Tax Buyouts*

Marco Del Negro
Federal Reserve Bank of Atlanta

Fabrizio Perri
NYU, CEPR and NBER

Fabiano Schivardi
Bank of Italy and CEPR

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PRELIMINARY AND INCOMPLETE

Abstract

The paper proposes a fiscal policy instrument that can reduce fiscal distortions without affecting revenues. The instrument is a *private* contract offered by the government to each individual citizen, whereby the citizen pays a sum of money upfront in exchange for a given reduction in her tax rate for a pre-specified period of time. The key issue is the pricing of the tax-rate reduction. We consider a calibrated Mirrlees economy and show that, under simple and non-distortionary pricing mechanisms, the contract is signed by a significant fraction of the population and can lead to sizeable increases in labor supply, consumption, TFP and welfare.

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1 Introduction

The paper proposes a instrument for fiscal policy, a private contract between the government and private citizens whereby the agent pays a sum of money upfront in exchange for a given reduction in her tax rate for a pre-specified period of time. We refer to this contract as a tax buyout: the contract makes it possible for the agent to effectively buy out a portion of her distortionary taxes via a lump-sum payment. The motivation for the paper arises from the debate on the detrimental role of high (distortionary) taxation on economic growth and labor supply. This debate is particularly lively in Europe, where marginal tax rates are in many countries substantially higher than in the United States (see Prescott 2004). In many of these countries, including the U.S., the current and perspective levels of fiscal deficits (and often debt) are high enough that the government cannot contemplate a tax reduction without considering its implication in terms of fiscal sustainability. Some authors (Mankiw and Weizierl, 2004) have argued, using essentially dynamic Laffer-curve arguments, that in the United States (and, one would suspect, *a fortiori* in Europe) the reduction in tax rates would in large part finance itself. This is a risky bet, however, as shown by the experience of the U.S. in the eighties. In absence of a growth effect that is strong enough to re-equilibrate tax revenues, the reduction in taxes must come at the cost of reduced government spending, an option often politically hard to follow.

This paper proposes a contract between the government and the households that reduces the distortionary taxation while keeping the government proceeds unchanged. The basic idea is that individuals who wish a tax reduction pay for it upfront in a non-distortionary fashion. As long as the tax reduction is priced correctly, the exchange is revenue neutral (in an NPV sense). A consequence is that those who do not participate in the contract are not, abstracting from general equilibrium effects, affected by it. Participation to the contract is entirely voluntary: those individuals that have most to gain from a reduction in the marginal tax rate self-select into the program. In some dimensions, our contract is similar to some of the mechanisms described in the optimal capital taxation literature (Judd 1985, Chamley 1986). From the government's perspective it involves an exchange between lump-sum taxation today (achieved by means of unanticipated capital taxes) and distortionary taxation in the future. Differently from these mechanisms, from the agents' perspective the exchange is not the result of expropriation on the part of the government, but of free choice.

In a world of perfect information the contract simply amounts to an exchange of tax revenues collected in a distortionary fashion for revenues collected lump-sum. In such a world, the amount of foregone revenues is straightforward to compute, since the government knows each agent's ability. This present discounted value computation would give the price of the contract. By construction, the contract is therefore revenue neutral agent by agent, and therefore for the economy as a whole. In such a world, however the government could collect all revenues lump-sum in the first place. Moreover, this world is not very interesting for a simple reason – it is not the one we live in. We therefore focus most of the paper discussing the introduction of the contract in a world with asymmetric information, where the government has only partial information (if any) on agents' abilities. In this world the contract is more difficult to price. Using a simple model economy, we show that even if the government has no information whatsoever on individual abilities, the introduction of the contract is nonetheless Pareto-improving. The intuition for this result is that the inefficiencies generated by distortionary taxation, once removed, create a surplus that the government can share with the agents. Therefore the government can price the contract high enough to make positive revenues, yet low enough to be attractive to the agents with high ability and high income prospects. We also discuss conditions under which the contract can lead the economy to the (informationally-constrained) Pareto-efficient outcome.

If the first part of the paper (section 2) explores the workings of the contract from a theoretical standpoint within a tractable framework, the second part (section 3) obtains quantitative results using a calibrated version of the model. We find ...

In this paper we focus exclusively on taxation of labor income in order to narrow the set of issues we have to deal with. Also, we want to understand how much mileage we can get from the introduction of the contract on labor income only. The idea of the contract applies to capital taxation as well, however.

