Journal of Public Economics 92 (2008) 1765–1771

Contents lists available at ScienceDirect

Journal of Public Economics

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

The impact of changing skill levels on optimal nonlinear income taxes ☆

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 24 May 2007
Received in revised form 28 February 2008
Accepted 4 March 2008
Available online 14 March 2008

JEL classification:
D82
H21

Keywords:
Optimal income taxation
Comparative statics

ABSTRACT

The impact of changing an individual's skill level on the solution to a finite population version of the Mirrlees optimal nonlinear income tax problem with quasilinear-in-leisure preferences is investigated. It is shown that it is possible to sign the directions of change in everyone's optimal consumptions and optimal marginal tax rates in response to such a change.

1. Introduction

In the Mirrlees (1971) optimal nonlinear income tax problem, everyone has the same preferences for consumption and leisure, but they differ in their skills as measured by their labour productivities. Because labour markets are competitive, an individual's wage is equal to his labour productivity. While the distribution of these skills is publicly known, the skill of any particular individual is private information. The only role for the government is to design an income tax schedule in order to meet its redistributive goals given the constraints that it faces. Merely assuming that the common individual utility function is concave and increasing in both consumption and leisure yields few general qualitative properties of optimal income taxes. For this reason, more restrictive functional forms have been considered in order to obtain more clear-cut results. Assuming that preferences are quasilinear in leisure, as in Lollivier and Rochet (1983), or quasilinear in consumption, as in Diamond (1998), has been particularly fruitful.

One of the reasons that quasilinear versions of the Mirrlees model yield strong conclusions is that it is then possible to obtain a closed-form solution for the optimal allocation. This result was first shown for preferences that are quasilinear in leisure by Lollivier and Rochet (1983) for a continuum of individuals. Closed-form solutions when the population is finite have been obtained by Weymark (1986) for quasilinear-in-leisure preferences and by Simula (2007) for quasilinear-in-consumption preferences.

Weymark (1987) has used the closed-form solution for a finite population version of the Mirrlees optimal income tax problem with quasilinear-in-leisure preferences and a weighted utilitarian social welfare function to derive a number of comparative static properties of this solution. However, he does not provide any comparative statics for the skill levels. The purpose of this article is to extend Weymark's analysis by showing how the optimal marginal tax rates and optimal consumptions vary in response to a change in any person's skill level for the model that he considered. For this kind of parameter change, it does not seem possible to obtain unambiguous comparative statics for the optimal pretax incomes without further restrictions on the model. Indeed, for either kind

☆ Craig Brett's research is generously supported by the Canada Research Chair Programme and by the Canada Foundation for Innovation. We are grateful to our referees and to Marcus Berliant for their comments.

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

0047-2727/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.jpubeco.2008.03.002

of quasilinearity, there are few clear-cut comparative static results available for the choice variables that enter linearly in the utility function.

Skills are the key parameters of interest in the Mirrlees model because they are the only source of heterogeneity between individuals. It is therefore important to know how the solution to the optimal income tax problem depends on the skills present in the economy. Aside from its intrinsic interest, knowing how optimal tax policy responds to changes in skills is of considerable practical significance because the skill distribution varies over time. Furthermore, the quasilinear optimal income tax model has many formal similarities to the models considered in the nonlinear pricing literature, such as that of Mussa and Rosen (1978). As a consequence, our results can be used to provide insight into how the solution to this kind of problem depends on the distribution of consumer tastes.

For the case in which an individual's skill level is increased, our findings can be summarized as follows. (i) It is optimal to increase the marginal tax rate of everyone with a lower skill and to decrease the marginal tax rate of everyone else except for the highest-skilled individual, whose marginal tax rate is always 0. (ii) It is optimal to decrease the consumption of everyone with a lower skill and to increase the consumption of everyone else except for the highest-skilled individual, whose consumption is only increased if it is his skill that has increased; otherwise his consumption is left unchanged. Some of these responses will reinforce one another when more than one skill is changed, so our analysis also provides some insight into the impact on the optimal solution of more complex changes in the skill distribution.

For quasilinear-in-leisure preferences, Brett and Weymark (2008) have investigated the comparative static properties of an extension of the Weymark (1987) model in which the government also chooses the level of provision of a public good, but in which there are only two skill levels. Even though there are only two skill levels in their model, it is nevertheless the case that the implications of changing either of these skills is less clear cut when there is a public good than we find here without one.[1] Simula (2007) has recently obtained a number of comparative static results using the quasilinear-in-consumption preference version of the Weymark (1987) model. In particular, he has shown how the optimal marginal tax rates and optimal pretax incomes vary with a change in someone's skill. A striking feature of these comparative statics is that the only marginal tax rates and pretax incomes affected by a change in some person's skill are his own and those of the person with skill level just below his.

Our analysis focuses on discrete skill distributions. Discrete distributions can be perturbed in two ways. One can, as we do, change the support of the distribution, keeping the relative numbers of individuals at each point in the distribution constant. This is one way to envision a change in the skill distribution brought about by technological change. Alternatively, one can keep the support of the distribution fixed and change the number of individuals at some wage levels. This kind of a change in the skill distribution has been considered by Hamilton and Pestieau (2005) and Boadway and Pestieau (2007), but only for the case in which there are two fixed skill levels. For preferences that are quasilinear in leisure, Hamilton and Pestieau (2005) have investigated the effects on the individual utilities of changing the proportion of individuals with each of the two skills when the social welfare function is either maximin or maximax. For preferences that are quasilinear in consumption, Boadway and Pestieau (2007) have identified how the utility possibilities frontier responds to this kind of change in the skill distribution.

In Section 2, we introduce our model. We present our comparative static results in Section 3. We offer some concluding remarks in Section 4. All proofs are in Appendix A.

2. The model

There are n individuals, indexed by $i=1,\ldots,n$. Individual i has skill level $w_i>0$, which is also the wage he receives in a competitive labour market. We also refer to w_i as i's type. To simplify the notation, we suppose that no two individuals have the same skill. Our comparative static results for a change in w_i are also valid when there are an arbitrary number of individuals with each skill.[2] Without loss of generality, we assume that

$$0 < w_1 < \cdots < w_n. \tag{2.1}$$

Person i supplies l_i units of labour and therefore has a pretax income of

$$y_i = w_i l_i, \quad i = 1, \ldots, n, \tag{2.2}$$

which is also i's labour supply in efficiency units.

There is a constant-returns-to-scale technology that converts labour in efficiency units into a single consumption good. Units of this good are chosen so that one unit of consumption is produced using one unit of labour in efficiency units. The production sector is competitive, so the price of the consumption good is 1. Person i's consumption is c_i. Because there is only one good and its price is 1, c_i is also i's after-tax income.

A commodity bundle for person i is a vector $(l_i, c_i)\in\mathbb{R}^2_+$.[3] Everyone has the same quasilinear utility function $u:\mathbb{R}^2_+\to\mathbb{R}$, where

$$u(l_i, c_i) = \upsilon(c_i) - \gamma l_i. \tag{2.3}$$

[1] Further comparative statics for this kind of quasilinearity may be found in Cebreiro-Gómez (2002) and Boone and Bovenberg (2007).
[2] See Weymark (1986, Section 5) for a discussion of how the optimal tax problem is modified when this is the case.
[3] $\mathbb{R}_+$ is the non-negative subset of the real line $\mathbb{R}$.