THE EFFECTS OF TAX-CUTS AND GOVERNMENT BONDS ON AGGREGATE DEMAND[*]

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I. INTRODUCTION

One of the most discussed issue in last decade is whether financing public expenditures make difference to the level of aggregate demand given that government expenditures are fixed.

The analysis of effects of fiscal deficits or government debt outstanding on consumption brought in several controversial theoretical and statistical results. Keynesian view implies that deficit financed tax-cuts raise disposable income, thereby stimulating aggregate demand. Ricardian Equivalence states that substitution of debt for taxes, for a given government expenditures and a constant population, does not affect the resource allocation between private investment and consumption in the economy. Individuals with rational expectations, according to Ricardian Equivalence, fully discount their increased tax liabilities. Therefore this equivalence is also known as "tax discounting hypothesis". If this hypothesis is true, an increased budget deficit or government debt outstanding created entirely by a current tax cut has literally no effect on interest rates, private investment and savings. Therefore government should realize that people with rational expectations will foresee the current and future government fiscal activities, hence should not have a policy of substitution of debt for taxes to change level of macro variables.

The purpose of this study is to investigate the assumptions and evidence of Ricardian Equivalence model. The plan of this study as follows. Section II explains the assumptions of and critiques to the Ricardian Equivalence. Section III gives the several empirical evidence from the econometric models in testing the Ricardian Equivalence that give controversial statistical implications.

II. EVALUATION OF THE MODEL

The term of Ricardian Equivalence comes from the statement that whether government taxes or borrows, the effect is the same, given that government expenditures are fixed. Today's borrowing will result in an increase in future taxes and the present value of borrowing of the government (present value of increase in future taxes) is equal to the increase in disposable income due to the tax cut. Therefore an infinitely-lived rational consumer does not consider government

bonds to be part of "net wealth".[1] Hence the individual will have this expectation of "equivalence":

$$B_t - E_{t-1}(B_t) = \sum_{i=0}^{\infty} R^{-i} \left[E_t(T_{t+i}) - E_{t-1}(T_{t+i}) \right]$$ (1)

Therefore consumption will be unchanged as a result of a tax cut, with given government expenditures. In order for this argument to hold, Ricardian Equivalence assumes that

1- The economy contains a representative individual with an infinite horizon.

2- Individuals borrow and lend at the same real interest rate as the government.

3- Future taxes are perfectly foreseen.

4- Taxes are lump sum.

5- Government expenditures are given.[2]

Robert Barro (1974, 1987 and 1989), a leading New Classical Economist, reintroduced Ricardo's (1951) idea in modern terms. Barro claims that an infinite-lived representative consumer can readjust his/her current consumption behavior by looking at outcomes of the government's current actions. For instance, if government runs a larger deficit by cutting current taxes, the consumer increases his/her saving, because today's tax cut generates an increase in the present value of future taxes. National saving remains the same, since an increase in private saving offsets the decrease in government saving. Therefore, in this analysis, a tax cut will not affect the consumption path, national saving and, hence, interest rates.

There are some objections to Ricardian Equivalence which can be summarized as follows:

1. Finite-lived consumers rather than infinitely-lived consumers. If the tax burden falls far in the future, then the present value of future taxes may be smaller than the increase in disposable income caused by a tax cut. This may motivate an increase in consumption.

Barro asserts that this argument may not hold true if the consumers take care of their children by leaving bequests for them. If parents have an altruistic behavior, they can leave their wealth to their children so that the budget constraint is not based on only one lifetime. Any increase in income because of a tax cut, hence, can be bequeathed to younger generations. As a result of bequests, then finite lives could convert to infinitive lives. This result, of course, is not realistic but rather an analytical convenience that has been commonly accepted as a tool in analyses that use the budget constraints.

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[1] Barro (1974).
[2] Barro (1989).

2. Liquidity constraints. In some cases consumers would like to spend more now, based on their future income, but they cannot reach this consumption level because of liquidity constraints or imperfections in financial markets. If the loan markets are imperfect, consumers who have liquidity constraints are not able to borrow to meet their consumption demand.[3]

Barro's answer is that there might be two groups. The first group, mostly large businesses, might have access to credit markets; whereas the second group consists of households and relatively low income consumers who do not have such access. The second group pays a higher interest rate, since loans to these people involve higher transaction costs. Then second group's discount rate is equal to its marginal borrowing rate, since its members equate their marginal rate of return on investment to their discount rate. An interest rate higher than the discount rate postpones today's consumption whereas a discount rate higher than the interest rate gives more weight to today's consumption. The government borrowing rate is equal to that of the first group, since together they dominate the credit market. Further, assume that the share of tax cut and future tax liabilities between the first and second group is equal. Since the second group's discount rate exceeds the interest rate, the present value of future tax liabilities (due to tax cut) of this group falls short of their share of tax cut. Therefore with a tax cut the second group increases its consumption. As its consumption increases, its discount rate (the marginal borrowing rate) will tend to decrease.[4] Therefore the second group will increase its demand for credit.

