post and thus may limit the time-inconsistency problem. Thus, giving agents additional choices in the form of unrestricted access to anonymous capital markets may be optimal despite the fact that it might add additional agency problems in taxation. This is an implication of the fact that, when a government lacks commitment, optimal taxes may still be

\(^1\)See Myerson (1979) and Harris and Townsend (1982) among others.

\(^2\)A sizeable literature has developed which characterizes the inefficiency of environments in which agents are not restricted to exclusive contractual relationships with the principal, but have access to outside anonymous markets; see Arnott and Stiglitz (1983), Allen (1985), Hammond (1987), which is aptly titled “Markets as Constraints,” Fudenberg, Holmström, and Milgrom (1990), Bisin and Gottardi (1999), Cole and Kocherlakota (2001), Bisin and Rampini (2002), Golosov and Tsyvinski (2003a,b), and many others.
chosen to implement the optimal allocation of a mechanism design problem, but it is not in general sufficient to restrict the analysis to direct revelation mechanisms, which induce the agents to reveal their private information to the principal truthfully, and non-revealing mechanisms must be considered. In other words, while a version of the Revelation Principle holds without commitment, its implication and significance need be reconsidered. ³

We adopt a Mirrlees approach to the study of optimal fiscal policy in several simple economies with private information, including an hidden effort and an hidden income economy. Differently from the Ramsey approach to taxation, therefore, we do not impose any ex-ante assumptions on the class of tax schemes considered. Optimal tax schemes are instead those which implement the consumption and savings allocation which solves the optimal mechanism design problem of the economy. Differently from most of the literature on Mirrlees taxation, e.g., Kocherlakota (2004a,b), we extend the analysis to the case of economies in which the government cannot commit.

We show that in all our two-period economies, both when the government has commitment and when it does not have commitment, it is sufficient to consider tax schemes composed of i) an income tax in the initial period; ii) a history-dependent income tax (or a social security payment, depending on sign and interpretation) in the second period; and iii) a tax on capital, possibly a non-linear function of capital. As shown by Golosov-Kocherlakota-Tsyvinski (2003) in a related environment, when the government has commitment a wedge between the agents’ and the social shadow interest rate needs to be imposed to implement the optimal consumption and savings allocation. Nonetheless effective taxes on capital, the taxes that agents pay in equilibrium, may optimally be set to zero. In fact, the wedge in shadow interest rates can be implemented by imposing a positive marginal tax rate on capital only for savings exceeding the optimal amount. In other words, the optimal savings allocation can be implemented by a non-differentiable tax scheme such that agents will effectively face zero taxes on capital.⁴ Moreover, with commitment, income taxes are set in the initial period, independently of the agents’ savings choices. When the government lacks commitment, on the other hand, the government chooses income taxes ex-post in the second period, and will end up making income taxes depend on the agents’ past savings decisions. This specific form of history-dependence is the crucial effect of lack of commitment, that is, of time inconsistency: the government cannot commit not to redistribute the agents’ accumulated savings across agents ex-post to provide social insurance; that is, the government cannot commit not to expropriate ex-post agents who save and not to bail out agents who do not save. Therefore, agents’ savings decisions are inefficiently distorted. Indeed, because of its incentive to redistribute savings ex-post in the second period, the government needs to design a tax scheme to be imposed in the initial period to induce them to save. A savings subsidy in the second period, for instance, would not do, since it would be undone by the

³See the discussion in Section 2.
⁴See also Kocherlakota (2004a,b).
government ex-post in the second period e.g., by means of social security payments.

In this context it then follows that granting the agents unrestricted access to anonymous unmonitored credit markets may be welfare improving for a benevolent government without commitment. We show that it is exactly the restrictions that anonymous markets impose on capital tax schedules and on the history-dependence of income tax schedules that have potentially positive welfare effects when the government lacks commitment. We also show that unrestricted access to anonymous capital markets may be essential to implementing optimal allocations, in the sense that agents will trade in these unmonitored markets in equilibrium.

Our analysis can be interpreted to provide a normative and positive rationale for offshore financial markets. Consistently with our analysis, the growth of offshore banking markets can be traced to restrictive fiscal and regulatory regimes in many European countries in the 1960s and 1970s. More recently, even though regulatory distortions in developed countries have substantially declined, offshore centers thrive as a mechanism for individual investors to avoid precisely those redistributive fiscal policies that are the focus of our analysis of lack of commitment, e.g., inheritance and other capital taxes. It is not our intent to claim that offshore markets necessarily have positive welfare effects: clearly, offshore markets may also serve various illegal and even criminal purposes, such as money laundering. Nor is this a paper on offshore financial markets. Rather, we show by way of examples that unmonitored anonymous markets may serve the important purpose of limiting the distortionary redistributive tax policies that even benevolent governments, whenever lacking commitment, would adopt. In other words, we propose this as a new rationale for why anonymous markets improve economic efficiency.

2 Optimal Fiscal Policy Without Commitment: A Mirrlees Approach

In this paper we study optimal redistributive fiscal policy without commitment in a simple two-period asymmetric information economy. Rather than attempting a general analysis of the optimal taxation problem, we will study several examples that illustrate our main result, namely that anonymous markets can be welfare improving when the government lacks commitment, even if the government is benevolent.

We follow a Mirrlees approach to dynamic optimal taxation and we envision opti-

\footnote{See, e.g., IMF Background Paper (2000).}

\footnote{Perhaps the clearest example of the role of unmonitored anonymous financial markets which had an important role in limiting the amount of redistributional taxation, thereby favoring investment and capital accumulation, is the case of Swiss bank accounts used by Italian investors.}

\footnote{Of course, when the government is not benevolent it is easier to construct examples in which anonymous markets, which limit the set of policy instruments available to the government, are welfare improving.}
mal policy as a solution to a mechanism design problem; see Mirrlees (1971). Recent contributions to optimal dynamic taxation have favored this approach over Ramsey’s; see Albanesi and Sleet (2003), Golosov, Kocherlakota, and Tsyvinski (2003), Golosov and Tsyvinski (2003a,b), and Kocherlakota (2004a,b). These papers, as Mirrlees’ original contribution, study optimal taxation in economies in which the government has full commitment. We are instead interested in the analysis of economies in which the government lacks commitment. The set of allocations that the government can implement through fiscal policy must therefore satisfy the requirements of time consistency, that is, of subgame perfection. In this context new methodological issues arise regarding the Mirrlees approach to optimal taxation and in particular the identification of optimal policy through the solution to a mechanism design problem. We discuss these issues in this section after introducing the general economic environment we study in this paper.

Our economy lasts for 2 periods and 3 dates. A continuum of ex-ante identical agents have preferences represented by

$$\sum_{t=1}^{2} \beta^{t-1} u(c_t),$$

where $c_t$ is the consumption of the single consumption good at time $t$, and $u(c_t)$ is a strictly increasing and strictly concave utility function. Agents face i.i.d. random income shocks realized at time 1 (and no additional shocks at time 2). Depending on the specific example we study, agents receive income at time 1 only or both at time 1 and time 2. Income at time $t$, $\theta_t$, takes values in $\{\theta_{tH}, \theta_{tL}\}$. We denote the income realization by $\theta_{ts}$ where $s \in \{H, L\}$. We will consider both the case where the realization of the income shock is private information of the agents and the case where the probability distribution of the individual shocks depends on the agent’s private effort choice at time 1. In this case the probability that $\theta_t = \theta_{tH}$ is $\pi_H(e)$, and effort $e$ takes values in $\{e_1, e_0\}$. Effort $e$ is associated with an effort cost $v(e)$, with $v(e_1) > v(e_0)$ and $\pi_H(e_1) > \pi_H(e_0)$. In most examples we assume that agents can borrow and lend at the interest rate factor $R = \frac{1}{\beta}$.

The government maximizes the representative agent’s ex-ante expected utility, $E\left[\sum_{t=1}^{2} \beta^{t-1} u(c_t)\right]$, where the expectation is taken with respect to the government’s information at time 1. Lacking commitment, though, the government will choose a new tax policy at time 2 to maximize $E[u(c_2)]$. In this case the expectation is taken with respect to the government’s information at time 2.

