Journal of Public Economics 95 (2011) 1239–1247

Contents lists available at ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/jpube

How optimal nonlinear income taxes change when the distribution of the population changes

Craig Brett [a], John A. Weymark [b,*]

[a] Department of Economics, Mount Allison University, 144 Main Street, Sackville NB, Canada, E4L 1A7
[b] Department of Economics, Box 1819, Station B, Vanderbilt University, Nashville, TN 37235, USA

ARTICLE INFO

Article history:
Received 5 April 2010
Received in revised form 12 May 2010
Accepted 31 May 2010
Available online 9 June 2010

JEL classification:
D82
H21

Keywords:
Asymmetric information
Comparative statics
Optimal income taxation

ABSTRACT

The impacts of changing the number of individuals of a particular skill level on the solutions to two versions of the finite population optimal nonlinear income tax problem are investigated. In one version, preferences are quasilinear in leisure. For this version, it is shown that it is possible to sign the directions of change in everyone's optimal consumptions and optimal marginal tax rates. In the other version, preferences are quasilinear in consumption. For this version, it is shown that it is possible to sign the directions of change in everyone's optimal before-tax incomes and optimal marginal tax rates. Moreover, the directions of change in the optimal marginal tax rates are the same for the two specifications of preferences.

1. Introduction

Following the work of Mirrlees (1971), the theory of optimal nonlinear income taxation has investigated the properties of optimal income tax schedules when a government's limited information about taxpayers prevents the use of non-distorting lump-sum taxes. Comparative static analyses of optimal nonlinear income taxes attempt to gauge how changes in the underlying structure of the economy affect optimal taxes and their associated distortions. In this article, we derive new comparative static results that show how optimal nonlinear income taxes and the associated allocations change when the distribution of skills changes. Changes in the demographic structure of the population may arise for a number of reasons. For example, the skill distribution may change due to mobility between jurisdictions, as in Hamilton and Pestieau (2005); it may change over time due to the augmentation of skills through education, as in Brett and Weymark (2003); or it may differ between identifiable subgroups of the population who, because of this tagging, may face different tax schedules, as in Boadway and Pestieau (2007).

We focus our attention on models with a discrete skill distribution and an arbitrary finite number of skill types. As noted by Brett and Weymark (2008a), it is possible to perturb discrete skill distributions in two ways. One can change the support of the distribution, say by increasing the skill level of individuals of a particular type. Comparative static analyses of this sort have been carried out by Brett and Weymark (2008a) and Simula (2010). Alternatively, one can keep the set of possible skill levels fixed and change the number of individuals with some skill level. This second kind of comparative static analysis is the focus of this article. Hamilton and Pestieau (2005) and Boadway and Pestieau (2007) have addressed some aspects of this issue, but only for the case of two skill types.

Because of the technical challenges inherent in the optimal income tax problem, existing comparative static results for nonlinear taxes are available only under restrictive assumptions concerning individual preferences. Weymark (1987) and Brett and Weymark (2008a,b) derive comparative static results for many changes in the economic environment for the case of preferences that are quasilinear in leisure. Hamilton and Pestieau (2005) also consider these kinds of preferences. Boadway and Pestieau (2007) and Simula (2010) consider preferences that are quasilinear in consumption. We consider both kinds of quasilinearity, using the Weymark model for quasilinear-in-leisure preferences and a generalization of the Simula model for quasilinear-in-consumption preferences.

In the models used by Simula and Weymark, the government maximizes a weighted sum of individual utilities subject to an economy-wide resource constraint and incentive compatibility constraints. The social welfare weights are chosen so as to satisfy standard redistributive criteria, like those described by Guesnerie and Seade (1982), Röell (1985), and Hellwig (2007), but are otherwise arbitrary. The restrictions on the welfare weights guarantee that the adjacent

* Corresponding author.
E-mail addresses: cbrett@mta.ca (C. Brett), john.weymark@vanderbilt.edu (J.A. Weymark).

0047-2727/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.jpubeco.2010.05.007

downward incentive compatibility constraints bind (in the terminology of Guesnerie and Seade, there is a strict monotonic chain to the left). Having this pattern of binding incentive constraints allows both Simula and Weymark to derive tractable reduced-form optimization problems that can be used to describe the choices of some of the variables of interest. Weymark's reduced-form can be used to compute the optimal after-tax incomes (consumptions) and the optimal marginal tax rates, whereas Simula's reduced-form can be used to compute optimal before-tax incomes and optimal marginal tax rates.

At an optimum, individuals of all types (except the most highly skilled) face a positive marginal tax rate. Equivalently, their before-tax income (labor supply) is distorted downward in the sense that a one unit increase in both the before- and after-tax income of such an individual would make that individual better off. This proposed increase does not violate the resource constraint, but it is not optimal because it violates a self-selection constraint. In particular, it would make it attractive for individuals of the next highest type to pretend to be of that type. Satisfaction of this self-selection constraint can be restored if the proposed increase is combined with transfers to individuals of the next highest type. These additional transfers might destroy incentive compatibility for the still more highly skilled, so additional transfers might be needed to obtain a feasible allocation. The total of all such transfers constitute the information rents received by higher types. These rents make the cost of increasing the before-tax income of individuals more than just the additional after-tax income that they receive. Moreover, the social cost of these rents determines the size of the optimal marginal tax rate of the type being considered. When preferences are quasilinear (in either sense), it is possible to derive explicit formulae for the social costs of the information rents and to deduce how the distribution of skills affects these costs. These formulae play an important role in our comparative static analyses.