2 A simple model with heterogeneous productivity

In this section we consider a small open economy populated by a continuum of agents, each with different productivity and initial level of wealth. The model is very similar to that in Heathcote, Storesletten and Violante (2005). Agents' productivity is a function of two components: i) a fixed component A, which is constant over time and distributed according to the CDF $F_A(A)$, and ii) a transitory one ϵ, which is i.i.d. across time and agents according to the CDF $F_\epsilon(\epsilon)$ and independent from A. We assume that the fixed component A is uninsurable while the transitory one ϵ can be perfectly insured.[1] Agents are endowed with and initial amount of wealth w. The government has an outstanding debt b_0 and a constant flow of government spending g, financed via labor taxes. We consider the simple case where the tax rate is constant and equal to τ. Private agents and the government have access to the world capital market where they can borrow and lend at the risk free rate r. We assume that this exogenous gross risk-free rate equals the inverse of the discount rate: $\beta(1 + r) = 1$.

Our modification to this otherwise standard set-up is that in each period the government offers each agent a contract, whereby the agent agrees to pay an amount of resources upfront in exchange for a reduction in her tax rate. Under perfect information the contract is designed in such a way that the value of resources extracted from each agent remains the same, regardless of the amount of tax reduction the agent chooses to purchase. That is, the contract is revenue neutral from the government's perspective, agent by agent. We show that under these conditions agents will want to pay all their taxes upfront in lump-sum form. The logic of this result is straightforward: The contract gives agents the opportunity to turn distortionary

[1] Bla Bla about equivalence with economy where agents can borrow and lend.

taxation into lump-sum taxation, and revenue neutrality implies that all the benefits from the reduction in distortions accrue to the agent. The economy with perfect information is a useful starting point for our analysis, as it highlights the basic insights of the contract, that will hold also in a more realistic setting. However, under perfect information, a benevolent government could more simply use lump-sum taxation – where the lump-sum taxes are a function of the fixed component of ability A – in the first place.

We then turn to study an economy with asymmetric information, where the government does not have perfect knowledge of the agents' abilities and therefore cannot implement (ability dependent) lump-sum taxation. In the most extreme case, we assume that the government has no information at all on abilities, so that the contract cannot be made contingent on them. The question is whether the introduction of the contract can be Pareto-improving in spite of this constraint. We show that this is the case. The intuition for this result is that the inefficiencies generated by distortionary taxation, once removed, create a surplus that the government can share with the agents. Therefore the government can price the contract high enough to make positive revenues, yet low enough to be attractive to the high ability agents.

The next section describes the economy and characterizes its stationary equilibrium. Section 2.2 describes the introduction of the contract under perfect information, and section 2.3 considers the asymmetric information case.

2.1 The economy

Agents' preferences and technology are given by:

$$\sum_{t=0}^{\infty} \beta^t u(c_t, l_t), \tag{1}$$

and

$$y_t = A\epsilon_t l_t, \tag{2}$$

respectively, where c_t and l_t are consumption and labor in period t, y_t is labor income, $\beta > 0$ is the time discount factor and u is a standard utility function. Given the assumption that the temporary shock ϵ_t is perfectly insurable, we consider a typical "component-planner" problem who chooses consumption and labor for all agents that have the same fixed level of ability A and wealth w. In addition, the assumption $\beta(1+r) = 1$ implies that the "component-planner" problem for this (A, w)-cohort is stationary and can be simplified as follows:

$$\max_{\{c(A,\epsilon,w,\tau),l(A,\epsilon,w,\tau)\}} \int u(c(A,\epsilon,w,\tau), l(A,\epsilon,w,\tau))dF_\epsilon(\epsilon) \tag{3}$$

subject to:

$$\int (rw + (1-\tau)A\epsilon l(A,\epsilon,w,\tau) - c(A,\epsilon,w,\tau)\ )\, dF_\epsilon(\epsilon) \ = \ 0 \tag{4}$$

where $c(A,\epsilon,w,\tau) > 0$, $l(A,\epsilon,w,\tau) \in [0,1]$, and the initial wealth level w is given.

The government sets constant labor taxes τ to finance constant exogenous current expenditures g and service its outstanding debt b. In the stationary equilibrium the government budget constraint is:

$$rb + g \ = \ \tau \int A \ \left(\int \epsilon l(A,\epsilon,w,\tau)\ dF_\epsilon(\epsilon) \right)\ dF_A(A). \tag{5}$$

Stationary equilibria for this economy, in which we impose $\beta(1+r) = 1$, are characterized by policy functions $c(A,\epsilon,w,\tau)$ and $l(A,\epsilon,w,\tau)$, and a Lagrange multiplier $\lambda(A,w,\tau)$ associated with (4) satisfying:

$$u_c(c(A,\epsilon,w,\tau), l(A,\epsilon,w,\tau)) \ = \ \lambda(A,w,\tau) \tag{6}$$

$$A\epsilon(1-\tau)u_c(c(A,\epsilon,w,\tau), l(A,\epsilon,w,\tau)) \ = \ -\,u_l(c(A,\epsilon,w,\tau), l(A,\epsilon,w,\tau)) \tag{7}$$

as well as the budget constraint (4), and a tax rate τ satisfying 5.