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8In our finite horizon setting there is no room for reputational mechanisms as studied, e.g., by Stokey (1989, 2002) and Chari and Kehoe (1990).
9A Mirrlees approach to optimal taxation has rarely been adopted to study economies in which the government lacks commitment. An early study is Roberts (1984); recently, see Berliant and Ledyard (2003).
10We can interpret the government which solves the time 2 problem as the time 2 government and will at times refer to it in that way.
taken with respect to the information available to the government at time 2, which includes the information collected during the enforcement of the tax policy at time 1. The ability to condition tax policy at time 2 on the information collected by the government’s fiscal policy at time 1 is a manifestation of the time-inconsistency problem.

A Mirrlees approach to optimal fiscal policy involves first characterizing the optimal incentive compatible consumption and savings allocation as the solution to a mechanism design problem and then solving explicitly for a tax scheme which implements the optimal consumption and savings allocation. When the government lacks commitment, however, the mechanism design problem is complicated by the fact that it is not in general sufficient to restrict the analysis to direct revelation mechanisms, which induce the agents to reveal their private information to the principal truthfully. Direct revelation mechanisms in fact might not implement all incentive compatible allocations when the government lacks commitment, and hence they might not implement all allocations induced by some indirect tax policy. Without commitment, the government cannot commit at time 2 not to exploit all the information collected at time 1. In this case it might then be optimal for the government not to induce the agents to reveal their private income shocks at time 1, that is not to rely on a direct revelation mechanism inducing truth-telling. This has been recognized in the literature, which has often concluded that the standard Revelation Principle result (as e.g., in Myerson (1979)) does not hold without commitment.\(^{11}\) In fact, a generalized version of the Revelation Principle with multiple agents, as in Myerson (1982), holds. In the environment of this paper this version of the Revelation Principle implies that the set of all allocations that can be induced by some tax policy coincides with the set of all allocations implemented by direct truth-telling mechanisms augmented by those allocations which can be implemented by mechanisms which are non-revealing at time 1; see Bester and Strausz (2003).\(^{12}\)

When studying optimal fiscal policy without commitment we therefore proceed as follows: We first characterize the optimal allocation in the class of direct revelation mechanisms, that is, under truth-telling. We then characterize the optimal allocation when we allow for non-revealing mechanisms. We finally solve for a system of taxes which implements the optimal allocation overall, be it revealing or not.

We show that in our economy it is sufficient to consider tax schemes composed of \(i\) an income tax at time 1, \(t_{1s}\); \(ii\) an income tax (or a social security payment, depending on sign and interpretation) at time 2, \(t_{2s}\); and \(iii\) a tax on capital, \(T_s\),

\(^{11}\)See e.g., Freixas, Guesnerie, and Tirole (1985) and Laffont and Tirole (1988). The classical example in this literature is one of a monopolist repeatedly facing a buyer whose valuation for an object is private information but constant over time; see Skreta (2002) for a clear exposition. An example which is more related to our optimal policy analysis is developed in Appendix A.

\(^{12}\)See the Appendix A for an illustration of this point in the context of an example related to our optimal policy analysis. See Berliant and Ledyard (2003) for an application to a different taxation environment.
possibly a non-linear function of capital, for \( s = H, L \).

Several aspects of such tax schemes deserve discussion as they will play an important role in our analysis. First, in general we allow taxes to depend on the income realization \( s \) (or \( \theta_1, \) which is equivalent) at time 1 or agents’ announcements thereof, even though income may not be observable to the government.\(^\text{13}\) In particular, the possible dependence of taxes \( t_2, \) at time 2 on \( s \) is a form of history-dependence of the tax scheme. It might however be optimal for the government at time 1 to implement a tax scheme which is independent of \( s \) at time 1 in order to make it impossible for the government at time 2 to design history-dependent taxes. This is the case when the optimal allocation is induced by a non-revealing mechanism. Second, we call the effective tax on capital the tax that agents pay at the optimal allocation, that is, for an agent of type \( s \) the value of the map \( T_s \) at the optimal saving \( k_s \) that taxes implement. Third, while a government with commitment can equivalently impose a tax on capital either in the first or in the second period, a government which lacks commitment needs to impose its tax on capital in the first period, since the government would otherwise undo the tax in the second period.\(^\text{14}\) Finally, the tax on capital \( T_s \) is only available to the government if savings are observable.

3 Optimal Fiscal Policy with Hidden Income

Consider a special case of the economy introduced in the previous section, where the government cannot observe the agents’ income. Specifically, suppose that agents receive a random time 1 income, \( \theta_1, \) taking either value \( \theta_{1H} \) or \( \theta_{1L}, \) \( \theta_{1H} > \theta_{1L}, \) with exogenous probability \( \pi_H \) and \( \pi_L, \) respectively. Income shocks are independent and identically distributed across agents. Agents receive no income at time 2. We therefore interpret time 2 as the retirement age. While we are interested in the optimal policy without commitment, we consider the case in which the government has commitment as a benchmark.\(^\text{15}\)

3.1 Optimal Fiscal Policy with Commitment

We will first characterize the optimal consumption allocation of this economy, that is, we formulate and solve the mechanism design problem. Since we assume here that

\(^{13}\)Our formulation is therefore different from Mirrlees’ and most of the ensuing literature, in which incentive compatibility is obtained through non-linear tax schemes which are allowed to depend only on observables. It is however equivalent, and it allows for a simpler analysis, especially when formulating the optimal policy problem without commitment. Berliant and Ledyard (2003) also use a mechanism design formulation in a related environment.

\(^{14}\)In the tax implementation we consider, we assume for simplicity that the tax on capital is designed by the time 1 government, but this is without loss of generality in terms of the optimal allocation.

\(^{15}\)Kocherlakota (2004b) studies the optimal fiscal policy problem with commitment in a related economy.
the government has commitment, we can restrict the mechanism design problem without loss of generality to the class of direct revelation mechanisms. Let $c_{ts}$ denote consumption at time $t$ in state $s$, $s = H, L$. At time 0, the government chooses $(c_{1s}, c_{2s})_{s=H,L}$ to maximize the ex-ante expected utility of the agents

$$\sum_{t=1}^{2} \beta^{t-1} \sum_{s=H,L} \pi_s u(c_{ts})$$

subject to the incentive compatibility constraint

$$u(c_{1H}) + \beta u(c_{2H}) \geq u(c_{1L} + \theta_{1H} - \theta_{1L}) + \beta u(c_{2L})$$

and the government’s budget constraint

$$\sum_{s=H,L} \pi_s c_{1s} + \frac{1}{R} \sum_{s=H,L} \pi_s c_{2s} \leq \sum_{s=H,L} \pi_s \theta_{1s}.$$  

The second incentive compatibility constraint, requiring truth-telling by type $\theta_{1L}$, has been dropped since it is not binding.

It is straightforward to show the following:

**Proposition 1** At the optimal allocation with commitment: i) agents with high income realization consume more in both periods: $c_{1H} = c_{2H} > c_{1L} > c_{2L}$; ii) agents are provided with partial social insurance, that is, resources are transferred to agents with the low income $\theta_{1L}$, and they consume more than the present value of their income: $c_{1L} - \theta_{1L} + \frac{1}{R} c_{2L} > 0 > c_{1H} - \theta_{1H} + \frac{1}{R} c_{2H}$; and iii) agents save different amounts at time 1 and agents with high income save more: $k_{L} = \frac{1}{R} c_{2L} < k_{H} = \frac{1}{R} c_{2H}$.\(^{16}\)

How can the optimal allocation be implemented via a tax system? Agents with low income can be induced to save the optimal amount by levying appropriate taxes on savings. While in this economy income shocks are not publicly observable, the government may however observe and tax the agents’ savings, $k_{s}$, at time 2. The optimal allocation can be implemented as follows:

**Proposition 2** The optimal allocation with commitment can be implemented with an income tax at time 1, $t_{1s}$, history-dependent social security payment at time 2, $-t_{2s}$, and a tax on capital, $T_{s}$, a piecewise linear function of $k_{s}$, at time 2, $s = H, L$. Optimal taxes can be designed so that: i) the tax on capital for high income agents, as well as the effective tax on capital for low income agents, are zero; and ii) the present value of the taxes of high income agents is positive while the present value of the taxes of low income agents is negative: $t_{1H} + \frac{1}{R} t_{2H} > 0 > t_{1L} + \frac{1}{R} t_{2L}$.

