BALANCED BUDGET MULTIPLIER, IMPERFECT COMPETITION AND INDIRECT TAXATION*

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WP-EC 99-02

* I am grateful to G. Fernández de Cordoba, A. Castañeda and an anonymous referee for their helpful comments. The usual caveat applies.

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ABSTRACT

This paper presents a counter-example to some new-Keynesian features. In particular, by considering indirect tax rates, I obtain a negative and monotonically non-increasing relation between the magnitude of both the balanced budget and the welfare multipliers with respect to the market-power.

Keywords: Balanced Budget Multiplier, Imperfect Competition, Indirect Taxation 

RESUMEN

Este artículo presenta un contraejemplo a algunas propiedades neo-keynesianas de los modelos de equilibrio general con competencia imperfecta. En particular, para el caso de impuestos indirectos, se obtiene una relación negativa y monotona no-creciente para los multiplicadores con presupuesto equilibrado y del bienestar respecto del poder del mercado.

Palabras clave: Multiplicador con Presupuesto Equilibrado, Competencia Imperfecta, Impuesto Indirecto
1. Introduction

General equilibrium models with imperfect competition have been used as an explanation of some Keynesian features with fully flexible prices. In this way, papers like Hart (1982), Blanchard and Kiyotaki (1987), Dixon (1987) and Mankiw (1988), among others, explore the effect of different market-power settings on the macroeconomic multipliers, reaching a positive and monotonically increasing relationship between the balanced budget multiplier and market-power. A common setup of these models is such that the government can resort to lump-sum taxation to balance its budget. In this framework imperfect competition works as the only inefficiency source which generates a space for public intervention. This insight is supported on the basis that fiscal policy does not distort relative prices, though it could be not possible in practice. This statement questions whether these Keynesian features of the multiplier remain unchanged under distortionary tax schemes, or not. Within this trend, Molana and Moutos (1992) and Heijdra, et. al., (1998) find non-positive multipliers for labor income tax rates, whereas Torregrosa (1997) demonstrates that this multiplier can be monotonically decreasing, and even non-monotonically, with respect to market-power.

Considering this point of departure, this paper deals with the relationship between the balanced budget multiplier and market-power, for indirect (ad-valorem and excise) tax rates schemes, reaching another counter-example to the Dixon-Mankiw monotonicity result.

The paper is structured as follows: In section 2, the model is presented and both output and welfare multipliers are calculated in its general form. Sections 3 and 4 are devoted to develop these multipliers for both the ad-valorem and excise tax rates schemes respectively. Finally, section 5 concludes with the final comments.
2. The economy

Let us consider an economy formed by two commodities: leisure considered as the numéraire and a composed commodity produced from labor; \( n + 2 \) independent agents: the social representative consumer, the government and \( n \) non-competitive firms. The former two agents constitute the demand-side of the economy and the latter the supply-side, according to the following assumptions:

(i) Household preferences are represented by a separable utility function. On the one hand, a Cobb-Douglas sub-utility function over consumption of the produced good (C) and leisure (L) and, on the other, a sub-utility function over the public provided produced good (g)

\[
u(C,L,g) = C^{\alpha}L^{1-\alpha} + \beta(g),
\]

where \( \alpha \in (0,1) \); \( \beta(0) = 0 \), \( \beta' > 0 \) and \( \beta'' \leq 0 \). Calling \( T \) the endowment of time, \( p \) the price of the produced commodity, and \( \Pi \) the total profits of the firms. The household budget constraint is given by

\[
pC = T - L + \Pi.
\]

Consumer’s choice is related only to C and L. Then, the solution for the maximization of (1) subject to (2) is

\[
C = \alpha(T + \Pi)/p,
\]

\[
L = (1-\alpha)(T + \Pi).
\]

(ii) Government’s role is modeled in the usual Keynesian fashion: a indirect tax revenue (R) is used to resort the amount \( g \) of government purchases. Thus, given the price \( p \), the government budget’s constraint is
\[ R = pg = G. \]  

Adding equations (3) and (5), the total expenditure in the economy is given by

\[ Y = \alpha (T + \Pi) + G, \]

which represents demand-side economics.