Hence, Barro states that a government issue of public debt can be a useful form of financial intermediation. The government can induce the first group to hold more than its share of the public debt. The second group, thus, holds less debt than its share and they obtain a kind of credit or loan from the first group after an increase in the second group's demand for investment. Thus loans between the first and second groups take place, although credit markets are imperfect.

3. Uncertainty. Martin Feldstein (1976) shows that when households are unsure about their future income levels, or because of the complexity in estimating the future tax liabilities, a current tax cut might result in an increase in consumption. Barro's answer[5] is that a deficit-financed tax cut does not have a real macro effect. In an economy with perfect credit markets, consumers want to hold extra debt, because they consider this extra debt as a perfect guarantee against the uncertainties of future taxes on incomes.

4. If taxes are not lump-sump. Andrew Abel (1986) points out that future taxes on capital income rather than labor income or progressive taxes on bequests induce consumers to increase their consumption. Ricardian Equivalence holds only if taxes are not distorting. A distorting tax can change the preference between working and leisure time by changing their relative prices. Therefore changes in marginal tax rates on income or on capital or any other form of taxes rather than lump-sum taxes are very likely to undermine Ricardian Equivalence.

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[3] Willem Buiter and James Tobin (1979).
[4] The first order conditions for optimization implies that the expected consumption exceeds the current consumption as long as the interest rate exceeds the discount rate.
[5] Barro (1989, pp. 214 - 215). See also Chan (1983).

III. EMPIRICAL EVIDENCE

There are several studies that call the Ricardain Equivalence into question. Martin Feldstein (1982) tests he effects of USA tax policy on consumption during the period 1930-1977.

$$C_t = b_0 + b_1 Y_t + b_2 W_t + b_3 SSW_t + b_4 G_t + b_5 T_t + b_6 TR_t + b_7 D_t + u_t \quad (2)$$

Where C is total consumption expenditure, Y is current income, W is the privately owned wealth, SSW is social security benefits, G is government expenditures, T is Total tax revenues, TR is transfers, D is Government debt. Ricardian Equivalence in this model implies five null hypotheses; $b_4 < 0$, $b_5 = 0$, $b_6 = 0$, $b_3 = 0$, and $b_2 = b_7$. He rejects the only first and third restrictions and is able to reject the second restriction only at 20 percent level. He concludes that a tax cut results in an increase in consumption, provided government expenditures are fixed, yet his statistical result in terms of second restriction does not reject the Ricardian Equivalence at conventional significance level. Therefore his statistical rejection of Ricardian Equivalence is controversial.

Lawrence Summers and James Poterba (1987) study the effects of tax changes of 1964, 1968, 1975 and 1981 on consumption behavior. He runs a test by the following equation for the period 1947:1- 1986:3 for USA.

$$C_t = \gamma_0 + \gamma_1 C_{t-1} + \gamma_2 \Delta Tax64_t + \gamma \Delta Tax68_t + \gamma \Delta Tax75_t + \gamma \Delta Tax81_t + u_t \quad (3)$$

Where C is consumption (Non-durable consumption, consumption of services and total consumption), $Tax64_t$ is tax cut in 1964, $Tax68_t$ is tax shock due to Vietnam War, $Tax75_t$ is tax rebate in 1975, $Tax81_t$ is tax cut during Reagan administration. He finds statistically significant and positive coefficients from the equation indicating that consumption changes when tax collection changes. Therefore the estimation results are against Ricardian Equivalence.