\(^{16}\)The marginal return on saving at the optimal allocation is higher for low income agents than for high income agents. As in Kocherlakota (2004b) incentive compatibility introduces a wedge between the subjective shadow interest rate of the agents, in our case of the agents with low income, and the social shadow interest rate.
We proceed in the following to prove Proposition 2 and in turn to characterize the optimal taxes \((t_1, t_2, T_s)_{s=H,L}\) which implement the optimal allocation. Optimal taxes solve the following problem. An agent with income shock \(\theta_{1s}, s = H, L\), takes the tax scheme \((t_1, t_2, T_s)_{s=H,L}\) as given and faces the following problem at time 1:

\[
\max_{(k_s, c_{1s}, c_{2s}, \delta)} \sum_{t=1}^{2} \beta^{t-1} u(c_{ts})
\]

subject to

\[
c_{1s} = \theta_{1s} - t_{1\delta} - k_s, \quad c_{2s} = Rk_s - T_s(k_s) - t_{2\delta},
\]

where \(\delta \in \{H, L\}\). The tax system \((t_1, t_2, T_s)\) which the agent faces depends on the income, that is, the state \(\delta\), which he declares. The government’s policy problem is to choose \((t_1, t_2, T_s)_{s=H,L}\) to maximize the ex-ante expected utility of the representative agent,

\[
\sum_{s=H,L} \pi_s \beta^{s-1} \sum_{t=1}^{2} \pi_s u(c_{ts}),
\]

subject to the constraint that \((k_s, c_{1s}, c_{2s}, s)\) solves the agent’s problem (4-5) given \((t_1, t_2, T_s)_{s=H,L}\) for \(s = H, L\), and the government’s budget constraint

\[
\sum_{s=H,L} \pi_s t_{1s} + \frac{1}{R} \left( \sum_{s=H,L} \pi_s (t_{2s} + T_s(k_s)) \right) = 0.
\]

We first characterize the optimal taxes on capital \(T_s\), which support the optimal allocation and in particular support optimal savings, \(k_s = \frac{1}{T} c_{2s}, s = H, L\). We let \(T_s\) depend on \(s\) and \(k_s\), i.e., we allow for taxes on capital which are a history-dependent function of savings. Take an agent with income \(\theta_{1s}\). Define the capital tax rate \(T'_s\) by setting \(T'_s(k) = \tau_s^+\) if \(k > k_s\) and \(T'_s(k) = \tau_s^-\) otherwise. The first order condition with respect to \(k_s\) of an agent who declares type \(s\) is

\[
u'(c_{2s})(1 - \tau_s^+) \leq u'(c_{1s}) \leq u'(c_{2s})(1 - \tau_s^-)
\]

and hence, rearranging,

\[
\tau_s^- \leq 1 - \frac{u'(c_{1s})}{u'(c_{2s})} \leq \tau_s^+.
\]

If \(\tau_s^+\) and \(\tau_s^-\), \(s = H, L\), are chosen to satisfy these inequalities, then agents who announce their income truthfully, i.e., choose the tax schedule designed for their income, will indeed save \(k_s\). Given the characterization of the optimal allocation in Proposition 1, we see that (9) can be satisfied by setting \(\tau_s^- = 0\), \(s = H, L\). But ensuring that agents cannot do better by choosing a different tax schedule and saving more or less imposes additional constraints on the tax schedule \(\tau_s\). In Appendix B we provide a detailed analysis of optimal taxes on capital, and we show that, without
loss of generality, the optimal allocation can be implemented with $\tau_L = \tau_H = 0$. We say therefore that effective taxes on capital are zero, in the sense that even though a positive marginal tax rate, $\tau_L > 0$ for $k > k_L$, is necessary to implement the optimal allocation, agents with income $\theta_1$ will in equilibrium save $k$, and face a tax on capital $\tau_s$ which is zero independently of their income realization. In Appendix B we show furthermore that we can implement the optimal allocation with zero taxes on capital for the agents who declare high income at time 1, that is, with $\tau_H = \tau_L = 0$. Agents declaring a low income at time 1 must instead face a positive tax on capital if they save more that at the optimal allocation, i.e., $\tau_L > 0$. This is required to induce agents with low income to save optimally and to induce agents with high income to report their income to the government truthfully.\footnote{In other words, $\tau_L^+ > 0$ is required to implement the wedge between the shadow interest rate of agents who declare low income and the social shadow interest rate at the optimal allocation; see footnote 16.}

The optimal income tax at time 1, $t_1$, and the optimal social security payment at time 2, $t_2$, are then determined to support the optimal consumption allocations $c_1$ and $c_2$: $t_1 = \theta_1 - k - c_1$ and $t_2 = Rk - T_s(k) - c_2$. Note that the condition $t_2 = Rk - T_s(k) - c_2$ is an equilibrium condition; each agent, after having revealed his type $s$, considers the social security payment $t_2$ as lump-sum and in particular as independent of his savings choice $k$.

3.2 Optimal Fiscal Policy without Commitment

We will first characterize the optimal consumption allocation of this economy by studying the mechanism design problem. Since we assume here that the government does not have commitment, as we noted in the previous section, we first look at direct revelation mechanisms which induce truth-telling and then at non-revealing mechanisms. We finally study the properties of the tax schemes which implement the optimal allocation.

The optimal fiscal policy without commitment under truth-telling must satisfy the constraint that the policy be optimal at time 2, after the agents’ types have been revealed. Formally, we need to require that the allocation $(c_{2H}, c_{2L})$ which the government promises to agents at time 1 satisfies

$$ (c_{2H}, c_{2L}) \in \arg \max_{c_{2H},c_{2L}} \sum_{s=H,L} \pi_s u(\hat{c}_{2s}) \text{ subject to } \sum_{s=H,L} \pi_s \hat{c}_{2s} \leq \sum_{s=H,L} \pi_s c_{2s}. \quad (10) $$

Thus, $(c_{2H}, c_{2L})$ has to solve the problem of the time 2 government. Otherwise, the problem is the same as the problem in (1-3). Constraint (10) implies that the incentive compatibility constraint (2) requires $c_{1H} = c_{1L} + \theta_{1H} - \theta_{1L}$; that is, no social insurance: $c_{1s} + \frac{1}{R} c_{2s} = \theta_{1s}, s = H, L$.\footnote{In other words, $\tau_L^+ > 0$ is required to implement the wedge between the shadow interest rate of agents who declare low income and the social shadow interest rate at the optimal allocation; see footnote 16.}
We next show that non-revealing mechanisms cannot improve on the representative agent’s welfare in this economy. A non-revealing mechanism requires that agents receive type-independent transfers at time 1 and at time 2. Moreover, agents cannot alter their allocation by choosing a different savings level since savings are observable, and hence in any non-revealing mechanism the allocation has to satisfy $c_1H - c_1L = \theta_1H - \theta_1L$ and $c_2H - c_2L = 0$. We conclude that in this economy the set of allocations in the class of non-revealing mechanisms is smaller than the set of allocations in the class of direct revelation mechanisms (but it contains the optimal allocation).

We have therefore shown the following:

**Proposition 3** At the optimal allocation without commitment: i) agents are fully insured at time 2: $c_2H = c_2L$; but ii) agents do not perfectly smooth their consumption: $c_{1s} \neq c_{2s}$, $s = H, L$; and iii) agents are provided with no social insurance: $c_{1s} + \frac{1}{R}c_{2s} = \theta_{1s}$, $s = H, L$.

Consider now the implementation problem of the optimal allocation without commitment. We can show the following result:

**Proposition 4** The optimal allocation without commitment can be implemented by a truth-telling tax scheme consisting of an income tax at time 1, $t_{1s}$, a history-dependent social security payment at time 2, $-t_{2s}$, and a tax on capital or a savings subsidy, $T_s$, a piecewise linear function of $k_s$, at time 1, $s = H, L$. Optimal taxes are designed such that: i) savings below $k_s$ trigger taxes equal to the shortfall (or, alternatively, imply an equivalent loss in subsidies); and ii) social security payments $t_{2s}$ are chosen by the government at time 2 as an increasing function of $k_s$ to provide full insurance ex-post, $s = H, L$.

Note that this implementation scheme, differently from the scheme used with commitment in Proposition 2, requires that taxes on capital be imposed at time 1. This is an important consequence of lack of commitment, as will be shown in the following.