2.2 The economy with the contract: perfect information

At the beginning of period 0 each agent is offered to buy a permanent reduction δ in its tax rate in exchange for the payment of an annuity rd. Under perfect information the fixed effect A is known at time 0 to both the government and the agent, while the future temporary shocks ϵ are by definition not known to either. The government chooses d such that the contract is revenue neutral *for each agent* in expected value. The government is making sure that in expected terms the amount of resources extracted from each agent does not change with the introdcution of the contract. Therefore d is a function of both A and δ that satisfies:

$$d(A;\delta) \quad = \quad \frac{1}{r}\int (\ \tau A\epsilon l(A,\epsilon,w,\tau) - (\tau-\delta)A\epsilon l(A,\epsilon,w-d,\tau-\delta)\ )\, dF_{\epsilon}(\epsilon) \tag{8}$$

where $l(A,\epsilon,w-d,\tau-\delta)$ is the policy function under the new regime. Note that the government is exploiting its knowledge of the agents' policy function in designing the contract.

In expression (8) we have used the same policy function for labor supply described in the previous section, with the only difference that the arguments w and τ are replaced by $w-d$ and $\tau-\delta$, respectively. Indeed, one can see that for any given δ these policy functions satisfy the first order conditions as well as the new budget constraint:

$$\int (r(w-d) + (1-\tau)A\epsilon l(A,\epsilon,w-d,\tau-\delta) - c(A,\epsilon,w-d,\tau-\delta)\ )\, dF_{\epsilon}(\epsilon) \ = \ 0. \tag{9}$$

Moreover, since the contract is such that the government's intertemporal budget constraint is unchanged for each agent, it is also unchanged in the aggregate:

$$\begin{aligned} &\int \left(\int \tau A\epsilon l(A,\epsilon,w,\tau)\ dF_{\epsilon}(\epsilon)\right)\ dF_A(A) \\ &\quad = \int \left(\int (\tau-\delta)A\epsilon l(A,\epsilon,w-d,\tau-\delta)\ dF_{\epsilon}(\epsilon) + rd(A;\delta)\right)\ dF_A(A) \end{aligned} \tag{10}$$

To simplify the notation, in the remainder of the paper we will use a short-hand notation $l_A(\tau-\delta) = \int \epsilon\tilde{l}(A,\epsilon,w-d;\tau-\delta)\ dF_{\epsilon}(\epsilon)$ and $c_A(\tau-\delta) = \int \tilde{c}(A,\epsilon,w-d;\tau-\delta)\ dF_{\epsilon}(\epsilon)$, and $\lambda_A(\tau-\delta) = \lambda(A,w-d,\tau-\delta)$ to denote aggregate (ability adjusted) labor supply, consumption, and Lagrange multiplier, respectively, for a (A,w)-cohort. Also, from now on we will loosely refer to the planner for the (A,w)-cohort as the "agent".

Next we turn to the question of the optimal choice of δ, the amount of tax reduction:

Proposition 1 *If the government prices the contract according to (8) agents will choose to buy the maximum possible tax reduction. Moreover, labor supply will increase for each agent.*

This result comes from the fact that the amount of resources extracted from each (A, w)-family by the government is the same regardless of δ. As a consequence, the old (without contract) optimal allocation remains feasible after the purchase of the contract. Hence, purchasing the contract cannot but raise the agent's utility. For future reference we write here the first order condition of the (A, w)-planner with respect to δ. Define the aggregate utiliy of the (A, w)-family as:

$$u(A, w-d, \tau-\delta) = \frac{1}{1-\beta} \int u(c(A, \epsilon, w-d, \tau-\delta), l(A, \epsilon, w-d, \tau-\delta)) dF_\epsilon(\epsilon) \quad (11)$$

Using the envelope theorem it is easy to show that the first order condition with respect to δ for the "component-planner" is given by:

$$\frac{\partial u(A, w-d, \tau-\delta)}{\partial \delta} = \lambda_A(\tau-\delta)\left(-r\frac{\partial d}{\partial \delta} + A l_A(\tau-\delta)\right). \quad (12)$$

2.3 The economy with the contract: asymmetric information

This section studies the economy with asymmetric information. We start by assuming that the government has no information whatsoever on A, and hence needs to offer everyone the same price for the contract $d(\delta)$. For simplicity, in this section we also abstract from differences in wealth: all arguments go through by making the price $d(\delta)$ a function of wealth.

