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UTILITY FUNCTIONS AND FISCAL ILLUSION FROM GRANTS***

J. PATRICK O'BRIEN* AND YEUNG-NAN SHIEH**

1. Introduction

THE theory of fiscal illusion from grants-in-aid evolved as an explanation to resolve an apparent conflict between microeconomic theory and empirical results in the area of local public finance. Specifically, receipt of lump-sum grants by a recipient government has been found to lead to increases in public expenditures by a greater amount than what would be expected given an equivalent increase in the community's income.¹ Initial inquiries into this phenomenon, invoking the notion of fiscal illusion on the part of voters/consumers, dealt strictly with the impact of unconditional grants on the behavior of recipient governments [Courant, Gramlich and Rubinfeld (1979), Oates (1979), and Winer (1983)]. Hewitt (1986) and Logan (1986) later extended the fiscal illusion model to the grantor government. They argued that grants cause not only a decrease in the perceived price of recipient government services, but also an increase in the perceived price of nonaid federal government services.

Given a general utility function, a public choice model, and the assumption that voters/consumers base their desired demand for public services on average tax prices, Hewitt (1986) explains by way of Proposition 1, as stated below, the existing empirical evidence with regard to the demand for services provided by a recipient government.

Proposition 1. The representative consumer/voter has a demand depicted by D , a tax price of t_c , and therefore desires LPG . With the introduction of grants, the person's perceived tax price falls to t_c and therefore the person desires LPG^* , which represents a movement along the demand curve. Hewitt (1986, pp. 473-474).

From Proposition 1 Hewitt formulates Hypothesis I.

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Hypothesis I: the receipt of intergovernmental grants (of any kind) will increase the demand for the services of a governmental unit. Hewitt (1986, p. 474).

On the other hand, the effect of grants on the demand for services provided by the grantor government is characterized by Proposition 2.

Proposition 2. If there are no grants, the typical consumer/voter will desire FPG ; with the introduction of grants the person will move up her demand curve and desire FPG^* . Hewitt (1986, pp. 474-475).

From Proposition 2 we have the following hypothesis:

Hypothesis II: when a government unit increases its level of intergovernmental grant disbursements, the demand for its services falls. Hewitt (1986, p. 475).²

Hypothesis I is well-known, and is the stuff of Courant et al. (1979), Gramlich (1977), Oates (1979), and Winer (1983). Hypothesis II is of a later vintage and is supported by the evidence presented in Logan (1986) and Hewitt (1986).

Propositions 1 and 2, however, apply only under conditions more restrictive than those specified by Hewitt. Furthermore, unless those conditions are satisfied, Hypotheses I and II cannot easily be deduced from these propositions.

The purpose of this paper is to reexamine the impact of grants on the demands for recipient and nonaid federal government services in a model more general than that used by Hewitt. It will be shown that in the presence of fiscal illusion the introduction of grants shifts the demands for recipient and nonaid federal government services as hypothesized by Hewitt if voters/consumers' utility functions are of the Cobb-Douglas type. However, if utility functions are of the Stone-Geary type, theory does not tell us whether the demands for recipient and federal government services should respond as hypothesized by Hewitt.³

2. The Model

For purposes of this analysis we have simplified Hewitt's model by making the

following assumptions. We assume all consumers/voters' responses are qualitatively in the same direction; therefore, a model with a typical consumer/voter captures the basic results of interest. We assume also that nonaid federal government services and recipient government services are normal goods. This assumption is supported by existing empirical evidence, e.g., Fisher (1988, pp. 284-295). Additionally, we assume a unitary per unit price for both recipient government services and nonaid federal government services.⁴ Following Logan (1986, p. 1312) and McGuire (1979, p. 44), we utilize a Stone-Geary type utility function, whereby the illusory model can be specified as:

$$\max U = b_0 \ln(Y_d - \gamma_0) + b_1 \ln(LPG - \gamma_1) + b_2 \ln(FGP - \gamma_2) \quad (1)$$

$$\text{subject to } Y = Y_d + \bar{t}_c LPG + \bar{t}_f FGP \quad (2)$$

where LPG = recipient government services, FGP = nonaid federal government services, \bar{t}_c = perceived consumer/voter recipient government tax share, \bar{t}_f = perceived consumer/voter federal government tax share, Y = real gross income, and Y_d = real private expenditures on market goods. Furthermore, $\bar{t}_c = (LPG - G_c)t_c/LPG$, and $\bar{t}_f = (FGP + G)t_f/FGP$, where t_c = actual consumer/voter recipient government tax share, t_f = actual consumer/voter federal government tax share, G_c = grant aid from federal government to recipient government, and G = total grant aid to all recipient governments. The b_i and γ_i ($i = 0, 1, 2$) are parameters with $b_0 + b_1 + b_2 = 1$.⁵ For simplicity, we abstract from income transfers such that $t_c G_c = t_f G$.⁶ A key feature of this model is that federal government grants result in both a decrease in the perceived price of recipient government services and an increase in the perceived price of nonaid federal government services.