(iii) The industry is formed by \( n \) non-competitive firms producing an amount \( q_j \) (\( j = 1,2,...,n \)) of output from labor. Without loss of generality, let us assume the simple constant returns technology \( q_j = N_j \) (\( N = \sum_{j=1}^{n} N_j \)). It is also assumed that labor market is competitive and firms' choices are independent, despite households are firm's owners. Then, the goal of the representative firm is to maximize,

\[ pq_j - q_j - R_j, \]

where \( R_j \) represents the amount of taxes levied on the \( j \)th firm and

\[ R = \sum_{j=1}^{n} R_j, \]

refers to the total tax revenue. Section 3 is devoted to the ad valorem tax rate case, where \( R_j = t_1 p(Q)q_j \) with \( 0 \leq t_1 < 1 \), while section 4 is concerned with the excise tax rate case \( R_j = t_2 q_j \), with \( t_2 \geq 0 \).

The first order condition for equation (7) can be written as,

\[ p(1 - \mu) = 1 + [dR_j/dq_j], \]
where \( \mu \in [0,1] \) is interpreted as a measure of market-power: when \( \mu \) tends to one firm behaves as monopolist (perfect collusion); when \( \mu \) tends to zero firms behave as Bertrand oligopolists (perfect competition); when \( \mu = \varepsilon/n \), where \( \varepsilon \) is elasticity of demand, firms behave a la Cournot. Finally, given the better firm's choice \( \hat{q}_j \) where fulfills equation (9), supply-side economics is represented by total output

\[
Q = \sum_{j=1}^{n} \hat{q}_j, \tag{10}
\]

and aggregate profits in the economy

\[
\Pi = \sum_{j=1}^{n} \Pi_j. \tag{11}
\]

Where \( \Pi_j = p(Q)\hat{q}_j - \hat{q}_j - R_j \) is the representative firm's profit in equilibrium.

Finally, general equilibrium requires the usual market clearing condition

\[
Y = pQ, \tag{12}
\]

which implies, according to equation (6), that

\[
Q = g + \alpha (T + \Pi)/p. \tag{13}
\]

Both \( \Pi \) and \( p \) depend on \( g \) due to equations (5), (7) and (8). Then, differentiating equation (13) with respect to \( g \), taking into account equation (3), the output balanced budget multiplier is

\[
\frac{dQ}{dg} = 1 + \frac{\alpha}{p} \frac{d\Pi}{dg} - \frac{C}{p} \frac{dp}{dg}. \tag{14}
\]
The increase in output due to an raise in government purchases is affected, first, by an income effect through the change in profits and, second, by a price effect that results from an increase in the tax rate needed to finance the higher government purchases.

Finally, it is interesting to study the effect on welfare of such a boost policy. Substituting equations (3) and (4) in equation (1), indirect utility function is obtained as,

\[ V(p, \Pi, g) = \gamma(T + \Pi)p^{-\alpha} + \beta(g), \]

where \( \gamma = \alpha^\alpha(1-\alpha)^{1-\alpha} \). Differentiating with respect to \( g \) and taking into account equation (3)

\[ \frac{dV}{dg} = \gamma p^{-\alpha} \left[ \frac{d\Pi}{dg} - C \frac{dp}{dg} \right] + \beta', \]

(15)

represents the impact of the balanced budget boost policy on welfare. As it can be observed, the positive effect on welfare due to a larger government purchases is diminished by the change in consumption. This change is motivated by price increase and the profits’ decrease, being both generated by the change in tax rate binding the government budget’s constraint. It is necessary to remark that this effect on welfare is opposed to the Keynesian features. This is because, according to Keynes, the balanced budget boost policy should not cause changes in welfare.

Next sections are devoted to compute these effects for both ad-valorem and excise tax rates.
3. Balanced budget boost policy under ad-valorem tax rates

In this case $R_j = tp(Q)q_j$ with $t \in [0,1)$. Thus, according to equation (9), the equilibrium price is

$$p = \frac{1}{(1-t)(1-\mu)}, \quad (16)$$

due to equations (5) and (8), equilibrium government purchases are

$$g = tQ \quad (17)$$

and aggregate profits in equilibrium are

$$\Pi = \mu Q/(1-\mu). \quad (18)$$

In order to compute the balanced budget multiplier defined in equation (14), the variations on profits and price of the balanced budget boost policy must be calculated. First, from equation (18),

$$\frac{d\Pi}{dg} = \frac{\mu}{(1-\mu)} \frac{dQ}{dg}. \quad (19)$$

Secondly, for variation on price, let us start computing the variation on the tax rate consistent with the government’s budget constraint given by equation (18), which is

$$\frac{dt}{dg} = \frac{1}{Q} \left[ 1 - t \frac{dQ}{dg} \right]. \quad (20)$$

Thus differentiating equation (16) with respect to $g$, and taking into account equation (20),
\[ \frac{dp}{dg} = \frac{p}{(1-t)} \frac{1}{Q} \left[ 1 - t \frac{dQ}{dg} \right]. \] (21)