2.3.1 Is the contract Pareto-improving under asymmetric information?

We want to show that the contract can be Pareto improving even under asymmetric information. Namely, we want to show that there exists a function $d(\delta)$ such that: (i) a positive mass of agents takes the contract, and (ii) the government budget is still balanced. The second condition implies that those agents who do not take the contract are made no worse off by its introduction. We will prove (i) and (ii) for a linear pricing function

$$d(\delta) = d\ \delta. \tag{13}$$

Call $R(d)$ the mapping between d, the price of the contract per unit of δ, and the change in government's revenues from the introduction the contract:

$$R(d) \quad = \int_{\underline{A}}^{\overline{A}} \Big[\ (\tau - \delta) A l_A(\tau - \delta) \ + \ r d\delta \ - \ \tau A l_A(\tau) \ \Big] \ dF_A(A). \tag{14}$$

First, we discuss two results on the optimal choice of δ. The first one does not depend on linearity of the pricing function:

Lemma 1 *Call δ_A the optimal choice of δ for any given pricing function $d(\delta)$. Let us have two agents with abilities $A_1 > A_2$. Then $\delta_{A_1} \geq \delta_{A_2}$.*

This result follows from the fact that in the first order condition of the agent with respect to δ (expression 12) rewritten in terms of short-hand notation is:

$$\frac{\partial u}{\partial \delta} \quad = \quad \left(A l_A(\tau - \delta) - r \frac{\partial d}{\partial \delta} \right) \lambda_A,$$

the term within parenthesis is increasing in A. The next Lemma shows that for any given pricing the agent's maximization problem with respect to δ will only have corner solutions.

Lemma 2 *Under a linear pricing function $d(\delta) = d\delta$, an agent of ability A will either not buy into the contract, or will always buy the maximum amount allowed.*

Next, for each level of ability we define two (per-δ-unit) prices, $\underline{d}_A$ and $\overline{d}_A$. The former is the lowest price at which the government is not losing resources from offering the contract to agent A. The latter is the price for which agent A is indifferent between taking and not taking the contract.

Lemma 3 *Under a linear pricing function $d(\delta) = d\delta$, for each level of ability A there exist:*

i) A per-unit price $\underline{d}_A$ such that agent A is willing to enter the contract and the government is neither losing nor gaining resources from the agent.

ii) A per-unit price $\overline{d}_A$ for which agent A is indifferent between taking and not taking the contract. If agent A decides to enter the contract, the government is gaining resources from the agent.

The lemma is proven in the appendix. A consequence of Lemma 3 is:

Corollary 1 *For $d \in (\underline{d}_A, \overline{d}_A)$ the government is gaining resources from offering the contract to agent A, and agent A is willing to take the contract.*

We have just shown that for each level of ability there is a price that is high enough to make government's revenues positive, yet low enough to be attractive to the agents. The removal of the inefficiency due to distortionary taxation creates a surplus that the government and the agent can share.

Building on this result, we now show that the government can attract into the contract the upper tail of the ability distribution, and still make positive revenues. Once we have shown this, it follows that the contract is Pareto-improving: The government could either rebate these excess revenues to all agents, or lower the price even further to attract more agents into the contract. Here we pursue the latter route, and show that if the price is low enough government's excess revenues are driven to zero. Define the *marginal ability* $A(d)$ as the level of ability for which $\overline{d}_A = d$. Such level is well defined for any $d \leq \overline{d}_{\overline{A}}$. Continuity of the policy function $l(.)$ with respect to ability implies that the mapping $A(d)$ is also continuous. As a consequence of Lemma 1 agents with ability less than $A(d)$ will not take the contract, while agents with ability greater than $A(d)$ will. Therefore government's revenues from the introduction of the contract (14) can be written as:

$$\begin{aligned} R(d) &= \int_{A(d)}^{\overline{A}} \Big[\ (\tau-\delta)Al_A(\tau-\delta) \ + \ rd\delta \ - \ \tau A l_A(\tau) \ \Big] \ dF_A(A) \\ &= \int_{A(d)}^{\overline{A}} \Big[\ rd\tau \ - \ \tau A l_A(\tau) \ \Big] \ dF_A(A). \end{aligned} \tag{15}$$

where the second line follows from Lemma 2. Continuity of $A(d)$ implies that:

Lemma 4 *$R(d)$ is continuous for $d < \overline{d}_{\overline{A}}$.*

From Lemma 3 we have that the government can attract to the contract the upper tail of the ability distribution, and still extract excess revenues from all of these high ability agents if $d > \underline{d}_{\overline{A}}$:

Corollary 2 *For $d \in [\underline{d}_{\overline{A}}, \overline{d}_{\overline{A}})$ all agents with ability $A \in [A(d), \overline{A}]$ will take the contract, where $A(d)$ is strictly less than $\overline{A}$. Moreover, $R(d) > 0$ in this interval.*

The above corollary, the continuity of $R(d)$, and the fact that $R(0) < 0$ imply:

Proposition 2 *There exist a pricing function $d(\delta) = d^*\delta$, with $d^* \in (0, \underline{d}_{\overline{A}})$, such that: (i) a positive mass of agents with $A \in [A(d^*), \overline{A}]$ enter the contract; (ii) the government's budget is balanced ($R(d^*) = 0$).*

Since those who enter the contract are better off, and those who do not enter the contract are no worse off given that the government still balances the budget, we have shown that the contract is Pareto improving. Yet, an unpleasant feature of linear pricing, the case considered in this section, is that all agents who enter the contract will purchase the maximum amount, and therefore pay the same price, regardless of the level of ability. But the gains from the contract increase with ability. In fact, it can be the case that high ability agents are not only extracting all the surplus from the reduction of their own distortions, but also appropriating some surplus from those lower ability agents that enter the contract.

3 Quantitative Analysis

In this section we parameterize the model described in section 2 and present some quantitative results on the effects of the introduction of the contract. For the utility function we consider the following functional forms:

i) Cobb-Douglas: $u(c, l) = \log(c) + \phi \frac{1}{1-\gamma} l^{1-\gamma}$.

ii) Quasi-linear (QL): $u(c,l) = \log\left(c - \frac{\phi}{v} l^{\nu}\right)$.

We use a log-normal distribution for abilities:

$$f(A) = \frac{1}{A\sigma\sqrt{2\pi}} \exp\{-\log(A-\mu)/2\sigma^2\}$$

In our baseline specification, the parameters of the utility function (γ, v, and ϕ) and the distribution for abilities are chosen according to the following criteria: i) γ and v are chosen to match a Frisch Elasticity of 0.75. ii) ϕ is such that time at work is .3; iii) The variance of the log-normal is set to match an earnings variance of 0.3 which is consistent with earnings inequality data in Continental Europe countries. Finally, the initial tax rate τ is set to 40%, also consistently with European data, and the real interest rate to r to .04. For the moment, we assume that all agents have the same level of wealth, set to zero for simplicity.

In this section we only consider the case where the contract is priced linearly:

$$d(\delta) = d\ \delta.$$

We are going to exploit the result obtained in section 2 that under linear pricing the agent's problem has only corner solutions: Those agents who take the contract are going to buy the maximum amount. In the quantitative analysis we constrain the maximum amount δ^* to be either 5 or 10%.

Figures 1 and 2 show the net revenues to the government from the introduction of the contract and the percentage of agents participating, respectively, as a function of the price d. When the price is very low, the government is losing resources: for example, when the price is zero the government is simply cutting taxes by 5% to all agents, as everybody takes the contract. As the price increases, losses are reduced, until a point at which they are zero: this is the price that ensures revenue neutrality. If we keep increasing the price, revenues keep rising for some time, and then start declining, as the increase in revenues is more than offset from the decrease in the share of agents who buy the contract. This profile is consistent with the theory of Section 2.3. Note that with Cobb-Douglas preferences the revenue schedule is shifted downward and to the right, as the gains from the increase in labor supply are lower. Figure 2 shows that the share of agents that buy the contacts decreases monotonically with the price.

Table 1 shows the percentage of agents participating the contract, the revenues from the contract as share of GDP and the price d^* as a fraction of median income for $\delta^* = 0.5$ and $\delta^* = .15$. The table also describes the macroeconomic consequences from the introduction of the contract in terms of average labor supply, output, consumption and the welfare change (in consumption equivalent) of the agents buying the contract (the column labeled $\%\Delta w_B$). The table shows that the assumptions regarding the form of the utility function, not surprisingly, make a substantial difference. Under Cobb-Douglas preference the labor supply response to the tax reduction is much smaller than in the Quasi-linear case. As a consequence, the contract is more expensive, a lower percentage of agents participate, and the effects on output, consumption, and welfare are smaller. Still, even in the most conservative scenario the effects of the contract are not trivial, as around 5% elect to but the contracts and output and consumption increase permanently by .5 and .8%, respectively.