Applying the Lagrange method to equations (1) and (2) and utilizing the resulting first-order conditions to solve for optimal quantities, we obtain the demand functions for private goods, recipient government services and nonaid federal government services as:

$$Y_d = (1 - b_0)\gamma_0 + b_0(Y - \gamma_1\bar{t}_c - \gamma_2\bar{t}_f) \quad (3)$$

$$LPG = (1 - b_1)\gamma_1 + (b_1/\bar{t}_c) \cdot (Y - \gamma_0 - \gamma_2\bar{t}_f) \quad (4)$$

$$FGP = (1 - b_2)\gamma_2 + (b_2/\bar{t}_f)(Y - \gamma_0 - \gamma_1\bar{t}_c) \quad (5)$$

Differentiating (4) and (5), we obtain the effects of grants on the demands for recipient government services and nonaid federal government services as:

$$\partial LPG/\partial G = -(b_1\gamma_2/\bar{t}_c)(\partial \bar{t}_f/\partial G) - b_1(1/\bar{t}_c)^2(Y - \gamma_0 - \gamma_2\bar{t}_f)(\partial \bar{t}_c/\partial G) \quad (6)$$

$$\partial FGP/\partial G = -(b_2\gamma_1/\bar{t}_f)(\partial \bar{t}_c/\partial G) - b_2(1/\bar{t}_f)^2(Y - \gamma_0 - \gamma_1\bar{t}_c)(\partial \bar{t}_f/\partial G) \quad (7)$$

where $(\partial \bar{t}_c/\partial G) < 0$ and $(\partial \bar{t}_f/\partial G) > 0$. Since $\bar{t}_c = (LPG - G_c)t_c/LPG$, an increase in G results in a decrease in the perceived tax price of recipient government spending. With additional aid a recipient government can increase services provided without levying additional taxes. If voters are unaware of the aid received, they perceive a reduction in the tax price of recipient government spending. Moreover, they perceive a rise in the tax price of grantor government nonaid services if the grantor government funds aid by reducing nonaid services or raising taxes. The first term on the right hand side of equations (6) and (7) is the cross-substitution effect, and the second term is the own price effect.

From (6), for example, we find that as G increases, the perceived tax price of recipient government services decreases, leading to an increase in the demand for local government services. This is the impact of the own price effect on the demand for recipient government services. On the other hand, the perceived tax price of grantor government nonaid services rises. The consumer/voter perceives, therefore, a drop in his real income, which has a depressing effect on the demand for recipient government services. In that the signs of the cross-substitution and own price effects are different, the signs of $\partial LPG/\partial G$

and $\partial FGP/\partial G$ can not be determined *a priori*.

From (6), however, we can conclude that

Proposition 1': an increase in federal government grants, which raises t_c , will cause the demand curve for recipient government services to shift in. On the other hand, it reduces t_f , which causes an increase in the amount of recipient government services demanded.

This result is quite different and more general than Hewitt's Proposition 1. It also implies that the derivation of Hypothesis I, as stated by Hewitt, requires an additional assumption about the relative strengths of the own price and cross-substitution effects associated with a change in G . Obviously, Hewitt neglected to consider the cross-substitution effect.

From (7), we can conclude that

Proposition 2': an increase in federal government grants, which reduces t_c , will cause the demand curve for nonaid federal government services to shift out. On the other hand, it raises t_f , which causes a decrease in the amount of nonaid federal government services demanded.

Again, this result is quite different from Hewitt's Proposition 2.

Proposition 1' can be depicted more clearly with the aid of Figure 1 which illustrates the effects of grants on the demand for recipient government services. Initially we assume the own price effect dominates the cross-substitution effect. With the introduction of grants, the consumer/voter's perceived price of nonaid federal government services increases to \bar{t}_f and the demand curve for recipient government services shifts inward to D^* . On the other hand, the consumer/voter's perceived price of recipient government services falls which represents a movement along demand curve D^* . The net effect is for the amount of recipient government services demanded to increase. However, if the cross-substitution effect dominates the own price effect, LPG^* would lie to the left of LPG' .