B. Douglas Bernheim (1987) uses a broad empirical consumption function to study macro effects of the fiscal variables on the level of consumption. He shows the existence of a close relationship between the deficit and aggregate consumption. He summarizes some studies that use data mainly for the USA, and finds that a deficit gives rise to a consumption increase of $0.20 to $0.50 for every dollar of deficit increase. The regression he ran is

$$C_t = a_0 + a_1 (Y_t - T_t) + a_2 (T_t - G_t - rD_t) \\ + a_3 G_t + a_4 D_t + a_5 W_t + a_6 X_t + e_t, \quad (4)$$

where C_t is consumption, Y_t is national income, T_t is tax revenues, G_t is government spending, D_t is debt, W_t is private wealth, r is the interest rate, X_t is a vector of other exogenous variables at time t, and e is the stochastic error term. All variables are in aggregate levels. The first term is disposable income, the second is the government surplus. The null hypothesis is $\alpha_1 = \alpha_2$, which would hold under Ricardian Equivalence. In his cross-country analysis of several developed and developing countries, Bernheim finds statistically significant effects of deficits on consumption. By taking 12 and 6 year averages (1972-1983) for each country and running cross-sectional regressions he finds that a $1 deficit-

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financed tax cut causes an increase in aggregate consumption of \$0.33 to \$0.44. This result is also against Ricardian Equivalence.

Seator and Mariona (1985) include a permanent income variable in their consumption equation

$$C_t = b_0 + b_1 Y_t^p + b_2 (Y_t - Y_t^p) + b_3 G_t^p + b_4 (G_t - G_t^p)$$

$$b_5 AMTR + b_6 RS_t + b_7 RL_t + b_8 T_t + b_9 TR_t + b_{10} D_t + b_{11} SSW_t + u_t \qquad (5)$$

where C_t is real per capita consumption, Y_t^p is permanent income, Y_t is current income, $G_t^{p\bullet}$ is permanent government expenditures, G_t is current government expenditures, RS_t and RL_t are short and long term after-tax interest rates, $AMTR_t$ is the average marginal tax rate, T_t tax collections, D_t is the market value of government debt, TR_t is transfers and SSW_t is the social security wealth at time t. All variables are measured in real per capita values. The sample period is 1929 - 1975 (for USA).

They proxy permanent income Y_t^p with the normal level of income. Normal levels of income are the stochastic steady state values of real GNP (Y_t) computed from an ARIMA model for Y_t. Transitory income is calculated as the difference between real GNP and the permanent income, $Y_t - Y_t^p$.

Expected signs of the coefficients are $b_8 < 0 < b_9$, b_{10}, b_{11} and these fiscal variables are expected to be jointly insignificant on consumption . They find that the coefficients on T, TR, D and SSW are jointly and individually equal to zero. This finding supports the Ricardian Equivalence. Their explanation for sensitivity of consumption to temporary income is the liquidity constraint. If there is a liquidity constraint, individuals who face it would be able to increase their consumption if government reduced current taxes and raised future taxes. But this also implies failure of Ricardian Equivalence. Their results are, however, consistent with Ricardian Equivalence by finding insignificant effects of fiscal variables on consumption. Although they use permanent components of income and government expenditures, they take into account only the current values of these fiscal variables tax revenue, transfers, debt, social security wealth in testing the Ricardian Equivalence. Besides, the main criticism of studies indicated above is that they do not take into account intertemporal utility maximization and rational expectations. Results from a consumption function that does not use expectations can not be consistent with the individuals utility functions that are maximized with respect to their budget constraints.

These test results have been controversial in terms of either statistical results or different theoretical and econometric models applied to the consumption function. In testing Ricardian Equivalence, one can conduct relatively more efficient econometric model that employs both current and lagged values of fiscal variables and income with zero innovations. The important point is to see whether effects of tax, government debt and income on consumption come from innovations or predicted parts of these variables. Therefore Ricardian Equivalence

can be tested by an equation below take takes into rational expectations and both employs current and lagged predicted values of the variables.

$$\Delta C_t = k + \psi + \alpha_{11}\Delta Y_t + \alpha_{12}L\Delta Y_t + \alpha_{13}L^2\Delta Y_t + \alpha_{14}L^3\Delta Y_t + \alpha_{21}\Delta T_t + \alpha_{22}L\Delta T_t + \alpha_{23}L^2\Delta T_t + \alpha_{24}L^3\Delta T_t + \alpha_{31}\Delta B_t + \alpha_{32}L\Delta B_t + \alpha_{33}L^2\Delta B_t + \alpha_{34}L^3\Delta B_t + n_t \tag{6}$$

ψ stands for revisions in future income (Y), bonds (B) and taxes (T) due to innovations in current variables and L is lag operator. Dynamic multipliers that can be obtained from a moving average representation of a VAR of order four are the unexpected parts or innovations in these variables. Ricardian Equivalence implies that α_{21} and α_{31} are jointly equal to zero.