Table 1 assumes that the government uses absolutely no information on abilities. This is a rather conservative assumption. It is conceivable that the contract keeps its non distortionary flavor even if the government uses some information on abilities/education to price it. Table 2 shows the effect of the contract when the government uses "some" information on abilities. Specifically, we consider the case where the government changes the price of the contract according to which percentile of the distribution an agent belongs to. The coarser are the percentiles, the less information the government use. We analyze the cases with two (above or below the median) and three percentiles. The table shows that more information increases the number of takers dramatically. With three percentiles and quasi-linear preferences virtually everybody in the economy takes the contract and even with with Cobb-Douglas preferences over 50% of the population elect to purchase the contract.

4 Conclusions

A tax buy-out is a simple contract between the government and private agents which, in theory, can reduce distortions in the economy without adversely affect government finances. Our preliminary work indicates its effects might be also quantitatively relevant even in presence of asymmetric information between the government and private agents. So far we have considered an environment with no financial frictions and no income shocks. A natural extension is to evaluate the effect of tax buy-outs in an environment in which agents face income shocks which are not perfectly insured.

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A Appendix

Proof of Proposition 1: Substituting the pricing equation 8 into the budget constraint 9 one obtains:

$$rw - \tau l_A(\tau) + Al_A(\tau - \delta) - c_A(\tau - \delta) \; = \; 0. \tag{16}$$

where $c_A(\tau - \delta)$ and $l_A(\tau - \delta)$ ($c_A(\tau)$ and $l_A(\tau)$) are allocations after (before) the purchase of the contract. This expression shows that the old optimal allocation $c_A(\tau - \delta) = c_A(\tau)$ and $l_A(\tau - \delta) = l_A(\tau)$ are still feasible after the purchase of the contract. Hence the level of utility achievable after the purchase of the contract can be no less than $u(c_A(\tau), l_A(\tau))$. Moreover, differentiability of the utility function implies that agent's utility strictly increases after the purchase of the contract. The slope of the indifferene curve at the old optimum is $(1 - \tau)$ while the slope of the new budget constraint is $(1 - \tau + \delta)$. Hence the new budget constraint cuts through the old indifference curve, and therefore utility strictly increases. In addition, given that $(1-\tau) < (1-\tau+\delta)$ at the new tangency point it must be that $l_A(\tau-\bar{\delta}) > l_A(\tau)$. In order to show this we can differentiate the A-family planner's utility at the "old" $(\delta = 0)$ allocation, which is still feasible. To simplify the expressions let us denote the consumption and labor allocation as $(c(\epsilon), l(\epsilon))$ (the other arguments, A, δ, and $w - d$, are fixed at this point):

$$\begin{aligned}
&\textstyle\int u(c(\epsilon), l(\epsilon)) dF_\epsilon(\epsilon) \; = \\
&\quad = \; \textstyle\int u(\tilde{c}(\epsilon), \tilde{l}(\epsilon)) dF_\epsilon(\epsilon) + \int \Big(u_c(\tilde{c}(\epsilon), \tilde{l}(\epsilon)) dc + u_l(\tilde{c}(\epsilon), \tilde{l}(\epsilon)) dl \Big) \, dF_\epsilon(\epsilon) \\
&\quad = \; \textstyle\int u(\tilde{c}(\epsilon), \tilde{l}(\epsilon)) dF_\epsilon(\epsilon) + \lambda \; \int \left(dc - A\epsilon(1 - \tau) dl \right) dF_\epsilon(\epsilon) \\
&\quad = \; \textstyle\int u(\tilde{c}(\epsilon), \tilde{l}(\epsilon)) dF_\epsilon(\epsilon) + \lambda \; \int \left((1 - \tau + \delta) A\epsilon dl - A\epsilon(1 - \tau) dl \right) dF_\epsilon(\epsilon) \\
&\quad = \; \textstyle\int u(\tilde{c}(\epsilon), \tilde{l}(\epsilon)) dF_\epsilon(\epsilon) + \lambda \; A\delta \int \left(\epsilon dl \right) dF_\epsilon(\epsilon)
\end{aligned} \tag{17}$$

where $\tilde{}$ denote the "old" allocation. The second line obtains from substituting the first order condition under the "old" equilibrium. The third line comes from differentiating the "new" budget constraint:

$$\int \left((1 - \tau + \delta) A\epsilon dl - dc \right) dF_\epsilon(\epsilon) = 0.$$

Expression (17) shows that, after buying an amount δ of the contract, i) the agent can increase utility by moving away from the old allocation along the new budgt constraint, ii) the direction in which utility increases is the one where the aggregate labor supply for the A-cohort, $dl_A = \int \epsilon dl dF_\epsilon(\epsilon)$, increases.

