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Separability and public finance

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ABSTRACT

In a second best environment, the optimal policy choice sometimes follows first best rules. This paper presents a formal general argument which allows to unify much of the literature. It lays down the information structure and separability assumptions under which the results hold in a variety of setups, with extensions to preference heterogeneity and individual production sets.

1. Introduction

In a first best setting, all information is publicly available and the government redistributes income at will. Efficiency can be achieved independently of equity concerns through lump sum transfers without recourse to indirect taxes. Pigovian taxes are used to correct externalities, and the Samuelson rule applies to the provision of public goods. In a second best environment, the social planner faces additional constraints, e.g., incentive constraints when some individual characteristics are not publicly observable. These new constraints narrow the scope of possible redistribution. The optimal rules of taxation then typically differ from the first best ones, and efficiency can no longer be disconnected from equity considerations. Indirect taxes then have a redistributive function, the Pigovian formula typically is not satisfied in the presence of externalities, and the Samuelson rule does not apply anymore.

Still there are a number of circumstances in the public finance literature where second best rules have a first best flavor. The best known instance is the Atkinson and Stiglitz (1976) theorem, according to which indirect taxation is useless when tastes for consumption goods are identical across agents, separable from leisure, and nonlinear income taxation is allowed. In the same vein, also under separability assumptions, the optimal provision of public goods follows the Samuelson rule in Christiansen (1981) and Kaplow (1996), and Pigovian taxation is the appropriate way to handle externalities in Cremer et al. (1998) and Kaplow (2006b). Kaplow (2004, 2008b) provide a synthesis of this literature. All these results hinge on some form of separability, coupled with specific informational assumptions. The purpose of this paper is to put forward their common underlying structure in a unified setting. It appears that in all these examples one can isolate in the second best program a part which has a first best shape: conditional on the values taken by some variables, the remaining ones are solutions of a first best program from which the incentive constraints are absent. Thus the variables that are determined in this part of the program satisfy standard properties of first best allocations.

Our argument is of a global nature. It avoids solving for the optimal allocation and using first order conditions, thus bypassing the difficulties associated with second order conditions and bunching. The technique allows to provide a concise synthesis of the existing results in the literature and to extend some of them. First keeping Atkinson and Stiglitz (1976) separability assumptions, indirect taxation remains superfluous when tastes for consumption goods are heterogeneous. Two conditions are required for this extension to be valid: the differences in the agents' preferences must be observable by the government (this may be the case for, e.g., a handicap or family size) and the income tax schedule must be allowed to depend on these differences. The result holds both when these differences are

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exogenously determined (handicap), as previously shown by Kaplow (2008a), or are the outcome of the agents endogenous choices (number of children).

Second, we look more closely at the production side of the economy. The technology in Atkinson and Stiglitz (1976) is linear with fixed transformation rates between labor and the commodities, but the result actually holds in economies with a general aggregate constant returns production set, provided that wages are independent of aggregate consumption. We also consider economies with individual production sets which depend on the private ability of the entrepreneur. Under a separability assumption which makes input/output trade-offs in commodities separable from both labor and hidden characteristics, the choice of the (separable) input/output combinations should not be distorted by differential taxation. Suppose for instance that the quantity of labor required to produce one final good depends on another input, say education services, and on a private ability parameter. Under the (demanding) separability assumption the return on education (the increase in output which follows a marginal increase in education, holding labor input constant) is independent of the ability parameter. Then education should be provided competitively, with no subsidies neither to the teachers nor to the students, as in Bovenberg and Jacobs (2005). All redistribution takes place through a nonlinear income tax, which should only depend on incomes, not on the education levels of the workers, even if these levels are observable.

The paper is organized as follows. The next section presents a regularity assumption that bears on the constrained allocations under study. Three different models are then examined in turn, dealing with indirect taxation, the provision of public goods and individual production.

2. A non-satiation property

We define a non satiation property which states that extra resources lead to a second best Pareto improvement. This property is a corner stone of the analysis and may hold in a variety of setups. We present the definition in a general framework, which encompasses the models used in the rest of the paper.

