MACROECONOMICS EFFECTS OF AN INDIRECT TAXATION REFORM UNDER IMPERFECT COMPETITION

Autor: *Ramón J. Torregrosa* (*)
Universidad de Salamanca

P. T. N.º 9/05

(*) Ed. FES, Campus Miguel de Unamuno, 37008 Salamanca. Spain.

Tel +34923294400; Fax +34923294686, email rtorregr@usal.es

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Edita: Instituto de Estudios Fiscales
N.I.P.O.: 602-05-004-X
I.S.S.N.: 1578-0252
Depósito Legal: M-23772-2001

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ABSTRACT

This paper explores the effect of a tax reform which shifts from specific to value added taxation in a general equilibrium model with imperfect competition (both Cournot and Free Entry Oligopoly). Such tax reform is characterized through a rate of substitution between taxes. This characterization allows us to find those rates of substitution between taxes which have an inflationary (deflationary) effect on price, as well as those rates which generate positive (negative) balanced budget multiplier. Furthermore, the model captures the impact of the tax reform on welfare taking into account both government expenditure and profits, in contrast with the partial equilibrium approach.

ACKNOWLEDGEMENT

I am grateful to Luis Corchón, Lauren Knott and Fernando Llavador and the participants in the XVIII Simposio de Análisis Económico and the XI Encuentro de Economía Pública for their comments and suggestions. I am also indebted to the Instituto de Estudios Fiscales for its financial support. The usual caveat applies.

JEL Classification Numbers: E62, H29

Keywords: Indirect Taxation, Tax Reform, Imperfect Competition

1. INTRODUCTION

Specific (or unit) taxes and ad valorem (or value-added) taxes exert different impacts on production under imperfect competition. Since most economies use both taxes to finance public spending it is natural to address the formal question of whether different schedules of indirect taxation can improve the efficiency of the economy, once imperfect competition is recognized in markets.

The literature on indirect taxation substitution has focused on the impact on consumer's surplus and production of different taxation schedules, under partial equilibrium. Suits and Musgrave (1955) and Bishop (1968) studied the effect of a substitution from specific to ad valorem taxation in the monopoly case, concluding that such tax reform yields higher tax revenues, and lower prices and profits. Dellipalla and Keen (1992), using a differential version of the Suits' and Musgrave's tax reform, obtain similar conclusions with respect to prices, tax revenues, consumer's surplus, profits and industry size, in a Generalized Cournot Oligopoly as well as in a Free Entry Oligopoly model. Therefore, the explicit comparison between ad valorem and specific taxation in partial equilibrium concludes that a tax reform which tilts the balance towards the ad valorem taxation yields to Pareto-improvements. Nevertheless, the partial equilibrium approach does not address some interesting issues such as wealth effects due to higher tax revenue and lower profits whereas a general equilibrium framework takes these into account.

The purpose of this paper is to study a tax reform which shifts from specific to value-added taxation, within a general equilibrium model with imperfect competition. Section 2 introduces the model and the Cournot equilibrium. In the model, a representative household is characterized through a Cobb-Douglas utility function. The utility function depends on leisure, h final goods and government expenditure. To avoid the problems related with the dependence of both the aggregate income and wages when firms choose their output (Neary, 2002), the final goods are produced using labor\ under increasing returns to scale in h (enough large) sectors by n (enough small) identical firms. These firms are burdened with both specific and value-added tax rates from where government expenditure is financed. Section 3 evolves the Government policy under Cournot equilibrium. This policy consists in a tax reform which shifts from specific to value-added taxation, and it is characterized by a constant rate of substitution between taxes. This characterization allows us to find those rates of substitution between taxes which have an inflationary (deflationary) effect on price, as well as those rates which generate positive (negative) balanced budget multiplier. Furthermore, the model captures the impact of the tax reform on welfare taking into account both government expenditure and profits, in contrast with the partial equilibrium case. Section 4 analyses the tax reform under Free Entry equilibrium, in such way that the effect of the tax reform on the main variables can be expressed in connection with those yielded under Cournot equilibrium, allowing for comparison between the effect of such a tax reform in both equilibria. Finally, section 5 summarizes the results.

2. MODEL AND EQUILIBRIUM

Following Caminal (1990), let us consider an economy with $h+1$ goods: leisure and h goods produced from labor and a technology; and $hn+2$ agents: a representative household, h sectors each with n non-competitive firms, and a government, defined by the following assumptions:

1) Household preferences are represented by a separable utility function. On the one hand, a Cobb-Douglas utility function over the quantity L of leisure and the vector $X=(x_1,x_2,\dots,x_h)$ of consumption of the produced goods and, on the other hand, a sub-utility function over the vector $g=(g_1,g_2,\dots,g_h)$ of publicly-provided produced goods. g can also be understood as the inputs necessary for the production of a quantity $\varsigma(g)$ of a public good (for example $\varsigma(g)=\sum_{i=1}^{h}\frac{\beta}{h}\ln g_i$), this characterization allow us to address the consumer´s tax return arising from taxes.

$$u(X,L,g)=\sum_{i=1}^{h}\frac{\alpha}{h}\ln x_i+(1-\alpha)\ln L+\sum_{i=1}^{h}\frac{\beta}{h}\ln g_i, \qquad (1)$$

where $\alpha\in(0,1),\beta>0$. Denoting W as the initial endowment of time and considering labor as the numèraire, let p_i be the price of the produced good $i(=1,2,\dots,h)$ and π the total profits of the whole firms. Thus, the household budget constraint is given by

$$\sum_{i=1}^{h}p_i x_i=W-L-\pi \qquad (2)$$

2) There are *h* industries each one formed by *n* identical and non-competitive firms, producing an amount $q_{ij}(j=1,2,\dots,n)$ of output from labor through the cost function

$$C(q_{ij})=k+cq_{ij},$$

which exhibits decreasing average cost. Where *h* is large enough and *n* is small enough to assume that the labor market is perfectly competitive while the produced goods markets are imperfectly competitive. This parametrization allows each industry to take total expenditure $Y_i=p_i(x_i+g_i)$ as given and warrants that both firms and household choices are independent. It is also assumed that firms maximize profits and behave *a la Cournot*. Thus the representative firm of sector i faces the following unit isoelastic inverse demand

$$p_i = {}^{Y_i}\!/_{Q_i}, \text{where} Q_i = \sum_{i=1}^{h} q_{ij}.$$

Finally, in each sector firms bear simultaneously a value added tax rate $t \geq 0$ and a specific tax rate $s \geq 0$ respectively. Therefore, the goal of the representative firm is to maximize

$$\left(\frac{Y_i}{(1+t)Q_i} - c - s \right) q_{ij} - k,$$

whose first order condition yields the symmetric equilibrium in each industry

$$Q_i(t,s) = \frac{(n-1)}{n(1+t)(s+c)} Y_i, \tag{3}$$

$$p_i(t,s) = \frac{n(1+t)(s+c)}{(n-1)}, \tag{4}$$

$$\pi_i(t,s) = \frac{Y_i}{n(1+t)} - nk. \tag{5}$$

Note that due to the symmetry of the model $p_i(t,s)$ is identical in each sector $i = 1, 2, \ldots, h$; thus equation (4) is just the price index of the economy.

