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Fraud deterrence in dynamic Mirrleesian economies

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ABSTRACT

Insurance schemes rely on legal consequences to deter fraud and tax evasion. This observation guides us to introduce random state verification in a dynamic economy with private information. With some probability, an agent's skill becomes known to the planner who prescribes punishments to misreporting agents. Deferring consumption can ease the provision of incentives creating a motive for subsidizing savings. In an infinite horizon economy, the constrained-efficient allocation converges to high consumption, full insurance, and no labor distortions for *any* positive probability of state verification.

1. Introduction

Optimal insurance design necessitates the provision of incentives for truthful reporting. These incentives can be given through compensation for exerted effort which renders insurance incomplete or deterrence due to legal consequences in case of fraud. While the recent literature following Mirrlees (1971) and Golosov et al. (2003) has focused on the first channel, insurance schemes in practice rely on both sets of incentives. Laws against fraud are as commonplace as ancient.[2] Their enforcement requires means of verifying the validity of claims.

This paper finds that fraud deterrence can shape the features of an optimal insurance design, particularly regarding the intertemporal allocation of distortions. Therefore, it takes a first step toward incorporating the threat of punishment for incentive provision in an otherwise dynamic standard Mirrleesian economy. The economy features idiosyncratic skill levels that evolve stochastically over time. Output is given by a production function with constant returns to both labor and capital. The planner observes the amount each agent produces and consumes, but, as in Mirrlees (1971), the exerted effort is not observable. This paper studies constrained efficient allocations in both finite and infinite horizon economies.

In contrast to the standard Mirrleesian setup, the planner gets to verify the present skill level of a subset of agents selected randomly each period. Households must put forth their claims before it is known whether their skill level will be observable. This "random state verification" technology effectively allows governments and private companies to check the validity of some but not all claims. State verification is random because whether a particular claim is observable or not is out of the control of both the claimant and the provider.

The key insight is that, with random state verification, the provision of incentives can be facilitated by deferring consumption to later periods. An agent caught misreporting receives lower utility. The *effective* punishment is given by the difference between the continuation welfare along the equilibrium path and a low prescribed continuation welfare.

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[2] For example, see Buckland (1975), p. 594.

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Back-loading consumption, though, has its downside. As Golosov et al. (2003) pointed out, the consumption spread needed for incentive provision increases with promised utility. Without state verification, this is the only force shaping intertemporal allocations and the planner finds it optimal to discourage saving. There are thus two counteracting forces regarding the intertemporal allocation of resources in the optimal contract once state-verification is introduced. The dominating force dictates whether the marginal benefit of investment is above or below the marginal cost, that is, whether the intertemporal wedge is positive or negative, respectively, and whether the constrained efficient allocations suggest a capital tax or subsidy. In contrast, the prescriptions regarding labor supply decisions are robust to the introduction of random state verification. As in the standard Mirrleesian framework, the labor decision of the agent with the top skill level is left undistorted, while the output of other agents is taxed. A simple two-period economy illustrates these effects.

A suggested subsidy on capital is not just a mere possibility. Typically the sign of the intertemporal wedge will change across periods and across agents. The discussion first turns to sufficient conditions for a negative intertemporal wedge. The marginal benefit of investment will be strictly above the marginal cost at some node, provided that the probability of state verification is within a certain range. Furthermore, for any positive probability of state-verification, there exists a long enough (but finite) time horizon such that the intertemporal wedge is non-positive with probability one.

The results are even starker for infinite horizon economies: For *any* (even arbitrarily small) probability of state verification, all distortions vanish in the long run with almost all agents receiving full insurance with a high level of consumption and no distortions of labor supply. In contrast, the standard dynamic Mirrleesian framework prescribes that the marginal benefit is above the marginal cost of investment, and efficiency requires immiseration as consumption converges to its lower bound for almost all agents. Thus an arbitrarily small deviation from the standard Mirrleesian economy in the direction of state verification can lead to a very different long-run behavior. The planner promises future consumption high enough to make the effective punishment deter any misreporting even if full insurance is provided. Loosely speaking, the economy outgrows the constraints imposed by private information.[3] Note the transition path is costly since the economy needs to accumulate aggregate capital and incur low consumption early on. Yet convergence to full insurance occurs with probability one. In an infinite horizon economy, all agents will experience a (long enough) streak of high skill level realizations along which it becomes easier and easier to provide incentives with future consumption. Deferring consumption and welfare is thus optimal and eventually the effective punishment is strong enough to support full insurance, turning it into an absorbing state. This result is connected with the general principle in Albanesi and Armenter (2012): As long as it is possible to front-load all the distortions present in the economy, the constrained efficient allocation rules out permanent intertemporal distortions.

Since the prescriptions of dynamic Mirrleesian economies are sensitive to very small monitoring probabilities, we must be precise about the exact constraints information imposes upon policy design. In this sense, the results constitute a first step toward a theory of optimal monitoring and punishment. They are followed by a brief discussion of some necessary properties of optimal monitoring and the associated constrained efficient allocations. While the logic and results regarding finite-horizon economies stand, this paper contains only a partial characterization regarding long-run prescriptions. Full insurance in the long run is no longer optimal and no agent is permanently exempt from monitoring. This section also discusses possible theories of punishment and their implications.

This work relates to the literature on the optimal taxation of savings. Early work on economies with linear factor taxation finds a zero tax rate on capital income, as in Judd (1985) and Chamley (1986). Subsequent research has further explored the Mirrlees approach to dynamic optimal taxation and disability insurance, including Albanesi and Sleet (2006), Kocherlakota (2005), Golosov and Tsyvinski (2006), Golosov et al. (2006), Werning (2007), Farhi and Werning (forthcoming), Mankiw and Weinzierl (2009) and Weinzierl (2011).

This paper further relates to work on the optimal design of audit and law compliance mechanisms in private information economies as in Stigler (1970), Border and Sobel (1987), and Cremer and Gahvari (1995). Ravikumar and Zhang (2012) study incentive provision through tax audits in a dynamic hidden income model. A related literature expands the costly state verification discussed in Townsend (1979) to dynamic economies, including Wang (2005), Monnet and Quintin (2005), and Popov (2007). This paper takes state verification as given and focuses on its implications for a dynamic private information economy.

The paper is structured as follows. Section 2 lays out the setup for the general economy. Section 3 presents a simple two-period economy that illustrates intra- and intertemporal distortions. Section 4 discusses intratemporal wedges in the general setup followed by results for the incentives to save in Section 5. The analysis concerning the evolution of the intertemporal wedge is presented in Section 6. Section 7 discusses the optimal design of state-verification and punishment. Section 8 concludes.

2. Setup and constrained-efficient allocations

Time is discrete with $t=0,1,\ldots,T$ and $T\leq\infty$. The economy is populated by a continuum of infinitely lived, ex-ante identical agents. Agents are subject to idiosyncratic shocks to their skill levels. At each date t, the agent's skill $\theta_t>0$ takes on a value from a finite support Θ according to the probability distribution $\{\pi(\theta):\theta\in\Theta\}$. Let $\theta^t=\{\theta_0,\theta_1,\ldots,\theta_t\}$ be the

[3] The assumption of constant returns to capital plays an important role here, ensuring that high consumption is indeed feasible.