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Optimal redistribution: A life-cycle perspective ☆

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ABSTRACT

In this paper, I characterize the optimal redistribution policy in a simple life-cycle framework with both an intensive and an extensive margin of labor supply. The extensive margin corresponds to the choice of a retirement age. The optimal allocation cannot be implemented in a decentralized economy by a standard non-linear income tax alone. It can however be implemented by a history-dependent social security system which redistributes resources across agents. A calibration of the model to the U.S. economy reveals that the retirement age should optimally be sharply increasing in productivity and that implementing the optimal life-cycle redistribution policy can generate large social welfare gains.

1. Introduction

Any redistribution policy should provide resources to the poor while preserving incentives to work for higher productivity workers. To characterize an optimal redistribution policy, it is therefore crucial to know how the labor supply of workers responds to incentives along two margins: the intensive and the extensive margin. The intensive margin determines the number of hours, or the intensity, of work of participating workers. The extensive margin determines whether individuals choose to participate or not.

Over the life-cycle, the extensive margin induces individuals to participate for only a fraction of their lives and to enjoy leisure during the remaining fraction. Declining productivity at old ages implies that agents typically choose to work when young and to enjoy leisure when old. Hence, in a simple life-cycle framework, the extensive margin de facto corresponds to the choice of a retirement age.

The extensive margin therefore gives a life-cycle dimension to workers' labor supply problem. Acknowledging this fact considerably strengthens Vickrey's (1939) case[1] for adopting a life-cycle perspective on the optimal redistribution problem.

In this paper, I therefore characterize the optimal redistribution policy in a life-cycle framework with a single dimension of heterogeneity across workers which affects both their productivity profiles and their fixed costs of working. I allow for two dimensions to labor supply: the number of hours of work conditional on participation, i.e. the intensive margin, and the retirement age, i.e. the extensive margin. The contribution of this paper is therefore to offer the first characterization of an optimal redistribution policy in a life-cycle framework with an endogenous retirement margin.[2] I begin by relying on the revelation principle to determine the optimal incentive-feasible allocation of resources. I then turn to the implementation of the optimum in a decentralized economy (with and without private savings). Finally, I calibrate the model to the U.S. economy in order to investigate numerically the key features of the optimal policy.

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[1] Vickrey's concern was that, for a given lifetime income, taxation should be neutral with respect to the point in time when income is realized. In an empirical investigation of this proposal, Liebmen (2002) showed that basing taxation on lifetime, rather than annual, income can reduce the deadweight loss of taxation by up to 11%.

[2] Due to lack of coordination, it turns out that Shourideh and Troshkin (2012) have subsequently made a similar contribution. Their paper focuses more on the design of pension systems; whereas mine focuses more on the consequences of the extensive margin for the optimal design of redistribution policies.

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The main results are as follows. The retirement age should be a key input of a redistributive fiscal system. To implement the optimal allocation in a decentralized economy, the government needs to rely on a history-dependent fiscal instrument; a standard history-independent non-linear income tax alone is not sufficient. I therefore show that a social security system, where pension payments are a function of the history of labor income, can implement the optimum. Some redistribution therefore needs to be done through this social security system. While this is already the case in practice, there has, so far, been little theoretical justification for seeing the pension system as more than a savings device. The calibration to the U.S. economy reveals that, at the optimum, the retirement age should be sharply increasing in productivity. Under a utilitarian social welfare function, replacing the current U.S. policy by the optimal policy generates a consumption equivalent social welfare gain equal to 15.4%. All the welfare gain generated by redistribution is due to a better allocation of labor supply rather than to a better allocation of consumption across workers.

1.1. Related literature

Mirrlees (1971) solved the optimal redistribution problem in a static environment with an intensive margin only. More recently, the consequences of adding an extensive margin to that framework have been analyzed rather extensively (see, for instance, Diamond, 1980; Saez, 2002; Chone and Laroque, 2005, 2011; Laroque, 2005; Immervoll et al., 2007; Beaudry et al., 2009; Jacquet et al., 2013; Brewer et al., 2010; Blundell and Shephard, 2012). Importantly, this literature has provided some support for the implementation of a tax credit, such as the Earned Income Tax Credit in the US, as it reduces the labor supply distortions induced by redistribution. However, these papers rely on a static framework where the participation decision of each individual corresponds to a discrete choice, i.e. to work or not to work. They therefore abstract from the life-cycle nature of workers' labor supply problem. Their treatment of the extensive margin is therefore different from the one proposed in this paper.[3]

The issue of the optimal design of a social security system with heterogeneous agents and endogenous retirement has, so far, been largely overlooked. Two important exceptions include the pioneering work of Diamond (2003, chapter 6) and of Sheshinski (2008).[4] In both cases, agents are heterogeneous in their fixed disutility cost of working but not in their productivity. The main finding is that agents with a low fixed cost retire later than others and some of the income generated by their extra activity is redistributed to those suffering from a high fixed cost. However, in both cases, the result is derived within an insightful but simplistic three period model with no intensive margin, which is clearly not suitable for a quantitative analysis. Also, the authors do not describe how the optimal allocation can be implemented in a decentralized economy.