Let taxes on capital be piecewise linear, i.e., $T_s'(k) = \tau_s^-$ for $k \leq k_s$ and $T_s'(k) = \tau_s^+$ otherwise. As noted, because of lack of commitment on the part of the government, we need in principle to distinguish between truth-telling schemes, which allow for revealing income taxes at time 1, $t_{1H} \neq t_{1L}$ and $T_H \neq T_L$, and non-revealing schemes which require $t_{1H} = t_{1L}$ and $T_H = T_L$. In either case, the optimal consumption allocation without commitment satisfies $k_H = \frac{1}{R}c_{2H} = \frac{1}{R}c_{2L} = k_L$, and hence need not induce different savings for different types of agents. Non-revealing tax schemes cannot improve on truth-telling schemes. While this follows from the characterization of the optimal allocation in Proposition 4, it is instructive to re-interpret this result in terms of the tax implementation problem. Even if the tax scheme at time 1 is non-revealing, the government could still choose a redistributive tax scheme, $t_{2H} \neq t_{2L}$, to provide full insurance, whenever agents save different amounts, $k_H \neq k_L$. 

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Thus, because of the observability of savings, both types of agents consume the same amount at time 2 even with a non-revealing tax scheme.

We therefore implement the optimal allocation with a truth-telling tax scheme. Both agents and the government at time 1 rationally expect that the government at time 2, observing the tax payments $t_1s$ and the level of savings $k_s$ of each agent and taking as given the predetermined tax scheme $t_1s$ and $T_s$, chooses $(t_2s)_{s=H,L}$ to maximize

$$\sum_{s=H,L} \pi_s u(c_{2s}),$$  \hfill (11)

subject only to the agents’ budget constraints

$$c_{2s} = Rk_s - t_{2s}, \quad s = H, L,$$  \hfill (12)

and the government’s budget constraint

$$\sum_{s=H,L} \pi_s t_{2s} = -R \left( \sum_{s=H,L} \pi_s (t_{1s} + T_s(k_s)) \right).$$  \hfill (13)

The solution of this problem consists of a tax scheme for time 2, $t_{2s}(k_s)$, $s = H, L$. The crucial effect of lack of commitment, that is, of time inconsistency, is that the tax scheme at time 2 depends on agents’ savings choices at time 1, $k_s$, $s = H, L$. Recall that, in contrast, with commitment the optimal tax scheme at time 2 consists of simple lump-sum social security payments. It is straightforward to show that $t_{2s}$ is increasing with $k_s$. Indeed, the government provides full insurance at time 2 and all agents consume the same at time 2. Therefore, the agents’ savings decisions at time 1 are distorted: high savings at time 1 lead to expropriation of the accumulated savings at time 2. In fact, given that savings get expropriated ex-post, agents effectively take their consumption at time 2 as given and as independent of the amount that they save. But then agents do not have an incentive to save at all at time 1. The government will have to take that into account at time 1 and provide agents with tax incentives to save as we will see. More formally, an agent with income shock $\theta_{1s}$, $s = H, L$, at time 1, and facing tax schedules $(t_{1s}, t_{2s}, T_s)_{s=H,L}$ solves the following problem at time 1:

$$\max_{(k_s, c_{1s}, c_{2s}, \hat{s})} \sum_{t=1}^{2} \beta^{t-1} u(c_{ts})$$  \hfill (14)

subject to

$$c_{1s} = \theta_{1s} - t_{1\hat{s}} - k_s - T_s(k_s), \quad c_{2s} = Rk_s - t_{2\hat{s}}(k_s),$$  \hfill (15)

where $\hat{s} \in \{H, L\}$. The government’s optimal taxation problem at time 1 is then to choose $(t_{1s}, T_s)_{s=H,L}$ to maximize the ex-ante expected utility of the representative agent,

$$\sum_{t=1}^{2} \beta^{t-1} \sum_{s=H,L} \pi_s u(c_{ts}),$$  \hfill (16)
subject to the constraint that \((k_s, c_{1s}, c_{2s}, s)\) solves the agent’s problem (14-15) given \((t_{1s}, t_{2s}, T_s)_{s=H,L}\), for \(s = H, L\), and the constraint that \((t_{2s})_{s=H,L}\) solves the time 2 government’s problem (11-13) given \((t_{1s}, T_s)_{s=H,L}\), where we can omit the government’s intertemporal budget constraint since it is satisfied by the tax scheme chosen by the government at time 2. The government at time 1 anticipates affecting the tax scheme that will be chosen at time 2 through the effect of taxes at time 1 on the savings levels \(k_s, s = H, L\), and through the government budget constraint. We can now complete the characterization of the optimal truth-telling tax scheme, as stated in Proposition 4. In particular, at time 1 both the agents and the government will anticipate that \((t_{2s})_{s=H,L}\) will be chosen at time 2 to provide full insurance across agents’ types, as implied by the solution of problem (11-13). In turn, full insurance at time 2, \(c_{2H} = c_{2L}\), greatly reduces agents incentives to save; since agents retirement consumption is independent of their individual savings, they have no incentive to save at all. As a result, the government has to effectively force agents to save at time 1. To do so, the government chooses taxes on savings at time 1 such that \(T'_s(k) = \tau^* = -1\), for \(k \leq k_s\), and \(T'_s(k) = \tau^*_s = 0\) otherwise. Thus, if an agent were to save less than \(k_s\), he would incur taxes in the amount of the difference between his savings and \(k_s\). Alternatively, we can interpret this as a subsidy for savings up to \(k_s\) and saving anything less than \(k_s\) results in a loss of the subsidy. Given these taxes on capital, agents of both income levels are willing to save \(k_s\). Agents with low income will not save less than \(k_L\) because this would raise their taxes at time 1 one-for-one. We can interpret this as agents not being able to borrow against their retirement income. Agents with high income will not save more that \(k_H\) since additional savings would be expropriated by the government at time 2. Recall that \(k_H = k_L\) and thus the capital tax schedule is the same for both types of agents and agents have no incentive to misreport their income. In this way, we are able to implement the optimal incentive compatible allocation which satisfies \(c_{1H} > c_{2H} = c_{2L} > c_{1L}\). To sum up, because the government can not commit not to expropriate agents who save ex-post or bail agents out who do not save, agents have no incentive to save at all, and the government needs to force agents to save ex-ante (or keep them from borrowing against social security benefits).

### 3.3 Optimal Fiscal Policy and Anonymous Markets

Suppose the government can give agents unrestricted access to anonymous markets, where it cannot monitor their savings. That is, suppose agents can save an amount \(k_s, s = H, L\), of their choice, hidden from the government, at the same gross interest rate or return \(R = \frac{1}{\beta}\). In this case agents can in effect smooth any state contingent consumption plan offered by the government. We discuss the effects of anonymous unmonitored credit markets in turn for the optimal fiscal policy problem with and without commitment.

When hidden savings are allowed by a government with commitment, the opti-
mal consumption allocation must satisfy the additional constraint that agents will optimally choose not to save more or less than the amount $k_s$, $s = H, L$, using the anonymous markets in order to smooth their allocation, i.e., that additional savings $\hat{k}_s$, $s = H, L$, are zero: $\hat{k}_H = \hat{k}_L = 0$. This amounts to adding the following constraint to the problem in (1-3):

$$\hat{k}_s = 0 \in \arg \max_{\hat{k}_s} u(c_{1s} - \hat{k}_s) + \beta u(c_{2s} + R\hat{k}_s), \quad s = H, L.$$ (17)

Notice that this adds an extra agency problem. Moreover, the solution to the problem in (1-3), the optimal allocation when no access to anonymous markets is allowed, has the property that $c_{1L} \neq c_{2L}$, and hence it does not satisfy constraint (17). It is therefore straightforward to show the following:

**Proposition 5** It is optimal for a government with commitment not to allow the agents access to anonymous credit markets. At the optimal allocation with commitment and access to anonymous credit markets: i) agents perfectly smooth their consumption: $c_{1s} = c_{2s}$, $s = H, L$; and ii) no social insurance is provided: $c_{1s} + \frac{1}{R}c_{2s} = \theta_{1s}$, $s = H, L$.

Note that the optimal allocation with commitment and access to anonymous credit markets coincides with the allocation that agents could achieve in an incomplete markets economy where they do not have access to state contingent insurance claims, but only to credit markets where they can borrow and lend at the interest rate factor $R$.\(^{18}\)

It is instructive to illustrate the effects of anonymous markets by also looking at the restrictions they impose on the optimal taxation problem which implements the optimal allocation. If agents have access to anonymous markets, agents can hide the capital tax base, and the optimal taxation problem is restricted by $T_s = 0$, $s = H, L$. Agents can perfectly smooth their after tax income and hence their only concern is the present value of income taxes and social security payments. The only incentive compatible fiscal policies, therefore, are such that income taxes and social security payments are equal in present value for both types of agents (and hence must have present value equal to zero). Indeed, the government can not provide any social insurance at all and might as well set taxes and social security payments to zero.