Substituting equations (19) and (21) in equation (14) and operating, the output balanced budget multiplier equals zero, i.e., \( \frac{dQ}{dg} = 0 \). This means that a balanced budget boost policy has no effects on output (employment). The explanation of this total crowding out effect, under ad-valorem tax rates, is that the boost policy increases both government’s demand and price, in such amount that the decrease in consumption equals the increase in government’s demand. Hence, firms do not change neither its output level nor its profits (substituting the result about the multiplier in equation (19) \( \frac{d\Pi}{dg} = 0 \)). The effect on price is calculated differentiating equation (21) with respect to g, which is \( \frac{dp}{dg} = \frac{p}{(1-t)} \frac{1}{Q} > 0 \). This allows us to compute the effects of the balanced budget boost policy on the welfare. Then, substituting the multipliers in equation (15) taking into account equations (13) and (17) and operating, the following equality holds,

\[ \frac{dV}{dg} = \beta' - \gamma p^{1-\alpha}. \] (23)

As it can be seen, a balanced budget boost policy under ad-valorem tax rate affects welfare in two ways: a positive effect derived from the increase on the government purchases and a negative effect arising from the increase in price due to the increase in the tax rate. Finally, the way the effect of the balanced budget boost policy on the welfare changes with respect to the market-power can be computed differentiating equation (23) with respect to \( \mu \)

\[ \frac{d}{d\mu} \left[ \frac{dV}{dg} \right] = - (1-\alpha)\gamma p^{\alpha} \frac{dp}{d\mu}. \]

Since, according to equation (16), \( dp/d\mu = p/(1-\mu) > 0 \), the effect of the balanced budget boost policy on the welfare is monotonically decreasing with respect to the market-power.
4. Balanced budget boost policy under excise taxes

In this case \( R_j = t q_j \) with \( t \in [0,1] \).\(^1\) Thus, according to equation (9) the equilibrium price is

\[
p = \frac{(1+t)/(1-\mu)}{p}.
\] (24)

According to equations (5) and (8), equilibrium government purchases are

\[
g = tQ/p
\] (25)

and aggregate profits in equilibrium are

\[
\Pi = p\mu Q.
\] (26)

In order to compute the balanced budget multiplier defined in equation (14), the variations on profits and price of the balanced budget boost policy must be calculated. First, differentiating equation (26) with respect to \( g \),

\[
\frac{d\Pi}{dg} = \mu \left[ Q \frac{dp}{dg} + p \frac{dQ}{dg} \right].
\] (27)

Secondly, for variation on price, let us start computing the variation on the tax rate consistent with equation (25), that is

\[
\frac{dt}{dg} = \frac{1}{Q} \left[ g \frac{dp}{dg} + p - t \frac{dQ}{dg} \right].
\] (28)

\(^1\)Despite that \( t \) can be higher than one, it is assumed that \( t \leq 1 \). This condition is also compatible with the fact that household expenditure is higher than public expenditure. In fact, the ratio between public expenditure and total expenditure is given by, according to equations (12) and (17), \( G/Y = t/p \) and the ratio between household expenditure and total expenditure is given by, according to equations (2) and (6), \( pC/Y = 1 - t/p \). If \( \forall \mu \in [0,1] \) \( pC > G \) then, \( 1-t/p > t/p \). Using equation (24), it is hold that when \( \mu > (t-1)/2t \), but since \( \mu \geq 0 \) then, \( t \leq 1 \).
Thus, differentiating equation (24) with respect to \( g \), taking into account (28),

\[
\frac{dp}{dg} = \frac{p}{Q} \left[ 1 - t \frac{dQ}{dg} \right].
\]  

(29)

Substituting equations (27) and (29) in equation (14) and operating, the output balanced budget multiplier under excise tax rates can be written as

\[
\frac{dQ}{dg} = \frac{-(1-\alpha)\mu(1+t)^2}{(1-\mu)(1-\alpha\mu-(1-\alpha)\mu^2)} < 0,
\]  