3) The Government uses the tax revenue to finance the quantity g_i of government purchases in sector i. Thus, given the price p_i, the government budget constraint is

$$\sum_{i=1}^{h} p_i g_i = G(t,s), \tag{6}$$

where

$$G(t,s) = \sum_{i=1}^{h} \frac{t}{1+t} p_i(t,s) Q_i(t,s) + s \sum_{i=1}^{h} Q_i(t,s) \tag{7}$$

is government tax revenue. Substituting equations (3) and (4) in equation (7), taking into account equation (6), and denoting by $Y = \sum_{i=1}^{h} Y_i$ the total expenditure in the economy, government expenditure-revenue is given by

$$G(t,s) = \left(t + \frac{s}{s+c} \frac{n-1}{n} \right) \frac{Y}{1+t}. \tag{8}$$

Finally let us assume, in accordance with Caminal (1990), that the quantity g_i of government purchases in each sector i is uniform (i.e., $g_i = {}^{G(t,s)}\!/_{ph}$), as this is the optimal fiscal policy given the symmetry of the model.

Characterizing the demand side equilibrium, let us maximize (1) subject to (2) yielding household´s optimal choice

$$p_i x_i = \frac{\alpha}{h}(W+\pi), i=1,2,...,h \qquad (9)$$

$$L=(1-\alpha)(W+\pi). \qquad (10)$$

Where $\pi = \sum_{i=1}^{h} \pi_i$. Therefore, taking into account equation (9) and g_i total expenditure in sector i is given by

$$Y_i = \frac{\alpha}{h}(W+\pi)+p_i g_i, \qquad (11)$$

adding equations (5) and (11) for each sector,

$$\pi(t,s) = \frac{Y}{n(1+t)} - hnk \qquad (12)$$

This particular shape of demand function allows us to interpret α as the marginal propensity to consume in equation (13) (see Mankiw, 1988). Substituting equations (12) and (8), taking into account (6), total expenditure in equilibrium is

$$Y(t,s) = \frac{\alpha n(1+t)(s+c)(W-hnk)}{(n-\alpha)c+(1-\alpha)s}, \qquad (14)$$

calling $w=W/h$ expenditure in sector *i* can be written as

$$Y_i(t,s) = \frac{\alpha n(1+t)(s+c)(w-nk)}{(n-\alpha)c+(1-\alpha)s}, \qquad (15)$$

and adding equations (3) and (4), taking into account (14), total output in equilibrium can be written as

$$Q(t,s) = \frac{\alpha(n-1)(W-hnk)}{(n-\alpha)c+(1-\alpha)s}. \qquad (16)$$

Note that for our economy total output in equilibrium does not depend on the value added tax rate. Finally, from (14), (15) and (16) it is necessary to assume that $W>hnk$ (or $w>nk$) to ensure the existence of a interior equilibrium.

3. TAX REFORM UNDER COURNOT EQUILIBRIUM

This section addresses the effect of a shift from specific to value-added taxation on prices, government expenditure, production and welfare in Cournot equilibrium. Starting from the initial situation given by the pair (t,s), the following tax reform is assumed,

$$ds=-\gamma dt \text{ with } \gamma>0. \qquad (17)$$

This type of reform generalizes the set of reforms that shift from specific to value-added taxation[1]. In particular γ represents the rate of substitution between both tax rates. Hereinafter the upper script C refers to the Cournot equilibrium and will be useful for comparison with Free Entry equilibrium. The following results refer to the Cournot equilibrium model presented in the former section.

Result 1

The tax reform given in (17) increases total production and decreases total profit

Proof: from equation (16), the gradient of total output with respect to the vector of tax instruments is

$$\nabla Q(t,s)=\left(0,-\frac{\alpha(1-\alpha)(n-1)(W-hnk)}{[(n-\alpha)c+(1-\alpha)s]^2}\right)=\left(0,-\frac{(1-\alpha)Q}{(n-\alpha)c+(1-\alpha)s}\right) \quad (18)$$

Calculating the total differential taking into account (17), the effect on total output of the tax reform is

$$dQ^C=\frac{\partial Q}{\partial t}dt+\frac{\partial Q}{\partial s}ds=-\gamma\frac{\partial Q}{\partial s}dt>0 \quad (19)$$

due to the sign of the gradient given in (18). In relation with total profit, starting from equation (12), taking into account equation (14), the gradient with respect to the vector of tax instruments is

$$\nabla\pi(t,s)=\left(0,-\frac{c\alpha(n-1)(W-hnk)}{[(n-\alpha)c+(1-\alpha)s]^2}\right)=\left(0,-\frac{cQ}{(n-\alpha)c+(1-\alpha)s}\right) \quad (20)$$

Calculating the total differential taking into account (17), the effect on total profit of the tax reform is

$$d\pi^C=\frac{\partial\pi}{\partial t}dt+\frac{\partial\pi}{\partial s}ds=-\gamma\frac{\partial\pi}{\partial s}dt<0\,,$$

due to the sign of the gradient given in (20).

Note that both output level and profits do not change with respect to a change in value-added tax rate. This feature is due to the type of preferences assumed (with unit isoelastic elasticity) and the proportionality of such tax rate. In this way, the increase in both government expenditure and price is balanced by an equal decrease in consumption yielding a total crowding-out effect (Torregrosa, 2003).

[1] For example, in Dellipalla and Keen (1992), the *P-shift tax reform* would be $\gamma=\frac{p}{(1+t)^2}=\frac{n(s+c)}{(n-1)(1+t)}$.

Let us analyze the effect of such a tax reform on prices, total expenditure and government expenditure-revenue.

Lemma 1

Price, total expenditure and government expenditure-revenue increase monotonically with respect to the vector of tax instruments.

Proof: Calculating their gradients with respect to the vector of tax instruments starting from equations (4), (8) and (14) respectively, after operating and simplifying, we have

$$\nabla p(t,s)=\left(\frac{n(s+c)}{n-1},\frac{n(1+t)}{n-1}\right) \tag{21}$$

$$\nabla Y(t,s)=\left(\frac{Y}{1+t},\frac{c(n-1)}{(n-\alpha)c+(1-\alpha)s}\frac{Y}{s+c}\right) \tag{22}$$

$$\nabla G(t,s)=\left(\frac{Y}{1+t},\frac{c(n-1)[n(1+t)-\alpha]}{n[(n-\alpha)c+(1-\alpha)s]}\frac{Y}{(1+t)(s+c)}\right) \tag{23}$$

These gradients show us that price, total expenditure and government expenditure-revenue in equilibrium increase monotonically with respect to the vector of tax instruments.

Lemma 1 allows us to study the effect on price, total expenditure and government expenditure-revenue in equilibrium of any tax reform through level curves which start from any initial pair (t,s) of tax rates. Let us call these curves as the iso-price (IP) curve , the iso-total expenditure (IY) curve and the iso-government expenditure-revenue (IG) curve.

Definition 1

The IP curve is given by the pairs (t,s) so that a tax reform as given in (17) holds the price unchanged. Taking into account equation (21) the slope of the IP curve is

$$\left.\frac{ds}{dt}\right|_{p}=-\frac{s+c}{1+t}<0, \qquad 24)$$

this way when in equation (17) $\gamma=\frac{s+c}{1+t}$ the tax reform becomes the iso-price tax reform.