$$\Delta C_t = b + \alpha_{11}[[(a_{11}-1)L + a_{12}L^2 + a_{13}L^3 + a_{14}L^4)] Y_t + (b_{11}L + b_{12}L + b_{13}L^3 + b_{14}L^4)T_t + (c_{11}L + c_{12}L^2 + c_{13}L^3 + c_{14}L^4) B_t] + \alpha_{12}L\Delta Y_t + \alpha_{13}L^2\Delta Y_t + \alpha_{14}L^3\Delta Y_t + \alpha_{21}[(a_{21}L + a_{22}L^2 + a_{23}L^3 + a_{24}L^4)Y_t + [(b_{21}-1)L + b_{22}L^2 + b_{23}L^3 + b_{24}L^4)]T_t + (c_{21}L + c_{22}L^2 + c_{23}L^3 + c_{24}L^4)B_t] + \alpha_{22}L\Delta T_t + \alpha_{23}L^2\Delta T_t + \alpha_{24}L^3\Delta T_t + \alpha_{31}[(a_{31}L + a_{32}L^2 + a_{33}L^3 + a_{34}L^4) Y_t + (b_{31}L + b_{32}L^2 + b_{33}L^3 + b_{34}L^4) T_t + [(c_{31}-1)L + c_{32}L^2 + c_{33}L^3 + c_{34}L^4)] B_t] + \alpha_{32}L\Delta B_t + \alpha_{33}L^2\Delta B_t + \alpha_{34}L^3\Delta B_t + v_t \tag{7}$$

where $b = k + \alpha_{11}m_1 + \alpha_{21}m_2 + \alpha_{31}m_3$

and $v_t = \psi + n_t + \alpha_{11}u_{1t} + \alpha_{21}u_{2t} + \alpha_{31}u_{3t}$

The m_1, m_2, m_3 (constants) and u_{1t}, u_{2t}, u_{3t} (innovations) are obtained from the VAR system of order four. The problem with this test in eq.(6) is that ΔC_t might respond to innovations rather than the predicted parts in $L^0\Delta Y_t$, $L^0\Delta T_t$, $L^0\Delta B$. Then such a response could be interpreted as failure of Ricardian Equivalence. This, however, would be wrong interpretation. Therefore, in testing equivalence using data for USA, UK and Turkey for period 1970-1993, I will first decompose $L^0\Delta Y_t$, $L^0\Delta T_t$, $L^0\Delta B$ into innovations and predicted parts by using the a VAR system of order four, and then use only predicted parts in which innovations are zero in eq.(7) above. Considering eq.(7) as an unrestricted system, I then run excess sensitivity test as follows:

$$\Delta C_t = b + \alpha_{11}[[(a_{11}-1)L + a_{12}L^2 + a_{13}L^3 + a_{14}L^4)] Y_t + (b_{11}L + b_{12}L^2 + b_{13}L^3 + b_{14}L^4)T_t + (c_{11}L + c_{12}L^2 + c_{13}L^3 + c_{14}L^4)B_t] + \alpha_{12}L\Delta Y_t + \alpha_{13}L^2\Delta Y_t + \alpha_{14}L^3\Delta Y_t + v_t \tag{8}$$

The degrees of freedom and the levels of significance are in parenthesis in the table. The null hypothesis is that H_0: $\alpha_{21} = \alpha_{22} = \alpha_{23} = \alpha_{24} = \alpha_{31} = \alpha_{32} = \alpha_{33} = \alpha_{34} = 0$, in eq.(8). The F statistic results given by table below indicates that the null hypothesis is accepted for Turkey, UK and the USA at 0.05 level. Therefore Ricardian Equivalence holds in all three cases.

Turkey	UK	USA
F(8,7) 0.575	F(8,7) 0.428	F(8,5) 0.488
(0.772)	(0.870)	(0.824)

IV. CONCLUSION

Ricardian Equivalence states that the choice between tax-cuts and debt finance have no effect on resource allocation between private investment and consumption in the economy, for given government expenditures.

Studies of this statement yield controversial results. This controversy may arise simply the fact that the testing models employ different variables. In testing the equivalence, the data or sample period by itself may cause statistical rejection (acceptance) at a certain level of significance, although theory is correct (wrong). Or failure of Ricardian Equivalence may originate in structure of economies under study, i.e., imperfect credit markets. The result from a model that use both contemporaneous and lagged values of variables indicates that Ricardian Equivalence holds. If this statistical result is true, government deficits or debt outstanding due to tax-cuts are irrelevant to alter the levels of investment, savings and aggregate demand, for given government expenditures.

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