Consider now the effects of allowing access to anonymous unmonitored credit markets when the government has no commitment. Suppose the government allows agents not to reveal their income at time 1 and instead recommends that agents save to perfectly smooth their income across the two time periods using anonymous markets. Given that agents do not reveal their income to the government, the government will not know agents’ types at time 2 from their reports or tax payments at

\(^{18}\)Environments of this type have been studied, e.g., by Allen (1985) and Cole and Kocherlakota (2001).
time 1. Moreover, since agents save in anonymous markets, agents’ savings are not observable to the government either and do not reveal agents’ types indirectly. Thus, the government at time 2 remains completely uninformed about the agents’ types and, given that, will not choose to redistribute any resources. In this way, the lack of commitment government can actually implement the incomplete markets allocation and hence does as well as a government with commitment when agents have access to anonymous markets.

Allowing for anonymous markets improves matters for a government which lacks commitment with respect to the case in which the government lacks commitment and savings are observable. In either case, the difference between each agent’s income and his consumption at time 1 equals his savings and hence equals the present value of what he consumes at time 2, which means that the present value of the allocation of each type equals his income, $\theta_{1s}$. But, with anonymous markets, agents perfectly smooth their consumption and choose different levels of consumption at time 2, i.e., $c_{2H} \neq c_{2L}$, and savings decisions for retirement are not distorted. Thus, both types of agents must be better off with anonymous markets.

In terms of the tax scheme implementing the optimal allocation, if the government allows the agents access to anonymous credit markets, this implies that its fiscal policy is subject to the restriction that $T_s = 0$, $s = H, L$, as well as to the additional restriction that the income taxes at time 2, $t_{2s}$, cannot depend on $k_s$, $s = H, L$. As a consequence, with anonymous markets agents with high income may save more without being expropriated by the government ex-post.

**Proposition 6** It is optimal for a government without commitment to allow the agents access to anonymous credit markets. At the optimal allocation without commitment and with access to anonymous credit markets: i) agents perfectly smooth their consumption: $c_{1s} = c_{2s}$, $s = H, L$; and ii) no social insurance is provided: $c_{1s} + \frac{1}{\tau}c_{2s} = \theta_{1s}$.

Note that the optimal allocation implemented with access to anonymous credit markets is the same whether the government has commitment or not. Also note that at the optimal allocation hidden savings are in fact used in equilibrium at least by agents with high income. In this sense hidden savings are essential to implementing the optimal allocation.

The combination of lack of revelation ex-ante and anonymous markets allows the government to pre-commit not to expropriate agents with high income ex-post. Both the lack of revelation and anonymous markets are critical. If agents were to tell the truth ex-ante, the government would not be able to implement the above allocation since the time 2 government would know agents’ types and hence be able to redistribute despite the fact that agents’ assets are hidden. If their savings were not hidden, then lack of revelation would not be sufficient since the savings levels would reveal the information to the government ex-post.\(^\text{19}\)

\(^{19}\)It turns out that an optimal allocation with truth-telling does not exist here. To see this note
4 Optimal Fiscal Policy with Hidden Effort and Other Examples

We briefly discuss several additional examples in which granting agents access to anonymous markets might be valuable.

4.1 Hidden Effort

Consider the same economy as before, except that agents choose an unobservable effort level at time 1 which affects the probability of the high income state at time 1, $\theta_{1H}$, which is now observable. The choice of effort $e \in \{e_0, e_1\}$ is associated with a utility cost $v(e)$, with $v(e_0) < v(e_1)$, and with a probability of the high income state $\pi_H(e)$, with $\pi_H(e_1) > \pi_H(e_0)$. We interpret the representative agent’s effort choice as affecting the probability that the agent is highly skilled, i.e., as affecting the accumulation of human capital. The government chooses taxation to provide social insurance wary of the effects of the tax scheme on the representative agent’s human capital accumulation.\(^{20}\)

Consider first a government with commitment. We proceed as in the section before, by first studying the optimal allocation and then its tax implementation. The government chooses an allocation $(c_{1s}, c_{2s})_{s=H,L}$ to maximize

$$\sum_{t=1}^{2} \beta^{t-1} \sum_{s=H,L} \pi_s(e_1) u(c_{ts}) - v(e_1)$$

subject to the incentive compatibility constraint

$$\sum_{t=1}^{2} \beta^{t-1} \sum_{s=H,L} \pi_s(e_1) u(c_{ts}) - v(e_1) \geq \sum_{t=1}^{2} \beta^{t-1} \sum_{s=H,L} \pi_s(e_0) u(c_{ts}) - v(e_0),$$

and the budget constraint

$$\sum_{s=H,L} \pi_s(e_1) c_{1s} + \frac{1}{R} \sum_{s=H,L} \pi_s(e_1) c_{2s} = \sum_{s=H,L} \pi_s(e_1) \theta_{1s}.$$\(^{20}\)

that if agents tell the truth ex-ante, then the time 2 government will redistribute resources such that $c_{2H} = c_{2L}$. This is feasible despite the fact that agents have access to anonymous markets because the government knows agents’ types, given that they are telling the truth, and knows their savings $k_s$ in equilibrium (although it can not observe them). However, with access to anonymous markets agents will perfectly smooth their consumption intertemporally and hence $c_{1s} = c_{2s}$, $s = H, L$. But then there is perfect insurance and, given this, agents with high income would not announce their income truthfully since by declaring low income they could pocket the difference.

\(^{20}\)The logical steps of the analysis in this case and the subsequent ones follow those of the previous hidden income economy. We are therefore less formal about the presentation of the various optimal taxation problems.
Note that we are assuming that implementing high effort, i.e., $e_1$, is optimal.

At the optimal allocation with commitment, consumption is perfectly smoothed conditional on each agents’ income at time 1, i.e., $c_{1H} = c_{2H}$ and $c_{1L} = c_{2L}$. In terms of capital taxation, this implies that capital is not taxed when the government has commitment, i.e., $\tau_s = 0$, $s = H, L$. To induce the agent to invest in human capital, that is, to exert effort $e_1$, the government provides less than full social insurance, however, i.e., $c_{1H} = c_{2H} > c_{1L} = c_{2L}$. Optimal income taxes $t_{1s}$ at time 1 are higher for high income agents than for low income agents and the present value of income taxes net of social security payments is negative for high income agents and positive for low income agents.

Because consumption is smoothed perfectly, this allocation can still be implemented when agents have access to hidden savings. Thus, with commitment, the government is indifferent regarding the agents’ access to anonymous credit markets.

Consider instead the case without commitment. As in the previous section we study the optimal allocation with truth-telling, we then check that it is not dominated by an allocation supported by a non-revealing mechanism, and we finally study its tax implementation. Suppose the government implements a mechanism with truth-telling. In this case, again, the government is unable to keep itself from reneging on its promises at time 2 and provides full insurance ex-post. But since agents rationally expect that the government will implement $c_{2H} = c_{2L}$ at time 2, all incentives to induce effort $e_1$ have to be provided through the allocation at time 1, i.e., through $c_{1s}$, $s = H, L$. Assuming that it remains optimal to induce high effort, the optimal allocation satisfies $c_{1H} > c_{2H} = c_{2L} > c_{1L}$, and income taxes are chosen accordingly.\footnote{\textsuperscript{21}} Note that the consumption allocation of neither type is characterized by perfect smoothing. This is because lack of commitment results in taxation at time 2 that effectively depends on $k_s$, and hence the net (after-tax) rate of return on savings implicitly depends on the state $s$. In other words, agents with high income can not save more since the government would expropriate them ex-post. Moreover, since the government would bail agents out who do not save, it has to provide agents with tax incentives to save ex-ante (or, equivalently, keep agents from borrowing against social security income).

The character of the optimal allocation with lack of commitment is not changed when we consider non-revealing mechanisms. If the government considers a non-revealing mechanism this implies that agents consume the same amount at time 2 in equilibrium. Otherwise, for example if agents’ would save different amounts and thus indirectly reveal their types, the government would redistribute resources ex-post. But then the government would optimally implement the same allocation as in a truth-telling mechanism.