Lemma 2

Any tax reform γ *so that* $\gamma>-\left.\frac{ds}{dt}\right|_{p}\left(\gamma<-\left.\frac{ds}{dt}\right|_{p}\right)$ *decreases (increases) the price.*

Proof: Taking into account (24), the total differential of *p* with respect to the tax reform can be written as

$$dp^C = \left(\frac{\partial p}{\partial t} - \gamma \frac{\partial p}{\partial s}\right) dt = -\frac{n(1+t)}{n-1}\left(\gamma + \left.\frac{ds}{dt}\right|_p\right) dt, \tag{25}$$

then $dp^C > 0 \left(dp^C < 0\right)$ iff $\gamma > -\left.\frac{ds}{dt}\right|_p \left(\gamma < -\left.\frac{ds}{dt}\right|_p\right)$

Definition 2

The IY curve is given by the pairs (t,s) so that a tax reform as given in (17) holds total expenditure unchanged. Taking into account equation (22) the slope of the IP curve is given by

$$\left.\frac{ds}{dt}\right|_Y = -\frac{s+c}{1+t}\frac{(n-\alpha)c+(1-\alpha)s}{(n-1)c} < 0. \tag{26}$$

Lemma 3

Any tax reform γ *so that* $\gamma > -\left.\frac{ds}{dt}\right|_Y \left(\gamma < -\left.\frac{ds}{dt}\right|_Y\right)$ *decreases (increases) the total expenditure.*

Proof: Taking into account (26), the total differential of Y with respect to the tax reform can be written as

$$dY^C = \left(\frac{\partial Y}{\partial t} - \gamma \frac{\partial Y}{\partial s}\right) dt = -\frac{c(n-1)Y}{(s+c)((n-\alpha)c+(1-\alpha)s)}\left(\gamma + \left.\frac{ds}{dt}\right|_Y\right) dt,$$

$$dY^C = \frac{Y}{1+t}\frac{\left(\gamma + \left.\frac{ds}{dt}\right|_Y\right)}{\left.\frac{ds}{dt}\right|_Y}, \tag{27}$$

then $dY^C > 0 \left(dY^C < 0\right)$ iff $\gamma > -\left.\frac{ds}{dt}\right|_Y \left(\gamma < -\left.\frac{ds}{dt}\right|_Y\right)$

Definition 3

The IG curve is given by the pairs *(t,s)* so that a tax reform as given in (17) holds government expenditure-revenue unchanged. Taking into account equation (23) the slope of the IP curve is

$$\left.\frac{ds}{dt}\right|_G = -\frac{n(s+c)[(n-\alpha)c+(1-\alpha)s]}{(n-1)c[n(1+t)-\alpha]} < 0, \tag{28}$$

when $\gamma = -\left.\frac{ds}{dt}\right|_G$ becomes the iso-government expenditure-revenue tax reform.

Lemma 4

Any tax reform γ *so that* $\gamma > -\left.\frac{ds}{dt}\right|_G \left(\gamma < -\left.\frac{ds}{dt}\right|_G \right)$ *decreases (increases) the government expenditure-revenue.*

Proof: As in the former cases the total differential of *G* with respect to the tax reform given in (17) can be written as

$$dG^C = \left(\frac{\partial G}{\partial t} - \gamma \frac{\partial G}{\partial s} \right) dt = - \frac{c(n-1)[n(1+t)-\alpha]Y}{(s+c)(1+t)n[(n-\alpha)c+(1-\alpha)s]} \left(\gamma + \left.\frac{ds}{dt}\right|_G \right) dt,$$

$$dG^C = \frac{Y}{1+t} \frac{\left(\gamma + \left.\frac{ds}{dt}\right|_G \right)}{\left.\frac{ds}{dt}\right|_G}, \qquad (29)$$

Finally, according to equations (24), (26) and (28),

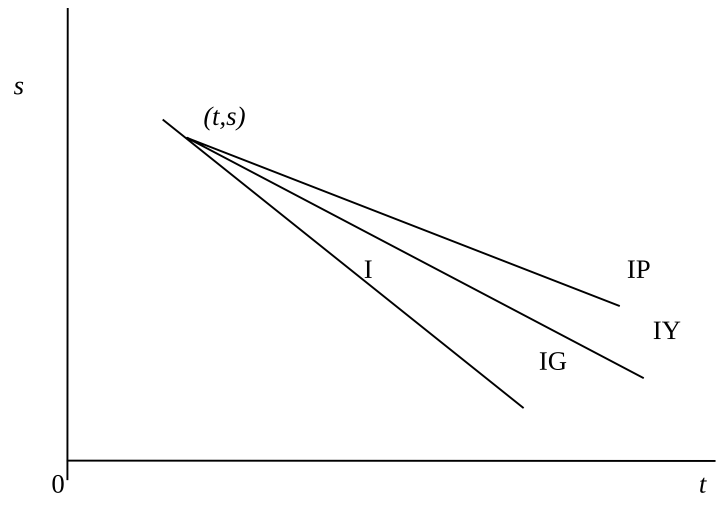
Lemma 5

For all pairs (t,s) *the shape of the* IP, IY *and* IG *curves fulfill the following condition,*

$$\left.\frac{ds}{dt}\right|_p > \left.\frac{ds}{dt}\right|_Y > \left.\frac{ds}{dt}\right|_G .$$

Figure 1 depicts, according to lemma 5, the shape of the IP, IY and IG curves for a given vector of tax instruments.

Figure 1



As a consequence of lemmas 2, 3, 4 and 5 the following result is reached:

Result 2

The tax reform given in (17) produces the following effects on price, total expenditure and government expenditure-revenue:

1) If $\gamma < -\left.\frac{ds}{dt}\right|_p$ price, total expenditure and government expenditure-revenue increase.
2) If $-\left.\frac{ds}{dt}\right|_p \leq \gamma < -\left.\frac{ds}{dt}\right|_Y$ price non-increases and total expenditure and government expenditure-revenue increase.
3) If $-\left.\frac{ds}{dt}\right|_Y \leq \gamma < -\left.\frac{ds}{dt}\right|_G$ price decreases, total expenditure non-increases and government expenditure-revenue increases.
4) If $-\left.\frac{ds}{dt}\right|_G \leq \gamma$ price and total expenditure decrease and government expenditure-revenue non-increases.

Result 2 says that the tax reform defined in (17) can produce different effects on price, total expenditure and government expenditure-revenue\ under Cournot equilibrium depending on the rate at which both tax rates are shifted. For example, the Dellipalla and Keen's (1992) *P-shift* tax reform extends down the IP curve, decreasing the price, but crosses both the IY and the IG curves in such way that if $\frac{\alpha}{1-\alpha}\frac{ct}{1+t} < s < \frac{\alpha}{1-\alpha}c$ the balanced budget multiplier dY/dG is negative[2].

Finally let us analyze the effect of the tax reform given in (17) on welfare. Substituting the equilibrium values given by equations (4), (9) and (10) into equation (1) the indirect utility function can be written as

$$V(t,s) = \ln \alpha^{\alpha}(1-\alpha)^{1-\alpha}h^{-\beta} + \ln(W + \pi(t,s)) - (\alpha+\beta)\ln p(t,s) + \beta \ln G(t,s).$$

As it is shown indirect utility function depends on the tax instrument vector through total profits, price index and government expenditure-revenue. Differentiating $V(t,s)$ with respect to (t,s),

$$\frac{\partial V(t,s)}{\partial t} = -\frac{\alpha+\beta}{p}\frac{\partial p}{\partial t} + \frac{\beta}{G}\frac{\partial G}{\partial t}, \qquad (30)$$

$$\frac{\partial V(t,s)}{\partial t} = \frac{1}{W+\pi}\frac{\partial \pi}{\partial s} - \frac{\alpha+\beta}{p}\frac{\partial p}{\partial t} + \frac{\beta}{G}\frac{\partial G}{\partial t}. \qquad (31)$$

[2] A complete analysis of this case can be found in Torregrosa (1996).

