Economics Letters 152 (2017) 62–65

Contents lists available at ScienceDirect

Economics Letters

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

Optimal tax policy in the presence of productive, consumption, and leisure externalities

Rolando A. Escobar-Posada [a], Goncalo Monteiro [b,*]

[a] *Universidad del Norte, Colombia*
[b] *State University of New York at Buffalo, United States*

HIGHLIGHTS

- Optimal taxes on capital and labor are constant. Consumption tax is time varying.
- When all externalities are positive, only labor income must be taxed.
- Optimal taxes on consumption and capital are independent of the leisure externality.
- Leisure externalities play a central role in reducing existing market distortions.

ARTICLE INFO

Article history:
Received 23 August 2015
Received in revised form
27 May 2016
Accepted 28 December 2016
Available online 3 January 2017

JEL classification:
D91
E21
O41

Keywords:
Time non-separable preferences
Consumption
Leisure and production externalities
Capital accumulation
Optimal tax policy

ABSTRACT

This paper presents the optimal tax policy in an economy featuring consumption, production, and leisure externalities. This extends prior models that only consider consumption and production externalities. The immediate consequence is labor income should be taxed (subsidized) if the leisure externality is positive (negative). In addition, numerical simulations show that in the presence of positive production externalities, and irrespective of the sign of consumption externalities, an increase in the importance of the leisure externality reduces the distortion generated by consumption and production externalities. This effect is reversed if production externalities are negative.

Published by Elsevier B.V.

1. Introduction

It is widely recognized that externalities play a central role in economic theory. Broadly speaking, they can be categorized as (i) productive, and (ii) non-productive. Production externalities have been a key element in recent growth literature such as Romer (1986), and Lucas (1988). Non-productive externalities can be classified into consumption and leisure externalities. The former, have been extensively used in the context models of "keeping up with the Joneses" to explain some puzzles arising in asset pricing (Abel, 1990; Constantinides, 1990; Campbell and Cochrane, 1999), and capital accumulation and growth (Liu and Turnovsky, 2005; Turnovsky and Monteiro, 2007). Leisure externalities have been used in the context of business cycle theory (Lettau and Uhlig, 2000; Fève et al., 2011), and economic growth (Pintea, 2010; Azariadis et al., 2013).

The presence of externalities raises two questions, namely "to what extent do they introduce distortions into the economy?", and if so "what are the appropriate corrective policy responses?" The current paper answers these questions by extending Turnovsky and Monteiro (2007) to allow for leisure externalities. We proceed in two main stages. The first part presents the model and characterizes the optimal tax policy to correct the distortionary effects created by the presence of externalities. One general conclusion is that, in contrast with Turnovsky and Monteiro (2007), the tax on labor income can no longer be set arbitrarily, because the number of corrective instruments must equal the number

* Corresponding author.
E-mail address: gm43@buffalo.edu (G. Monteiro).

http://dx.doi.org/10.1016/j.econlet.2016.12.033
0165-1765/Published by Elsevier B.V.

of distortions. The second part, numerically analyses the long-run economic implications of adding leisure externalities to the model. We conclude that, in the presence of positive production of externalities, increasing leisure externalities reduces the distortion generated by consumption and production externalities, irrespective of the sign (positive or negative) of the consumption externality. This effect is reversed if production externalities are negative.

2. The model

The economy is populated by N infinitely lived identical households growing at a constant rate, n. Each agent is endowed with one unit of time, which can be allocated between labor, L_i, and leisure, $l_i \equiv 1 - L_i$.

2.1. Households

Intertemporal utility is defined as in Turnovsky and Monteiro (2007), except that we introduce leisure externalities as an additional source of utility, i.e.

$$\Omega \equiv \frac{1}{1-\varepsilon}\int_0^\infty \left(C_i H^{-\gamma} l_i^{\theta} \bar{l}^{\phi}\right)^{1-\varepsilon} e^{-\beta t} dt$$

$$\varepsilon > 0,\ \theta > 0,\ 1-(1-\varepsilon)(1+\theta) > 0 \tag{1}$$

where C_i is current consumption, H the current level of a reference consumption stock, l leisure, and $\bar{l}(t) \equiv \sum_{i=1}^{N} l_i(t)/N(t)$ leisure externalities defined as the average leisure in the economy.

The level of reference consumption is an exponentially declining weighted average of the economy-wide average consumption, $\bar{C}(t) \equiv \sum_{i=1}^{N} C_i(t)/N(t) = C(t)/N(t)$,[1] with the rate of adjustment given by

$$\dot{H}(t) = \rho\left(\bar{C}(t) - H(t)\right) \tag{2}$$

with H being determined by (2), the economy-wide consumption imposes an externality on the agent.