Finally, we study the case in which the government which lacks commitment gives

\footnote{\textsuperscript{21}It may be the case that it is no longer optimal to induce high effort when the government lacks commitment. But this would not change our conclusion regarding the value of giving agents access to anonymous markets.}
agents access to anonymous credit markets. Consider again a non-revealing mechanism, i.e., taxes at time 1, \( t_{1s} \), which are independent of \( s \). The time 2 government, which observes taxes at time 1, will then not be able to infer agents’ types.\(^{22}\) Thus, the government remains uninformed by time 1 income taxes. Moreover, if agents save using the anonymous markets, the time 2 government can not observe savings either and hence, not knowing agents’ types, will refrain from redistributive income taxation. This however means that the government does not provide any social insurance. Now, for an open set of parameters, the expected utility of the representative agent is higher when he can perfectly smooth consumption in the absence of any social insurance, than when the retirement savings decision is distorted as in the case where access to hidden savings is restricted. To see this, suppose the parameters \( \theta_{1H} \) and \( \theta_{1L} \) are such that with commitment the optimal allocation coincides with the incomplete markets allocation, i.e., \( c_{ts} = \theta_{1s} R/(1 + R) \) for \( s = H, L, \) and \( t = 1, 2 \). Then this is also the solution with anonymous markets. The lack of commitment solution with no access to anonymous credit markets requires \( c_{2H} = c_{2L} \) and is hence clearly worse. The same is true in a small enough neighborhood of such values of \( (\theta_{1s})_{s=H,L} \).

Thus we conclude that, for an open set of parameters, a government with no commitment strictly prefers to give agents access to anonymous credit markets. Note however that in this case the government does not do as well as a commitment government when agents have access to hidden savings. While hidden savings constrain the government ex-post, which is valuable since the government lacks commitment, lack of commitment remains a constraint. Also, hidden savings (by agents with high income, \( \theta_{1H} \)) are again essential. In contrast, the government with commitment is indifferent with regards to allowing the representative agent access to anonymous credit markets.

There are two additional ways in which a government which lacks commitment might be able to improve on the allocations it is able to offer and which are of interest in practice. First, if hidden savings are not just hidden and hence not observable but moreover can not be seized by the government ex post, the government would be able to implement the commitment solution. Second, if the time 1 government could implement “limited record-keeping,” which means that not all the information collected to enforce taxation at time 1 is available to the time 2 government, then the commitment allocation could again be implemented if hidden savings are available. We discuss these in turn.

The role of non-seizable hidden savings. Suppose hidden savings are not seizable by the government ex-post, meaning that the government can not get agents to give up hidden savings but only observable savings. This changes the constraint

\(^{22}\)Even if in this economy the income of agents is observable to the government at time 1, we assume that the time 2 government can only observe agents’ types through agents’ reports or taxes at time 1, i.e., only if the time 1 government requires agents to report their income in order to make taxes dependent on it.
imposed by lack of commitment as follows: the time 2 allocation \((c_{2H}, c_{2L})\) which the government promises to agents at time 1 satisfies
\[
(c_{2H}, c_{2L}) \in \arg \max_{c_{2H}, c_{2L}} \sum_{s=H,L} \pi_s u(\hat{c}_s),
\] (21)
subject to \(\sum_{s=H,L} \pi_s \hat{c}_{2s} \leq \sum_{s=H,L} \pi_s c_s\) as well as
\[
\hat{c}_s \geq Rk_s, \quad s = H, L.
\] (22)
where \(k_s, s = H, L\) are the hidden savings of agent \(H\) and \(L\), respectively. Importantly, the time 2 government can not reduce the allocation of any agent below the amount in the hidden savings account. Clearly, this is an additional way in which hidden savings might restrict the time-inconsistency problem of the government and might improve matters further. Indeed, the commitment allocation can now be implemented as follows: Agents pay taxes at time 1 as in the commitment solution and save the amount required to fund their retirement consumption using hidden savings. This implements the commitment allocation as long as the time 2 government does not redistribute resources. The time 2 government knows agents’ types from their tax reports at time 1, but since it can not seize the hidden savings, it can not provide extra insurance ex-post. Thus, the time-inconsistency problem can be completely overcome in this example with non-seizable hidden savings.

**The role of limited record keeping.** The idea of limited record keeping is that the government at time 1 can destroy information that is solicited by the government at time 1 to implement taxation so that it is not available to the government at time 2. As above, we can implement the commitment solution by imposing the corresponding time 1 taxes, asking agents to save using the hidden accounts, and choosing not to pass along the records from time 1 taxation to the time 2 government. The time 2 government remains uninformed, since it does not have the time 1 records and cannot see savings, and hence will not be able to implement further redistribution. Limited record-keeping can hence play a role as a commitment device similar to the one played by (otherwise inefficient) lags in the political decision making process.\(^{23}\)

While non-seizable hidden savings and limited record keeping can be valuable when the government lacks commitment, neither would be of value and indeed they might be a constraint for a commitment government.

### 4.2 Hidden Effort and Ex-post Markets

Consider now an economy with hidden effort in which the representative agent receives random income both at time 1, \(\theta_{1s}, s = H, L\), and at time 2, \(\theta_{2s}, s = H, L\).

\(^{23}\)See Chari (2000).
The effort level chosen by agents at time 1 affects the probability of the high income state, that is, the probability that the agent’s income is \( \theta_{1H} \) at both time 1 and 2. Income is therefore persistent. There is no savings technology in this economy and hence there are no savings. Effort \( e \in \{e_0, e_1\} \) is associated with a cost \( v(e) \), with \( v(e_0) < v(e_1) \) and the probability of high income is \( \pi_H(e) \) with \( \pi_H(e_1) > \pi_H(e_0) \). We interpret the representative agent’s effort choice as effort towards the success of an entrepreneurial venture. Since there are no savings in the economy, the government’s tax scheme consist of only income taxes at time 1 and 2, \( t_{ts} \). It is chosen to provide the representative agent with social insurance. We will consider whether the government should allow “international” capital mobility, that is unrestricted access to anonymous capital markets ex-post, such that agents can take their ventures somewhere else. We show that this may be valuable in disciplining a government which lacks commitment.\(^{24}\)

We assume that \( \theta_{1H} > \theta_{2H} \geq \theta_{2L} > \theta_{1L} \) and that

\[
\sum_{s=H,L} \pi_s(e_1) \theta_{1s} = \sum_{s=H,L} \pi_s(e_1) \theta_{2s},
\]

that is, the expected income is the same at time 1 and 2, but income risk is higher at time 1.

The government’s problem with commitment is quite similar to the one in Section 4.1. The government chooses an allocation \((c_{1s}, c_{2s})_{s=H,L}\) to maximize the ex-ante expected utility of the representative agent, (18), subject to the incentive compatibility constraint, (19), but now facing separate time 1 and time 2 budget constraints

\[
\sum_{s=H,L} \pi_s(e_1) c_{ts} = \sum_{s=H,L} \pi_s(e_1) \theta_{ts}, \quad t = 1, 2. \tag{23}
\]

The optimal allocation, implemented via income taxation, provides partial insurance and induces a consumption allocation with the property that \( c_{1H} = c_{2H} > c_{1L} = c_{2L} \).

Consider allowing access to ex-post markets where entrepreneurs will receive their “marginal product.” That is assume that at time 2 agents can take their ventures somewhere else and generate their income \( \theta_{2s} \) there, which with competitive ex-post markets means that agents can ensure themselves a consumption of at least their income \( \theta_{2s} \) at time 2. But then the government’s problem in (18), (19), and (23), has to further satisfy

\[
u(c_{2s}) \geq u(\theta_{2s}), \quad s = H, L. \tag{24}\]

When agents have access to ex-post markets, the government’s tax scheme cannot support any insurance at date 2 and \( c_{2s} = \theta_{2s}, s = H, L \). As a consequence, with\(^{24}\)Kehoe (1989)’s argument that it may be undesirable for two governments which lack commitment to cooperate on policy has a similar spirit.
commitment, the government strictly prefers to limit capital mobility, that is, not to allow access to ex-post markets.²⁵

Consider the problem without commitment under truth-telling. Once again, the government will not be able to resist providing full insurance at time 2, and hence \( c_{1H} > c_{2H} = c_{2L} > c_{1L} \). Adopting a non-revealing mechanism, as in the previous economy, cannot improve the problem of the government at time 1 since it does not pre-commit the time 2 government’s choice. The income realization \( \theta_{2s} \) is observed by the government at time 2 and hence it can always choose taxes to provide full insurance. Indeed, a non-revealing mechanism would imply no insurance at time 1 either and thus would, in general, do worse than a truth-telling mechanism.