Equations (30) and (31) show us that while both value added and specific tax rates have a negative `price effect' and a positive `government expenditure-revenue effect', only the specific tax rate causes a negative `profit effect'. This is due to equation (20), where changes in the value-added tax rate do not change profit while an increase in the specific tax rate increases it. This drives us to the following result:

Result 3

The tax reform given in (17) produces the following effects on welfare:

1. A negative profit effect,
2. Several price and government expenditure-revenue effects depending on γ in such way that:
   - 3.2.a) if $\gamma < -\left.\frac{ds}{dt}\right|_p$ the price effect is negative while the government´s expenditure effect is positive,
   - 3.2.b) if $-\left.\frac{ds}{dt}\right|_p \leq \gamma < -\left.\frac{ds}{dt}\right|_G$ both the price and the government´s expenditure effects are positive,
   - 3.2.c) if $-\left.\frac{ds}{dt}\right|_G \leq \gamma$ the price effect is positive while the government´s expenditure effect is negative.

Proof: The total effect of the tax reform on welfare can be obtained through the total differential of *V(t,s)* taking into account (17).

$$dV(t,s)=\left(\frac{\partial V(t,s)}{\partial t}-\gamma\frac{\partial V(t,s)}{\partial s}\right)dt, \tag{32}$$

substituting the partial derivatives given in equations (30) and (31) in equation (32)

$$dV^C(t,s)=\left[-\frac{\alpha+\beta}{p}\left(\frac{\partial p}{\partial t}-\gamma\frac{\partial p}{\partial s}\right)-\frac{\beta}{G}\left(\frac{\partial G}{\partial t}-\gamma\frac{\partial G}{\partial s}\right)-\frac{1}{W+\pi}\frac{\partial \pi}{\partial s}\right]dt=...$$

$$...=-\frac{\alpha+\beta}{p}dp^C-\frac{\beta}{G}dG^C-\frac{1}{W+\pi}\frac{\partial \pi}{\partial s}dt, \tag{33}$$

$$dV^C(t,s)=\left[\frac{\alpha+\beta}{p}\left(\gamma+\left.\frac{ds}{dt}\right|_p\right)\frac{\partial p}{\partial s}-\frac{\beta}{G}\left(\gamma+\left.\frac{ds}{dt}\right|_G\right)\frac{\partial G}{\partial s}-\frac{1}{W+\pi}\frac{\partial \pi}{\partial s}\right]dt. \tag{34}$$

As it is seen in equation (34) profit effect is always negative, while both price and government´s expenditure-revenue effects depend on the difference between the rate of substitution γ and both the iso-price and the iso-government´s expenditure-revenue tax reforms. Since lemma 5 $-\left.\frac{ds}{dt}\right|_p < -\left.\frac{ds}{dt}\right|_G$ the result is straightforward.

Result 3 resumes the total effect that the tax reform given in (17) causes on welfare in terms of the change in the specific tax rate. In contrast with what happens in partial equilibrium, where the tax reform always causes an increase in welfare, here the effect on welfare is ambiguous. On the one hand, an additional wealth effect appears working in an opposite way, due to the fall in total profit. On the other hand, the first two terms of equation (34) capture the effect on welfare of the changes in both the price and government´s purchases respectively. These changes depend on the value of the tax reform γ with respect to the iso-price tax reform as well as the iso-government expenditure-revenue tax reform. As it can be seen, the tax reform 2.b $-\left.\frac{ds}{dt}\right|_p \leq \gamma < -\left.\frac{ds}{dt}\right|_G$ is particularly interesting because it decreases the equilibrium price and increases government´s expenditure causing a doubly profitable effect on welfare.

4. TAX REFORM UNDER FREE ENTRY EQUILIBRIUM

This section analyzes how the industry size in equilibrium, in each industry, is affected by the tax reform given in (17) and its repercussion on total output, price index, expenditure and welfare. As it is well known this equilibrium is interpreted as a long-run situation after industry size has adjusted due to the disappearance of economic profits. We follow the usual practice of treating $n \in \left(1, W/hk\right)$[3] as a continuous variable. Thus substituting expenditure in equilibrium in sector i, given by (15), into equation (5) imposing the zero profit condition and simplifying,

$$kcn^2 + ksn - \alpha(s+c)w = 0, \qquad (35)$$

whose unique positive solution is

$$n(s) = \frac{1}{2kc}\left(\sqrt{k^2s^2 + 4kc\alpha(s+c)w} - ks\right) \qquad (36)$$

[3] The left boundary of this interval is open because the unit isoelasticity of the demand function impedes the monopoly case. The openness of the right boundary is necessarily for the existence of the equilibria given in (12) and (13). To remark that W=hw.

As it can be seen in (36), as happens with total output and profit, the industry size in equilibrium does not depend on value added tax rate. Otherwise it is necessary to assume that $\alpha > k/w$ in order to guarantee that $n(s) > 1$ in equation (36). Let us calculate the variation of the industry size in equilibrium with respect to the specific tax rate.

$$\frac{\partial n}{\partial s} = \frac{1}{2c}\left(\frac{ks + 2c\alpha w}{\sqrt{k^2 s^2 + 4kc\alpha(s+c)w}} - 1\right) > 0. \qquad (37)$$

The fact that (37) is positive is due to the assumption that $\alpha > k/w$. This outcome is parallel to that achieved for profits in the previous section, and its insight is related to the fact that incipient profits attract entry (Stern, 1987). The following results are addressed to our model.

Result 4

The tax reform given in (17) decreases industry size under Free Entry equilibrium

Proof: It is straightforward, from equation (36), that $\partial n / \partial t = 0$. Thus, taking into account (37), the effect of the tax reform given in (17) on the industry size in equilibrium is

$$dn = \frac{\partial n}{\partial t} dt + \frac{\partial n}{\partial s} ds = -\gamma \frac{\partial n}{\partial s} dt < 0.$$

With respect to total output, in accordance with the equation (16), it depends on both industry size and specific tax rate (and is independent of the value-added tax rate). So, the effect of a change in specific tax rate on total output is (see section A1 of the appendix)

$$\frac{\partial Q}{\partial s} = -\frac{(1-\alpha)Q}{(n-\alpha)c + (1-\alpha)s} - \frac{hk[(2\alpha-1)n - \alpha]}{(n-\alpha)c + (1-\alpha)s}\frac{\partial n}{\partial s}. \qquad (38)$$

Equation (38) has two terms, the first one is equal to (18), which is just the variation on total output due to a variation in the specific tax rate under Cournot equilibrium. The second term captures the net effect of the change in industry size on output as a consequence of the change in the specific tax rate. Then, taking into account (19), the effect on total output of the tax reform given in equation (17) can be written as

$$dQ^F = \left(\frac{\partial Q}{\partial t} - \gamma \frac{\partial Q}{\partial s}\right) dt = dQ^C + \gamma \frac{hk[(2\alpha-1)n - \alpha]}{(n-\alpha)c + (1-\alpha)s}\frac{\partial n}{\partial s} dt. \qquad (39)$$

Hereinafter the upper script *F* refers to the Free Entry equilibrium and it is useful for the following results of comparison with the Cournot equilibrium (upper scripted by *C*).

Result 5

The effect of the tax reform given in (17) on total output is higher under Free Entry equilibrium than under Cournot equilibrium, i.e. $dQ^F > dQ^C$ if $\alpha > \alpha^q$ *Otherwise* $dQ^F < dQ^C$ when $\alpha \in \left(k/w, \alpha^q\right)$, *where*

$$\alpha^q = \frac{1}{2} + \frac{(2s+c)k + \sqrt{(2s+c)^2 k^2 + 8kwc(s+c)}}{8(s+c)w}.$$

Proof: Section A2 of the appendix.