(30)

since \( t \leq 1 \).\(^2\) It is interesting to know how the multiplier behaves with respect to market-power. For this purpose, let us call \( M(\mu) = \frac{dQ}{dg} \). Hence, differentiating equation (30) with respect to \( \mu \) and simplifying

\[
\frac{dM}{d\mu} = -\frac{M(\mu)}{\mu} \left[ 1 + \frac{\mu(\alpha + (1-\alpha)\mu)}{(1-\alpha\mu-(1-\alpha)\mu^2)} \right] < 0,
\]

i.e., for \( t \in [0,1] \), the balanced budget multiplier, \( M(\mu) \), is negative and monotonically decreasing with respect to market-power.

Finally, substituting equations (27) and (29) in equation (15) and simplifying, the effect of the balanced budget boost policy on welfare is given by

\[
\frac{dV}{dg} = \beta' \gamma p^{1-\alpha} \left[ 1 - \frac{(\mu+t)}{(1+t)} M(\mu) \right],
\]  

(31)

\(^2\)In the case that \( t > 1 \), \( \frac{dQ}{dg} \) loses its monotonicity finding a vertical asymptote in \( \mu^* = 1/(\alpha+(1-\alpha)t^2) \). But this case could be a misinterpretation of real economies. This is because \( t \) is expressed in units of leisure. Hence, \( t > 1 \) means an excise tax higher than the current wage. In the model this situation belongs to a benchmark where public expenditure is higher than household expenditure.
arising again two opposite effects. The first one is due to the more availability of public-providing amount g of the produced commodity. The second one is negative due to the increase in the tax rate necessary to resort additional government purchases, which is shifted to households through higher price and lower profits. Finally, differentiating equation (31) with respect to \( \mu \) we have

\[
\frac{d}{d\mu} \left[ \frac{dV}{dg} \right] =
\gamma(1-\alpha)p \cdot \alpha \frac{dp}{d\mu} \left[ 1 - \frac{(\mu+1)}{(1+t)} M(\mu) \right] + \gamma(1-\alpha)p \cdot \alpha \left[ \frac{M(\mu)}{(1+t)} + \frac{(\mu+1)}{(1+t)} M(\mu)' \right]
\]

which is negative because \( M(\mu) < 0 \) and \( M(\mu)' < 0 \). Then, the effect of the balanced budget boost policy on welfare is monotonically decreasing with market-power.

5. Conclusions

In this paper, both the monotonicity of the output (employment) multiplier and the effects on welfare of a balanced budget boost policy have been analyzed under the two main indirect tax rates. The results confirm the lack of regularity of the balanced budget multiplier in market clearing models with imperfect competition. For instance, under the ad-valorem tax rate scheme, output (employment) multiplier equals zero, which means that changes in public purchases have no effect on output, reaching a total crowding out effect for every level of market-power, conclusion which is similar to the reached by Molana and Moutos (1992) and Heijdra, et. al., (1998) for a distortionary income taxation. The explanation of this total crowding out effect in the model is that government boost policy increases the price through taxes. This increase yields a consumption falls in the same proportion the government increases its purchases. With respect to the effect on welfare of a boost policy this kind, it has been demonstrated that this effect is
negative and monotonically decreasing with respect to market power, pointing out a counter-Keynesian feature in welfare.

In the case of the excise tax rate, the results are related to market-power just in the opposite way to the conclusion reached by Dixon (1987) and Mankiw (1988). The output balanced budget multiplier is monotonically decreasing with respect to market-power, conclusion which is similar to the one reached by Torregrosa (1998) for a distortionary income taxation. With respect to welfare, like in the former case, the effect of a government boost policy is monotonically decreasing with respect to market-power.

In conclusion, Keynesian features attributed to the general equilibrium models with fully flexible prices and imperfect competition depend almost on the tax scheme considered. It is true that market-power causes inefficiency but it is also true that taxes, in general, do it too. In this sense, government is using an inefficient tool in order to amend an inefficiency. Thus, the consequence of an increase of public purchases do not drive the economy to a higher levels of output and welfare. On the contrary, as it has been proved, these magnitudes are dampened by such a boost policy and this effect is higher as higher is the market-power degree.
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