Access to ex-post anonymous markets, on the other hand, implies that the government will not be able to provide insurance at all at time 2. Effectively the lack of commitment or renegotiation constraint (10) is relaxed since the time 2 government can only choose among allocations which satisfy \( u(\hat{c}_{2s}) \geq u(\theta_{2s}), s = H, L \). This helps with incentives to provide effort ex-ante since agents now receive their entire income at time 2 and are no longer expropriated or bailed out, as the case may be. Indeed, depending on parameters a government without commitment may strictly prefer to allow agents to access markets ex-post. (Notice that, with access to ex-post markets, the optimal tax schemes with and without commitment coincide.) To see this, suppose the parameters are such that the \( \theta_{2H} \) and \( \theta_{2L} \) coincide with the consumption allocation at time 2 under the commitment solution, i.e., \( \theta_{2s} = c_{2s}, s = H, L \). With ex-post markets the commitment solution can be implemented. Again with lack of commitment the solution does not coincide with this and is hence worse.

Finally, note that, in equilibrium, agents do not actually have to move their projects elsewhere. Rather, agents having unrestricted access to ex-post markets is sufficient.

### 4.3 Investment Credit

In this subsection we consider the problem of a government which can not commit not to “bail out” borrowers whose income is low. We argue that access to hidden risk-free borrowing is welfare improving in this economy, since private lenders in an anonymous market have no incentives to bail borrowers out ex-post, and this has a positive effect on the borrowers’ incentives ex-ante.²⁶

Consider an economy in which the representative agent receives a random income at time 2 only, \( \{\theta_{2H}, \theta_{2L}\} \). The effort level chosen by agents at time 1 affects the

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²⁵Kehoe and Levine (1993)’s environment with limited commitment is related. They show that the agents’ limited commitment ability results in debt constraints and hence restricts the set of incentive compatible allocations. This parallels our result for the government with commitment exactly. We will show, however, that when the government lacks commitment, it is not a foregone conclusion that agents’ limited commitment is indeed a constraint.

²⁶See Bolton and Scharfstein (1996) for a related argument about the commitment value of the presence of multiple creditors.
probability of the high income state, that is, the probability that the agent’s income is $\theta_{2H}$ at time 2. Effort $e \in \{e_0, e_1\}$ is associated with a cost $v(e)$, with $v(e_0) < v(e_1)$ and the probability of high income is $\pi_H(e) \equiv \pi_H(e_1) > \pi_H(e_0)$. At time 1 the representative agent can borrow to finance consumption at the gross interest $R$. At time 1 neither the representative agent nor the government have any information about the future realization of the income of the project, $\theta_{2s}$. The government’s tax scheme at time 1 consists therefore only of an income tax $t_1$ at time 1 and a tax on debt $\tau$, both independent of $s$. The government’s tax scheme at time 2, instead, consists of a state contingent income tax $t_2s$. We can interpret the income tax at time 2 as an investment credit plan.

Consider first a government with commitment. Its optimal policy problem consists of the choice of $(c_1, c_{2s})_{s=H,L}$ to maximize

$$u(c_1) + \beta \sum_{s=H,L} \pi_s(e_1) u(c_{2s}) - v(e_1)$$

subject to the incentive compatibility constraint

$$u(c_1) + \beta \sum_{s=H,L} \pi_s(e_1) u(c_{2s}) - v(e_1) \geq u(c_1) + \beta \sum_{s=H,L} \pi_s(e_0) u(c_{2s}) - v(e_0),$$

and the government’s budget constraint

$$c_1 + \frac{1}{R} \sum_{s=H,L} \pi_s(e_1)c_{2s} = \sum_{s=H,L} \pi_s(e_1)\theta_{2s}.$$  \hfill (27)

Again we assume that effort $e_1$ is optimal.

The optimal tax scheme provides partial insurance, and induces a consumption allocation with the property that $c_{2H} > c_1 > c_{2L}$. With commitment, the government strictly prefers not to allow hidden risk-free borrowing. To see this note that the first order conditions of the government’s optimal tax problem (25-27) imply

$$\frac{1}{u'(c_1)} = \frac{1}{u'(c_{2H})} + \pi_H(e_1) \frac{1}{u'(c_{2L})}$$

and thus $u'(c_1) < \pi_H(e_1)u'(c_{2H}) + \pi_L(e_1)u'(c_{2L})$; see Rogerson (1985), Golosov, Kocherlakota, and Tsyvinski (2003), and Kocherlakota (2004b).

Consider now the case without commitment. In this case it is immediate to see that the consumption allocation supported by the optimal tax scheme has the property that $c_1 = c_{2H} = c_{2L}$, and thus the high effort $e_1$ can not be implemented. The time inconsistency of the government’s choice, induced by lack of commitment, has the dramatic effect of supporting only tax schemes which provide full insurance. Since the income realization $\theta_{2s}$ is publicly observed, the government at time 2 can always choose taxes to induce full insurance, and hence it is not possible to limit the time-inconsistency problem here.
Consider instead allowing hidden risk-free borrowing. Implicitly, we are also assuming that if an agent borrows from hidden sources only, the government cannot observe his income. In this case no taxes can be supported, but the high effort $e_1$ may be induced in equilibrium. Thus, without commitment, the government again strictly prefers to allow hidden risk-free borrowing depending on parameters.

### 4.4 Public Goods

We briefly sketch an example here, where anonymous markets reduce the time-inconsistency problem of ex-post excessive capital taxation for the provision of a public good. Suppose a government finances the provision of a public good at time 2 through Ramsey taxation of savings at that time. Suppose furthermore that agents decide how much to save at time 1. A government which lacks commitment will, ex-post, choose too high a tax rate on savings, since savings can be taken as given ex-post.\(^\text{27}\) This in turn distorts agents’ savings decisions ex-ante. Suppose the government gives agents access to anonymous markets, where agents can save at the same pre-tax interest rate $R$ and where the government can not tax savings. By allowing agents to invest some of their savings in anonymous markets, the government can constrain the time 2 government from taxing capital by too much, and can thus pre-commit not to raise capital taxes at time 2. This reduces the distortion of the consumption-savings decision and is welfare improving.

### 5 Conclusions

We show that access to anonymous markets might be optimal when the government cannot commit. Markets are good even when incentives are an issue - they protect from abuse by the government!

Importantly, when the government lacks commitment, not requiring the revelation of information about income and anonymous markets may be valuable even if the government is benevolent. Indeed, we restrict the analysis in our paper to the case of benevolent governments. But anonymity and anonymous markets are a mechanism to protect agents from the abuse of the government, _a fortiori_, when governments are not benevolent.

We study optimal income and capital taxation when the government faces a time-inconsistency problem and is unable to commit not to make taxation or social security benefits contingent on agents’ accumulated capital or income history. We show that lack of revelation ex-ante and anonymous markets allow the government to pre-commit not to expropriate agents with high income or bail out agents with low income ex-post.

\(^{27}\)We have in mind a two period problem, i.e., a problem with a finite horizon, and do not study reputational mechanisms as in Stokey (1989, 2002) and Chari and Kehoe (1990).
The incentive problem on the part of the principal that we consider is one of lack of commitment. But any incentive problem on the part of the principal would give rise to welfare gains associated access to anonymous markets. Qualitatively, our results could be extended, for instance, to an economy with double-sided moral hazard. Indeed, our analysis extends to general principal-agent environments in which incentive problems or informational asymmetries are two-sided and contracts are incomplete.
References


Appendix A: The Revelation Principle and Commitment - An Example

Consider the following example, a special case of the economy studied in this paper. The economy has 2 periods and 3 dates: 0, 1, and 2. It is populated by a continuum of ex-ante identical agents with preferences represented by a strictly increasing and strictly concave utility function $u(c_2)$, where $c_2$ is the consumption of the single commodity at time 2. That is, agents do not care to consume at time 0 and 1. Agents receive a random time 2 income: $\theta_{2H}$ or $\theta_{2L}$ with probability $\pi_H$ and $\pi_L$, respectively. Income is independent and identically distributed across agents. There is no income at time 0 and 1. Income is not publicly observable but each agent privately observes the realization of his time 2 income at time 1.

Consider first the benchmark case of a principal (e.g., a government) with commitment choosing the optimal allocation in this economy, i.e., $c_{2s}$, $s = H, L$. Any such allocation must satisfy feasibility

$$\pi_H c_{2H} + \pi_L c_{2L} \leq 0$$

and incentive compatibility

$$u(c_{2H}) \geq u(\theta_{2H} - \theta_{2L} + c_{2L})$$
$$u(c_{2L}) \geq u(\theta_{2L} - \theta_{2H} + c_{2H}).$$

It is straightforward to see that the only policy satisfying feasibility and incentive compatibility is

$$c_{2s} = \theta_{2s}, \ s = H, L,$$

where agents consume their own income and no social insurance can be implemented.