In relation to the price, the gradient of (4) with respect to the tax instrument vector is now

$$\nabla p(t,s) = \left(\frac{n(s+c)}{n-1}, \frac{(1+t)}{n-1}\left[n - \frac{s+c}{n-1}\frac{\partial n}{\partial s} \right] \right)$$

Note that in this case, while the effect on price of a change in the value-added tax rate is the same as that produced by (21), the effect on price of changes in the specific tax rate now reflects the relationship with the industry size in equilibrium. Thus an increase in the specific tax rate now has two opposite effects on price. On the one hand, as in equation (21), an increase in the specific tax rate increases the price for a given industry size, and on the other hand, it decreases the price as a consequence of the increase in the numbers of firms in equilibrium. Therefore the following result is reached

Result 6

The effect of the tax reform given in (17) on price is higher under Free Entry equilibrium than under Cournot equilibrium

Proof: The effect on price of the tax reform under Free entry equilibrium can be written, taking into account (25), as

$$dp^F = \left(\frac{\partial p}{\partial t} - \gamma \frac{\partial p}{\partial s} \right) dt = dp^C + \gamma \frac{(1+t)(s+c)}{(n-1)^2} \frac{\partial n}{\partial s} dt. \qquad (40)$$

Thus $dp^F > dp^C$ due to the second term of (40) is positive.

This is a consequence of the fall in the industry size in equilibrium due to the substitution of specific by value-added taxation. Equation (40) now has two parts: firstly the effect on price for a given industry size, and secondly the inflationary effect of a decrease in industry size. For example, while the iso-price tax reform ($\gamma = \frac{s+c}{1+t}$) does not change the price in the Cournot equilibrium, under Free Entry equilibrium the effect on price would be strictly positive.

Regarding total expenditure in equilibrium section A3 of the appendix shows that its gradient is

$$\nabla Y(t,s)=\left(\frac{Y}{1+t},\frac{c(n-1)}{(n-\alpha)c+(1-\alpha)s}\frac{Y}{s+c}+\frac{(1+t)nhk(s-2\alpha(s+c))}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}\right).$$

Therefore, taking into account (27), the effect of the tax reform given in (17) on total expenditure under Free Entry equilibrium can be written as

$$dY^F=\left(\frac{\partial Y}{\partial t}-\gamma\frac{\partial Y}{\partial s}\right)dt=dY^C+\gamma\frac{(1+t)nhk(2\alpha(s+c)-s)}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}dt. \qquad (41)$$

Section A3 helps the reader to obtain equation (41).

Result 7

The effect of the tax reform given in (17) on total expenditure is higher under Free Entry equilibrium than under Cournot equilibrium, i.e. $dY^F>dY^C$ *if* $\alpha>{}^{s}\!/_{2(s+c)}\equiv\alpha^y$. *Otherwise* $dY^F\leq dY^C$ *if* $\alpha\in(k/w,\alpha^y)$

The proof is straightforward from equation (41).

Regarding government expenditure-revenue, section A4 of the appendix shows that the gradient of the equilibrium value given in (8) with respect to the tax instruments vector is

$$\nabla G(t,s)=\left(\frac{Y}{1+t},\frac{c(n-1)[n(1+t)-\alpha]}{n[(n-\alpha)c+(1-\alpha)s]}\frac{Y}{(1+t)(s+c)}+\frac{hk[ns(1+t)(1-2\alpha)+\alpha s-2\alpha ntc]}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}\right).$$

Therefore, taking into account (29), the effect of the tax reform given in (17) on government expenditure-revenue under Free Entry equilibrium can be written as (section A4 of the appendix)

$$dG^F=\left(\frac{\partial G}{\partial t}-\gamma\frac{\partial G}{\partial s}\right)dt=dG^C+\gamma\frac{hk[(2\alpha(s+t(s+c))-s(1+t))n-\alpha s]}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}dt. \qquad (42)$$

As with equations (39), (40) and (41), this expression is formed by two parts, the first one is the effect of the tax reform for a given industry size, and the second reflects the effect of a change in industry size due to the change in the specific tax rate. According to equation (42) the following result is reached:

Result 8

The effect of the tax reform given in (17) on government expenditure-revenue is higher under Free Entry equilibrium than under Cournot equilibrium, i.e. $dG^F>dG^C$ *if* $\alpha>\alpha^g$. *Otherwise* $dG^F\leq dG^C$ *if* $\alpha\in(k/w,\alpha^g)$ *where*

$$\alpha^g = \frac{s(1+t)}{2(s+t(s+c))} + \frac{[2(s+t(s+c))+c]ks^2}{8(s+c)w(s+t(s+c))^2} + \dots$$

$$\dots + \frac{\sqrt{[2(s+t(s+c))+c]^2 k^2 s^4 + 8kwcs^3(1+t)(s+c)(s+t(s+c))}}{8(s+c)w(s+t(s+c))^2}.$$

Proof: Section A5 of the appendix.

Therefore the fact that the tax reform generates different changes in total output, total expenditure and government expenditure-revenue under Free Entry equilibrium than under Generalized Cournot equilibrium depends on marginal propensity to consume.

With regards to the effect of the tax reform given in (17) on welfare under Free Entry equilibrium, let us build the indirect utility function substituting the equilibrium values given by equations (4), (9) and (10) on equation (1) taking into account the zero profit condition

$$V(t,s) = \ln \alpha^{\alpha}(1-\alpha)^{1-\alpha} W - (\alpha+\beta)\ln p(t,s) + \beta \ln G(t,s).$$

Differentiating $V(t,s)$ with respect to $r=t,s$

$$\frac{\partial V(t,s)}{\partial r} = -\frac{\alpha+\beta}{p}\frac{\partial p}{\partial r} + \frac{\beta}{G}\frac{\partial G}{\partial r}, \tag{43}$$

thus, using (43) and following the steps of equation (32), the effect of the tax reform given in (17) on welfare can be written as

$$dV^F(t,s) = \left[-\frac{\alpha+\beta}{p}\left(\frac{\partial p}{\partial t} - \gamma\frac{\partial p}{\partial s}\right) + \frac{\beta}{G}\left(\frac{\partial G}{\partial t} - \gamma\frac{\partial G}{\partial s}\right)\right]dt,$$

taking into account (40) and (41)

$$dV^F(t,s) = -\frac{\alpha+\beta}{p}dp^F + \frac{\beta}{G}dG^F. \tag{44}$$

Note that, since $dp^F > dp^C$, the profitable effect of the fall on prices due to the tax reform is less possible. For example, the iso-price tax reform yields $dp^C = 0$, and $dp^F > 0$. In this case dG^F works by increasing welfare, but it can be lower than dG^C depending on marginal propensity to consume. Otherwise, if tax reform is the iso-government expenditure-revenue tax reform and $\alpha \le \alpha^g$ then $dG^F < 0$. In this case dp^F may works by increasing welfare but in to a lesser extent than in Cournot equilibrium due to $dp^F > dp^C$. The following result refers to this difference

Result 9

The difference between Free Entry equilibrium and Cournot equilibrium changes in welfare due to the tax reform given in (17) yields:

10.1) *a positive profit effect,*

10.2) *a negative price effect,*

10.3) *a positive (non-positive) government´s expenditure effect when* $\alpha>(\le)\alpha^g$.

Proof: Substracting (33) from (44) taking into account (40) and (42) and operating we have

$$dV^F - dV^C = \gamma\left[\frac{1}{W+\pi}\frac{\partial\pi}{\partial s} - \frac{\alpha+\beta}{n(n-1)}\frac{\partial n}{\partial s} + \frac{\beta}{G}\frac{hk[(2\alpha(s+t(s+c)) - s(1+t))n - \alpha s]}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}\right]dt,$$

which yields the result.