By the same token, agents will choose to buy $\delta_2 > \delta_1$. The additional cost of purchasing an additonal $\delta_2 - \delta_1$ amount of the contract is such that the $(c(\tau - \delta_1), l(\tau - \delta_1))$ allocation remains available. As a consquence, agents will purchase the maximum possible amount.

Proof of Lemma 2: From the first order conditions with respect to δ at a saddle point δ^* we have that:

$$rd = Al_A(\tau - \delta^*).$$

Multiply both sides b δ^* and substitute A into the agent's budget constraint 9 and obtain:

$$\begin{aligned} c_A(\tau - \delta^*) &= (1 - \tau + \delta^*)Al_A(\tau - \delta^*) + rw - rd\delta^* \\ &= (1 - \tau)Al_A(\tau - \delta^*) + rw. \end{aligned} \tag{18}$$

This shows that $(c_A(\tau - \delta^*), l_A(\tau - \delta^*))$ is a feasible allocation even in absence of the contract. The fact that it is not chosen – the agent chooses instead to consume and work $l_A(\tau)$ and $l_A(\tau)$, respectively – indicates that the utility at any saddle point is lower than that when the contract is not taken. Hence, any saddle point must be a minimum. Therefore there are only corner solutions to the agent's problem.

Proof of Lemma 3: We want to show that there exists a per-unit price $\underline{d}_A$ such that: i) agent A is willing to enter the contract, and ii) the government is neither losing nor gaining resources from the agent. Let $\underline{d}_A$ be such that 8 holds – that is, the second condition is met – when the agent purchases the maximum allowed amount of the contract $\bar{\delta}$:

$$r\underline{d}_A\bar{\delta} = \tau Al_A(\tau) - (\tau - \bar{\delta})Al_A(\tau - \bar{\delta}).$$

From agents' A perspective, this is the same pricing as under perfect information. Therefore Proposition 1 applies: at that price the agent is willing to purchase the contract. Note also that at $\delta = \bar{\delta}$ the marginal utility of the agent is still increasing in δ:

$$Al_A(\tau - \bar{\delta}) - r\underline{d}_A = A\frac{\tau}{\bar{\delta}}(l_A(\tau - \bar{\delta}) - l_A(\tau)),$$

and from Proposition (1) we have that $l_A(\tau - \bar{\delta}) - l_A(\tau) > 0$.

Next, we want to show that there exists a per-unit price $\overline{d}_A$ for which agent A is indifferent between taking and not taking the contract. Define Δu_A as the difference between the utility from taking the contract (and therefore, from Lemma 2, purchasing the maximum amount $\delta = \bar{\delta}$) and not taking the contract ($\delta = 0$):

$$\Delta u_A = u(c_A(\tau - \bar{\delta}), l_A(\tau - \bar{\delta})) - u(c_A(\tau), l_A(\tau)).$$

We are interested in the mapping between the per-unit price d and Δu_A. Proposition 1 implies that for $d = \underline{d}_A$ the mapping is strictly positive. As long as $c_A(.)$ and $l_A(.)$ are continuous in their arguments, the mapping is also continuous. Let us increase d to the level $\overline{d}_A^u$ such that we have a saddle point at $\delta = \bar{\delta}$:

$$r\overline{d}_A^u - Al_A(\tau - \bar{\delta}) = 0. \tag{19}$$

Since this is a saddle point, we can show that Δu_A is negative at $d = \overline{d}_A^u$ appealing to Lemma 2: $(c_A(\tau - \bar{\delta}), l_A(\tau - \bar{\delta}))$ is a feasible allocation even in absence of the contract. The fact that it is not chosen shows that Δu_A is negative at $d = \overline{d}_A^u$. Therefore by continuity there exists a $\overline{d}_A \in (\underline{d}_A, \overline{d}_A^u)$ such that Δu_A is zero and the agent is indifferent. The government's net revenues from agent A, equal to

$$rd\tau - \tau Al_A(\tau - \bar{\delta})$$

are strictly increasing in d as long as leisure is a normal good. Hence the government is gaining resources from agent A for $d > \underline{d}_A$.

