Taxation

Refundable Tax Policies and Resource Management: A Decision Science Note

Working Paper #10

by

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I. Background

Policymakers are increasingly confronted with the mandate of designing policies to deter demand for energy and for other resources experiencing critical domestic shortage while simultaneously not accentuating the middle-class tax burden. Recently, suggestions have been made to use product-specific taxation programs to modify consumer behavior away from these resources while concurrently reinjecting the derived revenue to leave unchanged disposable income. These market tampering processes may be broadly characterized under the title of *Refundable Taxation Strategies*. In this note we will address the probable impact of a variety of refundable taxation strategies and employ a decision science paradigm to study the structural policy differences in such proposals for demand modification.

Refundable tax structures have recently been proposed to reduce gasoline consumption.[1] While the arguments of this paper are not restricted to such gasoline programs, we will employ this problem area as a narrative vehicle to construct our arguments in three distinct but progressive stages. Stage one will carefully model the full tax reimbursement scheme which assumes

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[1] Illustrative of this style of policy is a suggestion by Mr. John C. Sawhill of the Federal Energy Administration to collect a thirty-cent per gallon "fee" on gasoline and to rebate to each adult an initial $100 and an eventual $150 yearly refund; *Energy Users Report*, No. 60, A-22, October 3, 1974.

a fixed tax per gallon on all grades of gasoline for all consumers. Although this tax would then be fully refundable via the income tax mechanism, it will be argued that the economic statics of such a policy does not imply significant reductions in gasoline consumption. Stage two will demonstrate that if discount rate dynamic arguments enter the model it is reasonable to infer that while some demand reduction may be achieved, the significance of this impact is likely to be minor when compared with a parallel policy outlined in the next stage. Finally, we will address the question of the optimal style of such a tax refund program, if the Federal Energy Administration or any other governmental policy group desires to modify consumer behavior in a manner which reduces the demand for a specific set of materials while concurrently not hamstringing the average consumer budget. Specifically, we will construct a consumer behavioral model and derive a tax refund strategy which results in zero net tax revenue while decisively deflecting consumption patterns in a pre-specified manner. This strategy possesses similar political characteristics to the fully refundable method, while retaining economic incentives assuring the accomplishment of the demand modification.

II. Fully Refundable Tax Strategy: A Static Appraisal

A fully refundable tax strategy can be viewed in the static case as follows: Assume that the utility maximizing consumer purchases two goods; X, a composite commodity, and G, gasoline, at prices P_X and P_G, respectively. Further, he pays the tax τ per unit of gasoline and is fully reimbursed through an income tax refund in the current period. The problem is to

$$(1) \qquad \text{Max} \quad U(X,G)$$

$$\text{s.t.} \quad Y + \tau G = P_X X + (P_G + \tau)\, G,$$

from which it is obvious that the utility maximizing conditions are the same as if no tax refund strategy is imposed (i.e., τG drops out of the constraint). The consumer, therefore, is not expected via a static analysis to reduce gasoline consumption.

III. Fully Refundable Tax Strategy: A Dynamic Appraisal

The dynamic solution of the consumer to the fully refundable tax strategy suggests some reduction in gasoline consumption. Assuming prices, discount rate (r), tax rate, income, and the marginal utility of income to be constant over time, the first-order conditions to the dynamic solution, with positive tax and discount rates, suggest some reduction in gasoline consumption since the consumer discounts future satisfaction from refunds. Specifically, the problem is to maximize the discounted utility of the consumer subject to his discounted budget constraints. That is,

$$(2)\quad \text{Max } L = \sum_{t=1}^{n} (1 + r)^{-t} \{U (X_t, G_t) + \lambda[Y + \tau G_{t-1} - P_X X_t - (P_G + \tau)G_t]\},$$

where n is the planning horizon. This formulation suggests that

$$(3)\quad U_{X_t} / U_{G_t} = P_X / [P_G + \tau \ (r/1 + r)], \text{ where } t = 1, \ldots, n.$$

Hence, assuming traditionally shaped indifference curves, the consumer is induced to discriminate against the consumption of gasoline as long as the discount and tax rates are positive.