Now consider the case of a principal (e.g., a government) lacking commitment. In this case it follows immediately that there does not exist a solution with direct, truthful revelation to the principal. In fact, if the principal were to succeed in inducing the agents to reveal their type $\theta_{2s}$ truthfully, for $s = H, L$, at time 1, he would then choose $c_{2s}$, $s = H, L$ to maximize

$$\pi_H u(c_{2H}) + \pi_L u(c_{2L})$$

subject only to

$$\pi_H c_{2H} + \pi_L c_{2L} \leq 0.$$

We do not consider lotteries in this example or in the rest of the paper. This can be shown to be without loss of generality if preferences are not state-dependent and exhibit non-increasing absolute risk aversion. See Prescott and Townsend (1984) for an example where these conditions are not satisfied and where lotteries are optimal.

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28 We do not consider lotteries in this example or in the rest of the paper. This can be shown to be without loss of generality if preferences are not state-dependent and exhibit non-increasing absolute risk aversion. See Prescott and Townsend (1984) for an example where these conditions are not satisfied and where lotteries are optimal.
No incentive constraints need to be satisfied because the agents’ types have been revealed to the principal. In this case lack of commitment imposes the following constraint on any truth-telling mechanism:

\[ c_{2H} = c_{2L}, \]

an implication of the first order condition of the principal’s maximization problem at time 2. If agents announce their type truthfully at time 1, the principal will provide full insurance ex-post at time 2. It follows then that it is not an equilibrium for type \( \theta_{2H} \) to announce their type truthfully in the first place.

Consider on the other hand any mechanism which has agents of both types declaring the same type, e.g., \( \theta_{2L} \).\(^{29}\) Such mechanisms are obviously not truth-telling. In this case though lack of commitment imposes no restriction: the maximization problem of the principal at time 2 is subject to incentive compatibility, since agents do not reveal their type, and its solution is \( c_{2s} = \theta_{2s}, s = H, L \). Therefore, there exists an allocation which can be implemented by a mechanism when truth-telling is not required, and that allocation coincides with the allocation implemented under commitment.

The rationale of the example is that the constraint imposed by lack of commitment does not directly restrict the set of feasible incentive compatible allocations, but instead its bite depends on the class of mechanisms it is applied to. If the principal at time 1, because of truth-telling, has the information to distinguish the agents with income \( H \), then the lack of commitment has bite, since the principal will use the information in the future to provide insurance and hence to expropriate the agents with income \( H \). If instead the principal does not have the information required to identify which agents have income \( H \), then lack of commitment has no bite as the principal cannot implement ex-post welfare improving transfers. In fact, as long as the principal’s posterior belief about any agent deviates from the unconditional probability, the principal will end up transferring some resources. Thus, no information can be revealed to the principal at all.

**Appendix B: A Complete Characterization of the Optimal Tax on Capital with Commitment and Observability of Savings**

Suppose the optimal consumption allocation \((c_{1s}, c_{2s})\) requires the agent to save \( k_s \). Capital taxes \( T_s, s = H, L, \) depend on \( s \) and \( k_s \) and let \( T'_s(k) = \tau_s^+ \) if \( k > k_s \) and \( T'_s(k) = \tau_s^- \) otherwise. We have shown in the text that, if \( \tau_s^+ \) and \( \tau_s^- \), \( s = H, L \), are chosen to satisfy

\[ \tau_s^- \leq 1 - \frac{u'(c_{1s})}{u'(c_{2s})} \leq \tau_s^+, \]

\(^{29}\)In fact, any random reporting strategy which is the same for both types will do (see also Bester and Strausz (2001)).
then agents who choose the tax schedule designed for their income, will indeed save $k_s$.

To keep an agent with high income from declaring low income and saving an amount different from $k_L$, $\tau^+_L$ and $\tau^-_L$ need to satisfy

$$u'(c_{2L})(1 - \tau^+_L) \leq u'(c_{1L} + \theta_{1H} - \theta_{1L}) \leq u'(c_{2L})(1 - \tau^-_L).$$  \(29\)

Combining equation (28) for $s = L$ and equation (29) we get

$$\tau^-_L \leq 1 - \frac{u'(c_{1L})}{u'(c_{2L})} \leq 1 - \frac{u'(c_{1L} + \theta_{1H} - \theta_{1L})}{u'(c_{2L})} \leq \tau^+_L.$$  \(30\)

Hence, for this equation to be satisfied we must have $\tau^+_L > 0$, i.e., a positive tax on savings above $k_L$ is imposed on agents who report low income, whereas we can set $\tau^-_L = 0$. Low income agents face a distorted marginal saving choice at time 1 in order to induce them to consume more at time 1, $c_{1L} > c_{2L}$. Indeed, $\tau^+_L$ has to be sufficiently high to keep high income agents who declare low income from saving more than $k_L$. The higher tax rate $\tau^+_L > 0$ is however not imposed in equilibrium.

Furthermore, we need to consider the savings decision of an agent with low income who declares high income instead. In the direct mechanism we were able to ignore the corresponding incentive constraint, since it does not bind, but this does not imply that in the tax implementation considered the agent could not do better by declaring high income and adjusting savings. The following condition on $\tau^+_H$ and $\tau^-_H$ are sufficient (but not necessary) to ensure this:

$$u'(c_{2H})(1 - \tau^+_H) \leq u'(c_{1H} + \theta_{1H} - \theta_{1L}) \leq u'(c_{2H})(1 - \tau^-_H).$$  \(31\)

which, combined with equation (9) for $s = H$, implies that

$$\tau^-_H \leq 1 - \frac{u'(c_{1H} + \theta_{1L} - \theta_{1H})}{u'(c_{2H})} \leq 1 - \frac{u'(c_{1H})}{u'(c_{2H})} = 0 \leq \tau^+_H.$$  \(32\)

Thus, we can set $\tau^-_H = 0$.

Furthermore, we show next that we can let $\tau^-_H = 0$ without loss of generality. We know that

$$u(c_{1H}) + \beta u(c_{2H}) = u(c_{1L} + \theta_{1H} - \theta_{1L} + \beta u(c_{2L})$$

and

$$u(c_{1L} + \beta u(c_{2L}) > u(c_{1H} + \theta_{1L} - \theta_{1H}) + \beta u(c_{2H}).$$

If $\tau^-_H = 0$, then the agent with low income could declare high income and perfectly smooth at interest rate factor $R = \frac{1}{\beta}$. He would thus choose

$$\max_b u(c_{1H} + \theta_{1L} - \theta_{1H} - \hat{b}) + \beta u(c_{2H} + R\hat{b})$$
which, using the first order condition and \( c_{1H} = c_{2H} \equiv c_H \), can be solved for \( b = \frac{1}{1 + R} (\theta_{1L} - \theta_{1H}) \) and implies that the agent consumes \( \bar{c}_L \equiv c_H + \frac{R}{1 + R} (\theta_{1L} - \theta_{1H}) \).

Suppose, by contradiction, that this violates the low type’s incentive constraint, i.e.,

\[
    u(c_{1L}) + \beta u(c_{2L}) < u(\bar{c}_L) + \beta u(\bar{c}_L).
\]

Note that since present value is transferred to agents with low income at an optimal allocation we have that

\[
c_{1L} + \frac{1}{R} c_{2L} > c_{1H} + \theta_{1L} - \theta_{1H} + \frac{1}{R} c_{2H},
\]

such that offering the consumption \( \bar{c}_L \) at both time 1 and 2 to agents with low income would be cheaper for the government.

Consider hence the alternative allocation \( \hat{c}_{1L} = \bar{c}_L, t = 1, 2 \), leaving the high type’s allocation unchanged. This would be feasible and would make the low type better off. It would also be incentive compatible since

\[
    \hat{c}_{1L} + \theta_{1H} - \theta_{1L} + \frac{1}{R} \hat{c}_{2L} = c_{1H} + \frac{1}{R} c_{2H},
\]

i.e., the allocation of the high type under a deviation and when he tells the truth have the same present value and hence

\[
    u(c_{1H}) + \beta u(c_{2H}) > u(\hat{c}_{1L} + \theta_{1H} - \theta_{1L}) + \beta u(\hat{c}_{2L})
\]

since the allocation when he tells the truth is perfectly smoothed.

But this contradicts optimality of the original allocation.