Table 1: Outcomes of the Contract

Tax red.	% buyers	$\Delta b/y$	d/y$_M$	$\%\Delta l$	$\%\Delta y$	$\%\Delta c$	$\%\Delta w_B$
Standard Preferences							
5%	9.1	19	2.4	0.3	0.5	0.8	1.5
10%	5.0	24	5.6	0.3	0.6	1.0	2.7
QL Preferences							
5%	30.5	42	2.2	2.6	3.7	6.2	3.1
10%	22.4	78	5.5	4.1	6.1	10.3	5.7

Parametrization: γ, v chosen to match Frisch Elasticity of 0.75; variance of earnings=.3, ϕ to match time at work equal to .3, $\tau = .4$, $r = .04$

Table 2: How Government's Information Affects the Outcomes of the Contract

	Standard Prefs						QL Prefs					
Govt. Info	% buyers			$\%\Delta w_B$			% buyers			$\%\Delta w_B$		
No Info	9.1			1.5			30.5			3.1		
2 Med.	33.5	9.1		1.7	1.5		41	30.5		3.6	3.1	
3 Quant.	25.1	33.3	9.1	1.7	1.6	1.5	29.5	33.3	30.5	3.8	3.7	3.1

The parametrization is the same as in table 1. No Info means that government has no information on abilities, 2 Med. that the government knows if an agent has ability above or below the median, 3 Quant. if an agent has ability the first, second or third quantile.

Figure 1: Government Revenues as a Function of the Price of the Contract

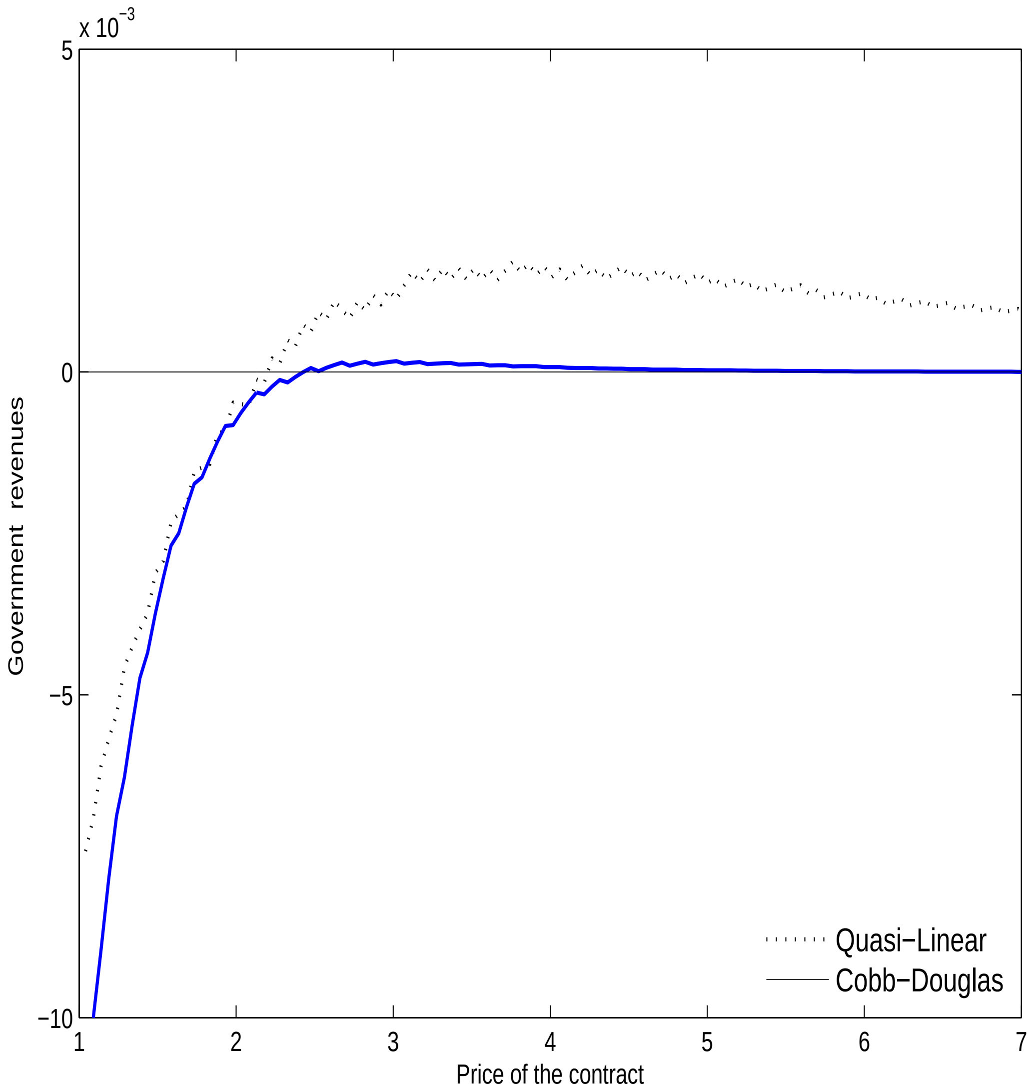

Figure 2: Participation Rate as a Function of the Price of the Contract