When preferences are quasilinear in leisure (resp. consumption), we are able to sign the directions of change in each person's optimal consumption (resp. income) and optimal marginal tax rate in response to an increase in the number of individuals of any given skill type. Moreover, the directions of change in the optimal marginal tax rates are the same for the two specifications of preferences. In particular, we show that for any skill type other than the highest, if the number of individuals of that type increases, then so does their optimal consumption (resp. income) when preferences are quasilinear in leisure (resp. consumption).

The general character of our results can be illustrated by considering an increase in the number of individuals, n_k, of a particular type, say k, other than the highest skilled when preferences are quasilinear in leisure. An increase in n_k does not change the size of the information rents associated with an increase in the consumption of type k individuals. It does, however, increase the number of type k individuals facing the distortion caused by these rents. As a result, an increase in n_k provides the government with an incentive to reduce these distortions. Therefore, the optimal marginal tax rate for individuals of type k falls, which induces an increase in their consumption.[1]

An increase in n_k also affects the optimal marginal tax rates faced by individuals of other types. For a type $i<k$, individuals of type k are receivers of information rents when the consumption of type i individuals increases. An increase in n_k increases the aggregate amount of information rents because they must now be paid to more individuals. However, and perhaps unexpectedly, the social marginal cost of the rents may actually decrease. The rents are a source of utility to individuals of type k. Thus, the benefits associated with the rents increase. The costs of the information rents are borne by all individuals in society. If individuals of type k have a social welfare weight greater than the average social welfare weight, then the additional benefits outweigh the additional costs and the net social marginal cost of the information rents decreases. In this case, the marginal tax rate faced by individuals of type i decreases, with the consequence that their consumption increases so as to increase these information rents. For a type $j>k$, individuals of type k help finance the information rents associated with increases in the consumption of type j individuals. If individuals of type k have a social welfare weight greater than the average social welfare weight, their tax contributions weigh more heavily in the computation of the social cost of the information rents. In this case, an increase in n_k causes the net social marginal cost of the rents to increase. Consequently, the marginal tax rate faced by individuals of type j increases and their consumption is decreased so as to decrease the information rents.[2]

In Section 2, we present a general framework that encompasses the models of both Simula and Weymark. We carry out our comparative analyses for the Weymark and Simula models, respectively, in Sections 3 and 4. Section 5 contains concluding remarks. Our proofs are gathered in an Appendix.

2. The framework

The economy consists of H individuals, who are partitioned into N types according to their labor productivities. The number of individuals of type i is denoted by n_i. The productivity of this type of individual is given by w_i. Types are ordered such that $w_1<w_2<\cdots<w_N$. The production sector is assumed to exhibit constant returns to scale and the labor market is perfectly competitive. With these assumptions, the before-tax labor income of an individual of type i is given by

$$y_i = w_i l_i, \tag{2.1}$$

where l_i is his labor supply.

The government chooses a tax schedule without the ability to observe individual skill types, w_i, or labor supply, l_i. It can observe before-tax income, y_i, and is assumed to be able to set any anonymous tax schedule it wishes using income as the tax base. Without loss of generality, we can set the price of the consumption good equal to 1, so an individual's consumption, c_i, is simply his after-tax income.

Individuals have preferences over c and l represented by a common cardinally significant utility function $\tilde{u}(c,l)$. Because of differences in skills, preferences over the observable variables c and y are type-specific, given by

$$\bar{u}_i(c,y) = \tilde{u}\left(c, \frac{y}{w_i}\right). \tag{2.2}$$

For the Weymark (1986, 1987) model, we multiply Eq. (2.2) by w_i (a type-specific monotonic transformation) to obtain a utility function $u_i(c,y)$. See Eq. (3.2) below. For the Simula (2010) model, we simply set $u_i=\bar{u}_i$.

An allocation $(c_1,y_1,\ldots,c_N,y_N)$ is a list of the consumptions and before-tax incomes of the N types of individuals. Because taxation is anonymous, revealed preference implies that when individuals optimize on their common budget set, the resulting allocation satisfies the self-selection (i.e., incentive compatibility) conditions

$$u_i(c_i,y_i) \geq u_i\left(c_j,y_j\right), \quad i,j=1,\ldots,N. \tag{2.3}$$

The taxation principle (cf. Guesnerie, 1995) implies that the set of allocations that can be obtained by individuals maximizing subject to some anonymous tax schedule is equivalent to the set of allocations

[1] There are additional effects, but we show that the effect described here dominates.

[2] The preceding discussion also applies to quasilinear-in-consumption preferences except that changes in before-tax incomes are substituted for changes in consumptions.