5. CONCLUSIONS

This paper introduces two new perspectives to the formal treatment of the comparison between specific and value-added (ad valorem) taxation. On the one hand, the use of a general equilibrium model with imperfect competition and, on the other hand, the characterization of a generalized tax reform with shift from specific to value-added taxation. The first feature allows us to analyze how changes in both government revenue-expenditure and profit (as a consequence of the tax reform) can affect household indirect utility in a different way than occurs in the partial equilibrium case. Furthermore the model allows us to study the real effects, the nominal effects and the effects on welfare simultaneously. This permits the interpretation of the results in macroeconomic terms. With regards to the second feature (the characterization of a generalized tax reform with shift from specific to value-added taxation) the approach is different to those of Suits and Musgrave (1955) and Dellipalla and Keen (1992), which characterize particular tax reforms like the *matched pairs* or the *P-shift* respectively. In this paper however, a general concept of tax reform is used, one which defines a rate of substitution between specific and value-added taxes. This feature allows us to extract new positive conclusions related to the effect of the tax reform on prices and both real and nominal variables of the economy.

The main conclusions are related to the type of equilibrium considered. In the Cournot equilibrium case one finds that any tax reform which shifts from specific to value-added taxation increases total output and decreases total profit. This conclusion is similar to that obtained in partial equilibrium for a particular characterization of the tax reform. The other result refers to the nominal variables and prices, where a variety of effects on total expenditure and government expenditure-revenue in equilibrium, related to the substitution rate between taxes, can be found. This produces a range of situations from one in which all of the variables may rise, if the substitution rate is small enough, to the opposite if the substitution rate is high enough. An interesting case is that there exist substitution rates which decrease the price while increasing both total expenditure and government expenditure-revenue, a case which means that the tax reform generates a positive balanced budget multiplier. With respect to welfare, beyond the profitable effect that a fall in prices causes (as with the partial equilibrium case), here the decrease in both government expenditure and total profit can work to reduce the welfare generated.

In the Free Entry Oligopoly case, one finds that any tax reform which shifts from specific to value-added taxation, decreases the number of firms in equilibrium. This adjustment in industry size increases the price with respect to the Cournot equilibrium. Furthermore, the adjustment in industry size has implications on the remaining variables which implications depend on marginal propensity to consume. This way, if marginal propensity to consume is large enough, total output, total expenditure and government expenditure-revenue under Free Entry equilibrium increases beyond the values reached under Generalized Cournot equilibrium. Otherwise, for lower levels of marginal propensity to consume a variety of effects on total output, total expenditure and government expenditure-revenue arises with respect to those of Cournot equilibrium. With regards to welfare, the difference between Free Entry equilibrium and Cournot equilibrium changes in welfare due to the tax reform just depict two opposite effects: the adjustment in industry size and the disappearing of profits.

APPENDIX

A0) *Under Free Entry equilibrium* $nk = \frac{\alpha(s+c)(w-nk)}{(n-\alpha)c+(1-\alpha)s}$.

Proof: Taking into account the free entry condition in (5) and substituting (15).

A1) *Determination of* $\frac{\partial Q}{\partial s}$.

Proof: Taking into account that *W=hw* equation (16) can be written as

$$Q(t,s) = \frac{\alpha h(n-1)(w-nk)}{(n-\alpha)c+(1-\alpha)s}.$$

differentiating with respect to *s*

$$\frac{\partial Q}{\partial s} = \alpha h\left[\frac{(w-nk)}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s} - \frac{(n-1)k}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s} - \frac{(n-1)(w-nk)}{[(n-\alpha)c+(1-\alpha)s]^2}\left(c\frac{\partial n}{\partial s}+1-\alpha\right)\right].$$

grouping terms and operating taking into account (18),

$$\frac{\partial Q}{\partial s} = -\frac{(1-\alpha)Q}{(n-\alpha)c+(1-\alpha)s} + \frac{\alpha h}{(n-\alpha)c+(1-\alpha)s}\left[\frac{(1-\alpha)(s+c)(w-nk)}{(n-\alpha)c+(1-\alpha)s} - (n-1)k\right]\frac{\partial n}{\partial s},$$

taking into account A0 and operating,

$$\frac{\partial Q}{\partial s} = -\frac{(1-\alpha)Q}{(n-\alpha)c+(1-\alpha)s} - \frac{hk[(2\alpha-1)n-\alpha]}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}.$$

A.2) $dQ^F > dQ^C$ if $\alpha > \alpha^q$, *and* $dQ^F < dQ^C$ when $\alpha \in \left(k/w, \alpha^q\right)$, *where*

$$\alpha^q = \frac{1}{2} + \frac{(2s+c)k + \sqrt{(2s+c)^2k^2 + 8kwc(s+c)}}{8(s+c)w}.$$

Proof: According to (39)

$$dQ^F - dQ^C = \frac{hk[(2\alpha-1)n-\alpha]}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}dt,$$

thus the negativiness or positiviness of $dQ^F - dQ^C$ depends only on the sign of $\Gamma(\alpha) = (2\alpha-1)n(\alpha) - \alpha$. As $n(\alpha)$ is positive for $k/w < \alpha \le 1$ it is easy to see that for $\alpha \le 1/2$ $\Gamma(\alpha) < 0$ and therefore $dQ^F - dQ^C < 0$.When $\alpha > 1/2$ $\Gamma(\alpha) > 0$ if $n(\alpha) > \alpha/(2\alpha-1)$. Taking into account equation (36), and operating, this condition can be written as

$$(2\alpha-1)\left[\sqrt{s^2k^2 + 4k\alpha wc(s+c)} - ks\right] > 2kc\alpha,$$

or

$$(2\alpha-1)\sqrt{s^2k^2+4k\alpha wc(s+c)}>2kc\alpha+(2\alpha-1)ks,$$

as both left and right side terms of the inequation are strictly positive it is true that

$$(2\alpha-1)^2\left[s^2k^2+4k\alpha wc(s+c)\right]>(2kc\alpha+(2\alpha-1)ks)^2,$$

developing terms and simplifying

$$(2\alpha-1)^2 w(s+c)>kc\alpha+(2\alpha-1)ks,$$

and developing $(2\alpha-1)^2$ and grouping terms with respect to α this inequation can be written as

$$L(\alpha)=4w(s+c)\alpha^2-[(s+c)(k+4w)+sk]\alpha+(s+c)w+ks>0.$$

$L(\alpha)$ is a convex parabola which reaches its minimum at

$$\alpha_{min}=\frac{1}{2}+\frac{(2s+c)k}{8(s+c)w},$$

and has two roots such that only one belongs to the interval (1/2,0) (we are analyzing the positivity of $L(\alpha)$ for $\alpha>1/2$), this value is given by α^q. Therefore $L(\alpha)>0$, i.e. $n(\alpha)>\alpha/(2\alpha-1)$ for $\alpha>\alpha^q$. And $L(\alpha)\leq 0$ for $k/w<\alpha<\alpha^q$.