A similar figure could be shown to illustrate the effects of grants on the demand for nonaid federal government services. Again, we could assume the own price effect dominates the cross-substitution effect. With the introduction of grants, the consumer/voter's perceived price of

$$= (1 - b_0)\gamma_0 + b_0(Y - \gamma_1\bar{t}_c - \gamma_2\bar{t}_r) \quad (3)$$

$$G = (1 - b_1)\gamma_1 + (b_1/\bar{t}_c)$$

$$(Y - \gamma_0 - \gamma_2\bar{t}_r) \quad (4)$$

$$P = (1 - b_2)\gamma_2$$

$$+ (b_2/\bar{t}_r)(Y - \gamma_0 - \gamma_1\bar{t}_c) \quad (5)$$

Differentiating (4) and (5), we obtain the effects of grants on the demands for recipient government services and nonaid federal government services as:

$$\partial G/\partial G = -(b_1\gamma_2/\bar{t}_c)(\partial\bar{t}_r/\partial G)$$

$$-b_1(1/\bar{t}_c)^2(Y - \gamma_0 - \gamma_2\bar{t}_r)(\partial\bar{t}_c/\partial G) \quad (6)$$

$$\partial P/\partial G = -(b_2\gamma_1/\bar{t}_r)(\partial\bar{t}_c/\partial G)$$

$$-b_2(1/\bar{t}_r)^2(Y - \gamma_0 - \gamma_1\bar{t}_c)(\partial\bar{t}_r/\partial G) \quad (7)$$

where $(\partial\bar{t}_c/\partial G) < 0$ and $(\partial\bar{t}_r/\partial G) > 0$. Since $= (LPG - G_c)\bar{t}_c/LPG$, an increase in G results in a decrease in the perceived tax price of recipient government spending. With additional aid a recipient government can increase services provided without levying additional taxes. If voters are unaware of the aid received, they perceive a reduction in the tax price of recipient government spending. Moreover, they perceive a rise in the tax price of grantor government nonaid services if the grantor government funds aid by reducing nonaid services or raising taxes. The first term on the right hand side of equations (6) and (7) is the cross-substitution effect, and the second term is the own price effect.

From (6), for example, we find that as \bar{t}_c increases, the perceived tax price of recipient government services decreases, leading to an increase in the demand for recipient government services. This is the impact of the own price effect on the demand for recipient government services. On the other hand, the perceived tax price of grantor government nonaid services rises. The consumer/voter perceives, therefore, a drop in his real income, which has a depressing effect on the demand for recipient government services. In that the signs of the cross-substitution and own price effects are different, the signs of $\partial LPG/\partial G$

and $\partial FGP/\partial G$ can not be determined *a priori*.

From (6), however, we can conclude that

Proposition 1': an increase in federal government grants, which raises \bar{t}_c , will cause the demand curve for recipient government services to shift in. On the other hand, it reduces \bar{t}_r , which causes an increase in the amount of recipient government services demanded.

This result is quite different and more general than Hewitt's Proposition 1. It also implies that the derivation of Hypothesis I, as stated by Hewitt, requires an additional assumption about the relative strengths of the own price and cross-substitution effects associated with a change in G . Obviously, Hewitt neglected to consider the cross-substitution effect.

From (7), we can conclude that

Proposition 2': an increase in federal government grants, which reduces \bar{t}_c , will cause the demand curve for nonaid federal government services to shift out. On the other hand, it raises \bar{t}_r , which causes a decrease in the amount of nonaid federal government services demanded.

Again, this result is quite different from Hewitt's Proposition 2.

Proposition 1' can be depicted more clearly with the aid of Figure 1 which illustrates the effects of grants on the demand for recipient government services. Initially we assume the own price effect dominates the cross-substitution effect. With the introduction of grants, the consumer/voter's perceived price of nonaid federal government services increases to \bar{t}_r and the demand curve for recipient government services shifts inward to D^* . On the other hand, the consumer/voter's perceived price of recipient government services falls which represents a movement along demand curve D^* . The net effect is for the amount of recipient government services demanded to increase. However, if the cross-substitution effect dominates the own price effect, LPG^* would lie to the left of LPG^* .

A similar figure could be shown to illustrate the effects of grants on the demand for nonaid federal government services. Again, we could assume the own price effect dominates the cross-substitution effect. With the introduction of grants, the consumer/voter's perceived price of

recipient government services falls and the demand curve for nonaid federal government services shifts outward. On the other hand, the consumer/voter's perceived price of nonaid federal government services rises which represents a movement along the new higher demand. The net effect is that the amount of grantor government nonaid services demanded decreases. As in the case with the demand for recipient government services, however, it is important to note that this predicted change is predicated upon the dominance of the own price effect over the cross-substitution effect.