Consider an economy with different consumers. The consumers are indexed by a possibly multidimensional characteristics n. They buy private goods c, supply labor ℓ and enjoy the public good g. The utility of consumer n is denoted $U(c_n, \ell_n, g, n)$. It is increasing in each component of private consumption and decreasing with labor supply. The distribution of characteristics in the population is described through the cumulative distribution function of n, denoted $F(\cdot)$. The economy may have a productive sector. The activity of firm j is described with a couple (z_j,ℓ_j), where z_j is a vector of private goods whose positive components are outputs, and negative are inputs. The positive labor input is ℓ_j. Technology is represented through production sets satisfying standard assumptions. The public good g is produced from the inputs in private good and labor (c_g,ℓ_g). The aggregate resource constraint on private goods (omitting labor) can be written as

$$\int_n c_n dF(n) + c_g \leq \int_j z_j d\tilde{F}(j),$$

where the inequalities hold componentwise.

In a first best setup, extra resources in private goods lead to a Pareto improvement. An allocation that satisfies this property is *non-satiated*. In a second best situation, the government has more limited power than in the first best, since it faces additional constraints, e.g., incentive compatibility. We refer to these additional constraints as *second best constraints*, and to an allocation which satisfies them as a *constrained allocation*. An optimal feasible constrained allocation is a second best allocation.

We shall consider constrained allocations which are non-satiated. Formally

Definition 1. *A feasible constrained allocation is* non-satiated *when an increase dx, dx* ≥ 0, *dx* $\neq 0$, *in the aggregate resources of private goods, leading to the aggregate resource constraint*

$$\int_n c_n dF(n) + c_g \leq \int_j z_j d\tilde{F}(j) + dx,$$

allows a Pareto improvement while satisfying the second best constraints.

The production efficiency lemma of Diamond and Mirrlees (1971) states conditions under which the non-satiation property is satisfied at the optimum in an economy with linear taxation. This property also holds in the non linear taxation Mirrlees (1971) setup, under the single-crossing condition (Hellwig (2007)). The government then must take into account incentive constraints, in addition to the feasibility constraints. Under the usual single-crossing condition, the incentive constraints which make sure that high productivity individuals do not mimic the less-well-off are binding and prevent transfers from the rich to the poor. But it is always possible to give the extra resources to the richest agents without violating incentives. In the absence of single-crossing conditions with multiple consumption goods, there may exist circular no-envy conditions, such that every agent would like to imitate someone else. In this situation, the increase in aggregate resources must be used to simultaneously change the allocation of the concerned agents to induce a Pareto improvement while preserving incentive compatibility. Such a Pareto improvement is implementable in the (few) cases that we have studied. It seems plausible that constrained allocations often are non-satiated, but we have no proof of this property under general assumptions.

3. Indirect taxes

3.1. The Atkinson Stiglitz setup

In the setup of Atkinson and Stiglitz (1976), the preferences of agent n are represented by a utility function $U(V(c),\ell,n)$, where c is her consumption vector, ℓ her labor supply, and n is a non negative scalar which denotes labor productivity (there is no public good). This function is separable between consumption goods on the one hand, and labor supply on the other hand. The function $V(c)$, identical across agents, is assumed to be increasing and quasi-concave. When it is differentiable, the marginal rate of substitution between any two consumption goods does not depend on labor supply nor on productivity.

Technology is linear. The feasibility constraint takes the form

$$\int_n pc_n dF(n) \leq \int_n n\ell_n dF(n), \tag{1}$$

where p is a fixed vector of producer prices.

The government observes individual incomes $y = n\ell$, but not separately individual productivities nor labor supplies. It announces a non linear schedule $R(\cdot)$ which relates before tax income y to after tax income $R(y)$. It also can impose linear taxes $q–p$ on consumption goods, where q is the vector of consumer prices. Given q and $R(\cdot)$, an agent whose before tax income is y maximizes her utility $U(V(c),\ell,n)$ subject to the budget constraint $qc = R(y)$. From the separability assumption, the consumption bundle chosen by the agent depends only on her income y, not separately on her productivity n or her labor supply ℓ. This bundle indeed maximizes $V(c)$ on the budget set $qc = R(y)$. The solution to this problem is the demand function $\gamma(q,R(y))$.

The government chooses a vector of consumer prices q, an income profile (y_n) and the corresponding after tax income profile $R(y_n)$,