A3) *Determination of* ∇Y *and equation (41)*

Proof: Starting from equation (14), it is easy to see that $\frac{\partial Y}{\partial t}=\frac{Y}{1+t}$ because $n(s)$ in equation (36) does not depend on *t*. Otherwise, taking into account that $W=hw$ equation (14) can be written as

$$Y(t,s)=\frac{\alpha hn(1+t)(s+c)(w-nk)}{(n-\alpha)c+(1-\alpha)s},$$

$$\frac{\partial Y}{\partial s}=\alpha h(1+t)\left[\frac{n(w-nk)}{(n-\alpha)c+(1-\alpha)s}+\frac{(s+c)(w-nk)}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}-\frac{n(s+c)k}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}\ldots\right.$$

$$\left.\ldots-\frac{n(s+c)(w-nk)}{[(n-\alpha)c+(1-\alpha)s]^2}\left(c\frac{\partial n}{\partial s}+1-\alpha\right)\right],$$

grouping terms and operating,

$$\frac{\partial Y}{\partial s}=\frac{\alpha h(1+t)}{(n-\alpha)c+(1-\alpha)s}\left[(s+c)\left(w-nk-\frac{n(w-nk)}{(n-\alpha)c+(1-\alpha)s}-nk\right)\frac{\partial n}{\partial s}\ldots\right.$$

$$\left.\ldots++n(w-nk)\left(1-\frac{(1-\alpha)(s+c)}{(n-\alpha)c+(1-\alpha)s}\right)\right],$$

$$\frac{\partial Y}{\partial s}=\frac{\alpha h(1+t)}{(n-\alpha)c+(1-\alpha)s}\left[(s+c)\left(\frac{(s-\alpha(s+c))(w-nk)}{(n-\alpha)c+(1-\alpha)s}-nk\right)\frac{\partial n}{\partial s}+\frac{n(n-1)(w-nk)c}{(n-\alpha)c+(1-\alpha)s}\right],$$

taking into account A0,

$$\frac{\partial Y}{\partial s}=\frac{\alpha h(1+t)}{(n-\alpha)c+(1-\alpha)s}\left[(s+c)\left(\frac{s(w-nk)}{(n-\alpha)c+(1-\alpha)s}-2nk\right)\frac{\partial n}{\partial s}+\frac{(n-1)cY}{\alpha h(s+c)(1+t)}\right],$$

$$\frac{\partial Y}{\partial s}=\frac{c(n-1)}{(n-\alpha)c+(1-\alpha)s}\frac{Y}{s+c}+\frac{(1+t)nhk(s-2\alpha(s+c))}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}.$$

The total differential of Y with respect to the tax instrument vector, taking into account the fiscal reform

$$dY^F=\left(\frac{\partial Y}{\partial t}-\gamma\frac{\partial Y}{\partial s}\right)dt=\ldots$$

$$\ldots\left[\frac{Y}{1+t}-\gamma\frac{c(n-1)}{(n-\alpha)c+(1-\alpha)s}\frac{Y}{s+c}-\gamma\frac{(1+t)nhk(s-2\alpha(s+c))}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}\right]dt,$$

grouping terms taking into account (26)

$$dY^F=\left[\frac{c(n-1)}{(n-\alpha)c+(1-\alpha)s}\frac{Y}{s+c}\left(\frac{(s+c)[(n-\alpha)c+(1-\alpha)s]}{(1+t)(n-1)c}-\gamma\right)\ldots\right.$$

$$\left.\ldots-\gamma\frac{(1+t)nhk(s-2\alpha(s+c))}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}\right]dt,$$

finally according to equation (27), equation (41) is yielded

$$dY^F=dY^C+\gamma\frac{(1+t)nhk(2\alpha(s+c)-s)}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}dt.$$

A4) *Determination of* ∇G *and equation (42)*

Starting from equation (8),

$$\frac{\partial G}{\partial t}=\frac{Y}{1+t},$$

$$\frac{\partial G}{\partial s}=\left[\frac{c}{(s+c)^2}\frac{(n-1)}{n}+\frac{s}{(s+c)n^2}\frac{\partial n}{\partial s}\right]\frac{Y}{1+t}+\left[t+\frac{(n-1)}{n}\frac{s}{(s+c)}\right]\frac{1}{1+t}\frac{\partial Y}{\partial s},$$

substituting the value of $\partial Y/\partial s$ obtained in A3 a grouping terms taking into account A0,

$$\frac{\partial G}{\partial s}=\frac{Y}{1+t}\left[\frac{c}{(s+c)^2}\frac{(n-1)}{n}+\left(t+\frac{(n-1)}{n}\frac{s}{(s+c)}\right)\frac{c(n-1)}{[(n-\alpha)c+(1-\alpha)s](s+c)}\ldots\right.$$

$$\left.\ldots+\left[\frac{s}{(s+c)n^2}+\left(t+\frac{(n-1)}{n}\frac{s}{(s+c)}\right)\frac{(s-2\alpha(s+c))}{n[(n-\alpha)c+(1-\alpha)s]}\right]\frac{\partial n}{\partial s}\right].$$

operating and simplifying,

$$\frac{\partial G}{\partial s}=\frac{Y}{1+t}\left[\frac{c(n-1)[n(1+t)-\alpha]}{n[(n-\alpha)c+(1-\alpha)s](s+c)}+\frac{1}{(s+c)n^2}\left[s+\frac{[nt(s+c)+s(n-1)][s-2\alpha(s+c)]}{(n-\alpha)c+(1-\alpha)s}\right]\frac{\partial n}{\partial s}\right].$$

Let us calculate the total differential of G with respect to the tax instrument vector, taking into account the fiscal reform

$$dG^F=\left(\frac{\partial G}{\partial t}-\gamma\frac{\partial G}{\partial s}\right)dt=...$$

$dG^F > dG^C$ if $\alpha>\alpha^g$. Otherwise $dG^F \le dG^C$ if $\alpha\in(k/w,\alpha^g)$ where

$$\alpha^g=\frac{s(1+t)}{2(s+t(s+c))}+\frac{[2(s+t(s+c))+c]ks^2}{8(s+c)w(s+t(s+c))^2}+...$$

$$...+\frac{\sqrt{[2(s+t(s+c))+c]^2k^2s^4+8kwcs^3(1+t)(s+c)(s+t(s+c))}}{8(s+c)w(s+t(s+c))^2}.$$

$$.=\left[\frac{Y}{1+t}\left[1-\gamma\frac{c(n-1)[n(1+t)-\alpha]}{n[(n-\alpha)c+(1-\alpha)s](s+c)}\right]-\gamma\frac{(1+t)hk1}{(s+c)}\left[s+\frac{[nt(s+c)+s(n-1)][s-2\alpha(s+c)]}{(n-\alpha)c+(1-\alpha)s}\right]\frac{\partial n}{\partial s}\right]dt,.$$

operating, this equation can be written as

$$dG^F=-\frac{c(n-1)Y}{[(n-\alpha)c+(1-\alpha)s](s+c)}\left(\gamma+\left.\frac{ds}{dt}\right|_Y\right)-\gamma hk\frac{[nt(1+t)(1-2\alpha)+\alpha s-2\alpha ntc)]}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}dt,$$

finally, taking account (29) equation (42) is achieved.