Finally, for the case in which $\gamma_0 = \gamma_1 = \gamma_2 = 0$, the demand functions for private goods, recipient government services and nonaid federal government services would be

$$Y_d = b_0Y \quad (3')$$

$$LPG = (b_1/\bar{t}_c)Y \quad (4')$$

$$FGP = (b_2/\bar{t}_r)Y \quad (5')$$

In this case, the demands for recipient government services and nonaid federal government services depend only on their own prices.

Therefore, for Hypotheses I and II to flow logically from Propositions 1' and 2', we must assume either that voters/consumers' utility functions are of the Cobb-Douglas type or that the own price effect of grants dominates the cross-substitution effect.

3. Conclusions

Ten years ago, Oates pointed out an apparent asymmetry between lump-sum grants and increases in private income. He stated that "Increases in income shift the demand curve outward . . . , while grants lower the price to the taxpayer-voter and produce a downward movement along his demand curve" (1979, p. 28). He further noted that

"increases in personal incomes to the members of a community are not equivalent, in terms of their bud-

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Recipient Government Services

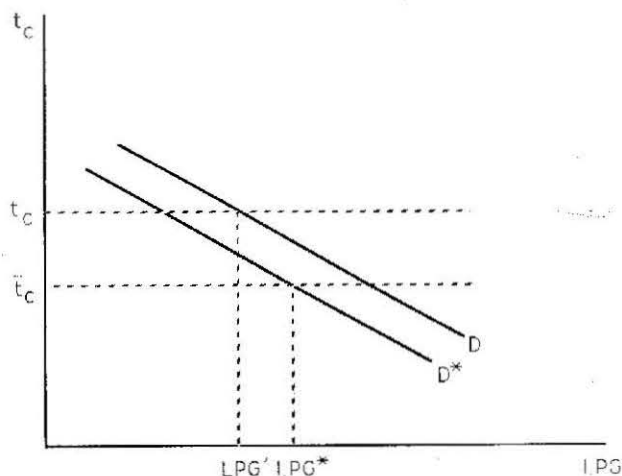


FIGURE 1.

getary effects, to an equal increase in lump-sum intergovernmental revenues because, although they may generate the same true budget constraint, they do not result in the same *perceived* budget constraint" (1979, p. 29).

This important proposition was based on a partial equilibrium model in which the fiscal illusion associated with federal government spending is ignored. Recently, Hewitt found that in a dual illusion model Oates' proposition that grants lower the price to the taxpayer-voter and produce a downward movement along his demand curve can be applied to both demands for recipient government goods and federal government goods.

In this paper, we show that in a dual illusion model the impact of grants on the demands for recipient government services and nonaid federal government services reflect two effects: (1) Grants change the perceived price of public goods and produce a movement along the demand curve; (2) Grants change the perceived price of recipient government services (nonaid federal government services) and shift the demand curve for nonaid federal government services (recipient govern-

ment services). These results are quite different from Hewitt's findings. We further show that the second effect, i.e., the cross-substitution effect, disappears if the utility function is of the Cobb-Douglas type. This indicates that Hewitt's results apply only as a special case.

ENDNOTES

***We are grateful to Professor Robert Logan and two anonymous referees for valuable comments and suggestions. Any remaining errors are strictly ours. Professor O'Brien's work was partially supported by a 1989 Summer Research Grant from the School of Management, UAF.

¹This phenomenon is referred to as the flypaper effect.

²Utilizing virtually the same theoretical framework, Logan (1986) formulated a similar hypothesis.

³It is of interest to note that the impact of grants on the demands for recipient and nonaid federal government services will be more ambiguous if utility functions are of a general type.

⁴In terms of Hewitt's framework we assume $P_r = 1$ and $P_f = 1$. As such, $\Sigma t_c = 1$ and $\Sigma t_f = 1$. These assumptions change the interpretation of t_c and t_f from the consumer/voter's tax prices per unit of recipient government and nonaid federal government services, respectively, to the consumer/voter's tax shares for the two public services.

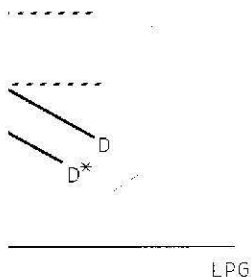
⁵See for instance Henderson and Quandt (1980, p. 38).

⁶In general, for an individual consumer/voter $t_c C = t_f G(1 + \alpha)$, where α is greater than, less than, or equal to zero. In the aggregate, however, α must be equal to zero.

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