It can be observed that with either shorter reimbursement periods (e.g., current reductions from withholding tax) or interest received on the tax payments, the dynamic solution approximates the static case. Further the dynamic solution suggests that G_{t-1} tends to approximate G_t as t approaches infinity, since rebates increase as consumption rises but at a decreasing rate. Thus, the dynamic solution tends toward the static solution over time.

IV. Lump-Sum Tax Refundable Strategy

The basic flaw limiting gasoline consumption reduction in the previously described fully refundable tax strategy is that the decision rules (marginal conditions) are not significantly affected. However, a strategy can be found which both reduces gasoline consumption and retains the desired objective of no increase in overall taxes on consumers.[2]

Assume a tax on gasoline as described above. However, rather than fully refunding this tax to individual consumers, simply refund the tax through a non-individualized refund mechanism. Under this program, the choice problem facing the consumer is:

$$(4) \quad \text{Max} \quad U(X,G)$$
$$\text{s.t.} \quad Y + R = P_X X + (P_G + \tau)\, G,$$

where R is a lump-sum transfer to the consumer and is independent of his behavior. The first-order conditions for utility maximization are:

$$(5) \quad U_X = \lambda P_X$$
$$U_G = \lambda (P_G + \tau)$$
$$Y + R = P_X X + (P_G + \tau) G$$

and since

$$(6) \quad \frac{U_X}{U_G} = \frac{P_X}{P_{G} + \tau} < \frac{P_X}{P_G}$$

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[2] This policy family includes as a special case the above-mentioned Federal Energy Administration gasoline conservation measure.

suggests that for positive tax rates, consumption will be reduced by this strategy. Moreover, if total tax revenues equal total rebates, no increase in net taxes is required for this reduction in consumption.

One may suspect that this static solution may not be dynamically realized. In particular, the rebate R is nonconstant as aggregate rebates are adjusted to equal tax revenues; hence, these rebate (income) effects imply perturbations in the income available until the equilibrium refund level is reached. It can be shown, however, that the dynamic equilibrium solution implies the desired reduction in gasoline consumption as presented above. To visualize this, assume that aggregate refunds in the current period equal tax revenues of the previous period. The refund for each consumer may be considered independent of his gasoline consumption since his taxes are insignificant compared to total taxes and hence to total refunds. Therefore, assuming prices, tax rate, income and marginal utility of income to be constant over time and assuming R_t approaches R_{t+1} over time, the dynamic equilibrium choice problem is to

$$(7)\quad \text{Max } L = \sum_{t=1}^{n} (1 + r)^{-t} \{U(X_t, G_t) + \lambda[Y + R_t = P_X X_t - (P_G + \tau)G_t]\}$$

which results in the solution of

$$(8)\quad U_{X_t} / U_{G_t} = P_X / (P_G + \tau) \text{ where } t = 1, \ldots, n.$$

This is identical to the static decision rule derived in 6.[3]

[3]The stability of such a dynamic equilibrium is, of course, dependent upon the character of the consumer response pattern as well as the refund adjustment mechanism. These points are not addressed in this note.

V. Concluding Remarks

This note has addressed the broad question of constructing an optimal tax refund policy to modify consumer behavior in a manner that is determined to be in the interest of an overall national policy, while not further burdening the average citizen by extracting additional tax revenues. Fully refundable tax strategies have been shown to result in relatively minor and short-run effects, since their impact on gasoline consumption is based upon secondary response characteristics. We have then specified a lump-sum refundable tax strategy which satisfies both the political constraints of zero net tax revenues and the desired behavioral characteristics of significantly deflecting consumption patterns. While these theoretical predictions must be subjected to empirical measurement of their policy impact, we hope this note has served as a survey of the theoretical considerations which must be recognized by policymakers in structuring refundable tax strategies.