A5) $dG^F > dG^C$ *if* $\alpha>\alpha^g$. *Otherwise* $dG^F \le dG^C$ *if* $\alpha\in(k/w,\alpha^g)$ *where*

$$\alpha^g=\frac{s(1+t)}{2(s+t(s+c))}+\frac{[2(s+t(s+c))+c]ks^2}{8(s+c)w(s+t(s+c))^2}+...$$

$$...+\frac{\sqrt{[2(s+t(s+c))+c]^2k^2s^4+8kwcs^3(1+t)(s+c)(s+t(s+c))}}{8(s+c)w(s+t(s+c))^2}.$$

Proof: According with (42)

$$dG^F-dG^C=\gamma hk\frac{[[2\alpha(s+t(s+c))-s(1+t)]n-\alpha s]}{(n-\alpha)c+(1-\alpha)s}\frac{\partial n}{\partial s}dt.$$

thus the negativity or positivity of dG^F-dG^C depends only on the sign of $\Gamma(\alpha)=[2\alpha(s+t(s+c))-s(1+t)]n(\alpha)-\alpha s$. As $n(\alpha)$ is positive for $\alpha\in(k/w,1]$ it is easy to see that for $\alpha\le {s(1+t)}/{2(s+t(s+c))}$, $\Gamma(\alpha)<0$ and therefore $dG^F-dG^C<0$. When $\alpha> {s(1+t)}/{2(s+t(s+c))}$, $\Gamma(\alpha)\ge 0$ if, taking into account equation (36)

$$[2\alpha(s+t(s+c))-(1+t)]\left[\sqrt{s^2k^2+4k\alpha wc(s+c)}-ks\right]>2kc\alpha,$$

operating, this condition can be written as

$$[2\alpha(s+t(s+c))-(1+t)]\sqrt{s^2k^2+4k\alpha wc(s+c)}>(1+t)ks[2\alpha(s+c)-s],$$

as both left and right side terms of the inequation are strictly positive

$$[2\alpha(s+t(s+c))-(1+t)]^2\left[s^2k^2+4k\alpha wc(s+c)\right]>(1+t)^2k^2s^2[2\alpha(s+c)-s]^2,$$

developing terms and simplifying

$$[s(1+t)-\alpha(2(s+t(s+c))+c)]ks^2+[2\alpha(s+t(s+c))-s(1+t)]^2(s+c)w\geq 0,$$

and developing $[2\alpha(s+t(s+c))-s(1+t)]^2$ and grouping terms with respect to α this

$$L(\alpha)=4w(s+c)(s+t(s+c))^2\alpha^2+(1+t)ks^3+(s+c)ws^2(1+t)^2-\ldots$$

$$\ldots-\left[4s(1+t)(s+t(s+c))(s+c)w+s^2k(2(s+t(s+c))+c)\right]\alpha\geq 0,$$

$L(\alpha)$ is a convex parabola which reaches its minimum at

$$\alpha^g=\frac{s(1+t)}{2(s+t(s+c))}+\frac{[2(s+t(s+c))+c]ks^2}{8(s+c)w(s+t(s+c))^2},$$

and has two roots so that only one belongs to the interval $\left(\frac{s(1+t)}{2(s+t(s+c))},1\right)$ (we are analyzing the positivity of $L(\alpha)$ for $\alpha>\frac{s(1+t)}{2(s+t(s+c))}$), operating and simplifying this value is given by α^g. Therefore $L(\alpha)\geq 0$ for $\alpha\geq\alpha^g$. And $L(\alpha)<0$ for $k/w<\alpha<\alpha^g$

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SÍNTESIS

PRINCIPÁLES IMPLICACIONES DE POLÍTICA ECONÓMICA

En este trabajo se ensaya el efecto de una reforma fiscal que sustituye impuesto específico por impuesto sobre el valor añadido (IVA en adelante) en un modelo de equilibrio general con competencia imperfecta. Este tema ha sido profusamente tratado en Economía Pública bajo la perspectiva del equilibrio parcial concluyendo la pareto-dominancia del IVA sobre el impuesto específico bajo competencia imperfecta en cantidades. En otras palabras cuando en equilibrio parcial el impuesto específico es sustituido por un IVA se obtienen mejoras paretianas en forma de mayor excedente de los consumidores y aumentos en la recaudación fiscal. Otros efectos derivados de este tipo de reforma tienen que ver con variaciones en los beneficios y los precios. Por tanto este tipo de reformas genera efectos renta y retorno que la óptica del equilibrio parcial es incapaz de capturar, esta es precisamente la motivación del trabajo. Por tanto, se estudia el impacto neto sobre el bienestar que se deriva de una sustitución de impuesto específico por IVA mediante un modelo de equilibrio general con competencia imperfecta que capture no solo las variaciones en los precios sino, además, los efectos renta derivados de las variaciones en la recaudación (retorno) fiscal y los beneficios.

El modelo utilizado tiene tres sectores: las economías domésticas, el sector productivo y el sector público y está dotado exógenamente con una cantidad inicial de insumo primario, que podemos abstraer como tiempo disponible, a partir del cual las economías domésticas obtienen utilidad y las industrias trabajo. Este trabajo es utilizado para transformar los bienes mediante unas tecnologías con rendimientos crecientes (esto último permite además estudiar el efecto de la reforma en el largo plazo). Las empresas, en cada industria, están sometidas tanto a impuesto específico como IVA, recaudación que el sector público utiliza para financiar la compra de bienes en cada industria y que suministra gratuitamente a las economías domésticas. De esta forma, el retorno fiscal además tiene un papel expansivo en la demanda agregada. Ilustrando mediante un ejemplo: la industria editorial produce libros que son comprados por las economías domésticas para sus librerías privadas pero también son comprados por el sector público para las bibliotecas públicas. En este caso cuando el sector público compra libros no sólo suministra gratuitamente un bien (servicio) privado a los consumidores, sino que además aumenta la demanda agregada de esa industria. Establecido este marco, la política fiscal consiste en sustitución de impuesto específico por IVA. Esta política que llamamos reforma fiscal viene caracterizada en el modelo a través de una tasa de sustitución constante y permitirá caracterizar los resultados en función de dicha tasa.

Los resultados del trabajo se refieren a los dos tipos de equilibrios no competitivos que el modelo permite considerar: el equilibrio de Cournot, que es interpretado como la situación de corto plazo, y el equilibrio con libre entrada, que caracteriza el largo plazo.

En el caso del equilibrio de Cournot las principales conclusiones son:

1) Cualquier política fiscal que sustituya impuesto específico por IVA aumenta el producto total de la economía y disminuye el beneficio agregado de las industrias.
2) Que hay una tasa de sustitución umbral para la cual la reforma fiscal pasa de ser inflacionista a ser deflacionista.
3) Que la recaudación (retorno) fiscal puede aumentar o disminuir dependiendo de el valor de la tasa de sustitución fiscal, aún así siempre que la reforma fiscal es inflacionista la recaudación (retorno fiscal) aumenta.

Los resultados 1 y 2 contrastan con las conclusiones obtenidas en equilibrio parcial en donde la reforma fiscal siempre generaba menores precios y mayor recaudación.

En el caso de equilibrio con libre entrada las principales conclusiones son:

1) Cualquier política fiscal que sustituya impuesto específico por IVA disminuye el tamaño de equilibrio de las industrias.
2) Que en el largo plazo los precios aumentarán respecto del corto plazo para cualquier reforma, incluyendo las reformas que eran deflacionistas a corto plazo.
3) Que el producto total de la economía aumentará (disminuirá) en el largo plazo respecto del corto plazo dependiendo de si la propensión marginal al consumo es mayor (menor) que un valor umbral.

Con respecto al bienestar, medido mediante la función indirecta de utilidad de las economías domésticas, se obtiene el conjunto de efectos rentas que se querían medir. En concreto, el caso de equilibrio de Cournot la caída en el beneficio total de las industrias genera un efecto renta negativo que disminuye el bienestar, mientras que en el caso de el equilibrio con libre entrada este efecto negativo se materializa como consecuencia de la caída en el tamaño de la industria. En síntesis, y en contrate con los resultados de equilibrio parcial, se concluye que es posible encontrar reformas fiscales de sustitución de impuestos específico por IVA, en particular inflacionarias para las cuales el bienestar disminuye.

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