Laroque (2011) determines the optimal taxation of income in a life-cycle model with an extensive margin only. However, a crucial difference with the approach of this paper is that he does not assume a fixed utility cost of working but, instead, a fixed productivity cost of working. This implies that, even in a life-cycle framework, the participation decision corresponds to a discrete choice, i.e. a worker participates at a given age if and only if his productivity net of the fixed cost at that age is positive. In other words, the fixed cost does not introduce a non-convexity into workers' labor supply problem which would have induced them to choose to work for a fraction of their lives.[5] This explains why, in contrast to what I find in this paper, he obtains the same labor income tax schedule in his life-cycle model as in a corresponding static analysis, except that the social weights depend on lifetime, rather than current, income.

While I focus on redistribution, some work has been done on the optimal financing of an exogenous stream of government expenditures in a life-cycle context. Erosa and Gervais (2002) restrict their analysis to linear taxes and show that, if labor income taxes could not be decreasing with age, then taxing capital is a desirable, albeit imperfect, substitute. Gorry and Oberfield (2012) solve for the optimal taxation of a single agent who has both an intensive and an extensive labor supply margin (the latter induces him to choose to participate for a fraction of his life). Importantly, the only fiscal instrument allowed is a standard history-independent non-linear income tax. Hence, the policy which they derive is only constrained optimal, which explains why the "no distortion at the top" principle does not hold in their context.

Finally, there have recently been major developments in dynamic optimal taxation with heterogeneous agents (see Kocherlakota, 2010 for a comprehensive survey). While this literature builds on Mirrlees (1971), its main focus has not been on redistribution policies but, instead, on the optimal provision of insurance against skill risks. The main corresponding results are about savings distortions, not about the optimal allocation of time between work and leisure. Quantitative analyses of labor supply distortions have nevertheless been performed under some special circumstances. For instance, Albanesi and Sleet (2006) assume independently and identically distributed productivity shocks, in Farhi and Werning (2013) productivity follows an AR(1) process, Diamond and Mirrlees (1978), Golosov and Tsyvinski (2006) and Denk and Michau (2013) only allow for permanent disability shocks, Golosov et al. (2011) and Weinzierl (2011) focus on two or three period models and Kapicka (2006) does not allow for savings. My paper complements this literature by determining the optimal labor supply distortions in a life-cycle context with an extensive margin and without uncertainty, i.e. without skill risks.

Some of the most important results of this New Dynamic Public Finance literature are about the implementation of optimal allocations in decentralized economies. In particular, Grochulski and Kocherlakota (2010) have shown, in a very general context, that the implementation problem could be solved with a history-dependent social security system. My presentation of the optimal pension system builds on their insights.

I begin by presenting, in Section 2, the structure of the economy and the corresponding labor supply model. The optimal incentive-feasible allocation of resources is derived in Section 3. I then characterize, in Section 4, a history-dependent social security system which implements the optimum in a decentralized economy. A calibration of the model to the U.S. economy and a numerical simulation of the optimal policy are performed in Section 5. This paper ends with a conclusion.

2. Model

Individuals face a deterministic life-span equal to H. Utility is additively separable between consumption and leisure. Agents derive an instantaneous utility $u(c_t)$ from consuming c_t at age t, where $u'(.) > 0$, $u''(.) < 0$, $\lim_{c\to 0+} u(c) = -\infty$ and $\lim_{c\to 0+} u'(c) = +\infty$. They work from age 0 until a retirement age R and get disutility $v(l_t)$ from supplying l_t units of labor at age t, where $v(0) = 0$, $v'(0) = 0$, $v'(.) \geq 0$ and $v''(.) > 0$. They also have to incur a fixed cost of working $b > 0$ which, for simplicity, is assumed to be independent of age. Lifetime utility V is time

[3] This literature typically assumes two dimensions of heterogeneity: productivity and fixed costs of working. In a life-cycle context, I can only characterize the optimal policy with a single dimension of heterogeneity (which nevertheless affects both the productivity profiles and the fixed costs of working). However, the fact that, even with only one dimension, the optimal life-cycle policy is not a replication of the corresponding optimal static policy strongly suggests that the same would be true with two dimensions of heterogeneity.

[4] Cremer et al. (2004) also look at optimal social security with endogenous retirement. Workers can only be of two or three types which differ in both productivity and disutility of labor. They show that the retirement age is distorted downward for everybody except for workers with the highest productivity and lowest disutility of labor.

[5] In the words of Ljungqvist and Sargent (2006), Laroque (2011) does not have a "time averaging" model of the labor supply.