We impose the following restrictions on the size of the externalities to ensure that its impact is dominated by the direct benefits:

$$\gamma < 1 \quad \text{and} \quad \varepsilon(1-\gamma)+\gamma > 0 \tag{3a}$$

$$\theta + \phi > 0 \quad \text{and} \quad \theta\left[(1-\varepsilon)(\theta+\phi) - 1\right] < 0. \tag{3b}$$

Condition (3a) refers to the consumption externality. The first inequality asserts that a uniformly sustained increase in the consumption level increases utility, whereas the second ensures that a uniformly sustained increase in the consumption level has diminishing marginal utility. Condition (3b) asserts the same for leisure.[2]

2.2. Firms

Production is described by a Cobb–Douglas technology presenting constant returns to scale in private inputs, i.e. capital, K_i, and labor, L_i. Additionally, output depends on the average stock of capital in the economy, denoted by $\bar{K}(t) = \sum_i K_i(t)/N(t) = K(t)/N(t)$, which is taken as given by the firm. Dropping the time index, individual output is given by:

$$Y_i = \alpha L_i^{\sigma} K_i^{1-\sigma} \bar{K}^{\eta}; \quad 0 < \sigma < 1. \tag{4}$$

Aggregating over N identical agents, yields the aggregate production function[3]:

$$Y = \alpha N^{\sigma-\eta}(1-l)^{\sigma} K^{1-\sigma+\eta} \tag{5}$$

with η being a measure of the externality in production. As before, we impose the following production externality restriction:

$$\sigma > \eta > -(1-\sigma). \tag{6}$$

The first inequality imposes an upper limit on any positive externality generated by average capital to ensure that a uniformly sustained increase in the capital stock has diminishing marginal product. The second, ensures that the externality, if negative, is sufficiently small so that the social marginal product of capital remains positive.

3. Equilibrium: decentralized economy

Individuals choose consumption, labor, and the rate of capital accumulation to maximize utility (1), subject to the capital accumulation equation:

$$\dot{K}_i = (r - n - \delta)K_i + wL_i - C_i, \tag{7}$$

where r denotes the gross return to capital, w the wage rate, and δ the rate of depreciation of capital. In doing so, agents take the aggregate quantities $\bar{C}$, $\bar{K}$, as well as $\bar{l}$ and H as given.

Assuming firms maximize profits under perfect competition, and inputs get paid their marginal product, expression (7) can be written as:

$$\dot{K}_i = \alpha L_i^{\sigma} K_i^{1-\sigma} \bar{K}^{\eta} - C_i - (n+\delta)K_i. \tag{7'}$$

We define a balanced growth path as one along which all quantities grow at a constant rate, except for labor allocation, which is constant. Therefore, expressing the dynamics in terms of the following scale-adjusted stationary variables $k^* \equiv K/N$, $y^* \equiv Y/N$, $h^* \equiv H/N$, $c^* \equiv C/N$, l^*, and focusing on the equilibrium path along which all households are identical so that $C_i = \bar{C}$, $K_i = \bar{K} l_i = \bar{l}$, we obtain:

$$\dot{k}^* = \left(1 - \frac{c^*}{y^*}\right) y^* - (\delta+n)k^* \tag{8a}$$

$$\dot{h}^* = \rho\left(c^* - h^*\right) \tag{8b}$$

$$\begin{aligned}\dot{l}^* = F\left(l^*\right)\Bigg\{&\left[(1-\sigma) - \varepsilon(1-\sigma+\eta)\left(1-\frac{c^*}{y^*}\right)\right]\frac{y^*}{k^*} \\ &- \rho\gamma(1-\varepsilon)\left(\frac{c^*}{h^*} - 1\right) \\ &- \left[\beta + \delta\left(1-\varepsilon(1-\sigma+\eta)\right) + n\left(1-\varepsilon(1-\sigma)\right)\right]\Bigg\}\end{aligned} \tag{8c}$$

$$\frac{c^*}{y^*} \equiv \frac{C}{Y} = \frac{\sigma}{\theta}\frac{l^*}{1-l^*} \tag{8d}$$

$$F\left(l^*\right) \equiv \frac{l^*(1-l^*)}{\varepsilon(1-\sigma l^*) - (\theta+\phi)(1-\varepsilon)(1-l^*)} > 0. \tag{8e}$$

[1] In what follows, aggregate quantities will be denoted by capital letters, and averages by an over bar "−".

[2] If $\varepsilon > 1$ the first inequality implies the second in (3b).

[3] This expression differs from expression (9) in Turnovsky and Monteiro (2007) because in our model capital externality is defined as the average stock of capital in the economy, whereas in Turnovsky and Monteiro (2007) it is specified as the aggregate stock of capital. Hence, the exponent of N, in the aggregate production function, is $\sigma - \eta$, instead of σ. Furthermore, using Turnovsky and Monteiro (2007) terminology, implies $g = (\sigma-\eta)/(\sigma-\eta)$ instead of $g = \sigma/(\sigma-\eta)$. This difference affects the quantitative results, as seen in Table 2, which do not match those given in Turnovsky and Monteiro (2007), except when $\eta = 0$ and $\phi = 0$. Qualitatively speaking, however, the behavior of the model remains the same.