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THE EFFECTS OF FEDERAL GOVERNMENT

DEFICITS AND DEBT

Robert Lawrence Arnold

Honors Thesis

May 6, 1986

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1. INTRODUCTION

The economic issue receiving the most attention in the popular press in recent years has been the effects of government deficits and the resulting debt on the economy. With federal government deficits of approximately $180 billion for the past three years and a debt that is approaching two trillion dollars it is imperative that their effects upon output, investment and inflation are understood. Within the school of Classical economic thought there are two opposing views on this issue. Within the Classical macroeconomic system, deficit spending is a strong stimulus to consumption which boosts output. This model also shows that bonds issued by the government to finance the deficit compete with private debt for investment funds thus raising interest rates and crowding out private investment. With a minor modification, the Classical system displays a quality that is known as the Ricardian equivalence theorem. It is simply the notion that the bonds issued to fund a government deficit are not perceived as net wealth in the aggregate so that consumption and interest rates are unaffected. The economy willingly holds government bonds in order to offset future taxes so that deficit spending has no effects on interest rates, the level of private investment or on inflation.

The purpose of this paper is to econometrically examine data from the United States time series to determine whether the Ricardian equivalence theorem is valid. The effects of government deficits and the outstanding stock of government debt upon the levels of saving and consumption are tested on data spanning the years 1929 to 1984.

The first section of the paper looks at the theoretical implications of deficit spending by the government. First, the Classical model is described and the theoretical effects of government deficits are derived. Second, the model is modified so that consumers perceive the future taxes implied by current deficits. This alteration makes the Ricardian equivalence theorem operative and its effects on the economy are then described.

The second section of this paper is an empirical investigation into the validity of the Ricardian doctrine. First, the life cycle model presented in Barro (1978) which is used in this econometric investigation is described. Second, improved data that has recently become available is presented. It makes several studies that were done previously on this topic out of date so the conclusions of Barro (1978) and Tanner (1979) are examined and updated. Third, modifications are made to the basic model to test various hypotheses about the effects of government deficits and debt. Finally, conclusions are drawn on how deficits affect the economy and on the validity of the Ricardian hypothesis.

2. THEORY

In order to understand what effects may be expected from government deficit spending, it is necessary to examine the relationships that exist in our economy. The Classical economic model provides good insight into the effects of government deficits. It is a model in which agents are infinitely lived and in which they seek to maximize their lifetime utility. One prominent aspect of this model is that all markets clear. More specifically, wages and prices are not sticky.

2.1 CLASSICAL MODEL

The classical system is listed below:

1.)	$W/P = F_n(K,N)$	Real wages equal the marginal product of labor
2.)	$N = N(W/P)$	Labor supply is a function of the real wage
3.)	$Y = F(K,N)$	Output equals the production of firms which use capital and labor
4.)	$C = C(YD, R - \pi)$	Consumption is a function of output and the real interest rate
5.)	$I = I(q - 1)$	Investment is a function of the rate of return on capital
6.)	$Y = C + I + G + \delta K$	Output is used for consumption, investment, government expenditures and to replace depreciated capital
7.)	$M/P = m(R,Y)$	The demand for real money balances is a function of the nominal interest rate and the level of output

The variables used in this system are defined as follows, with all exogenous variables, those variables that are determined outside of the system, preceded by an asterisk:

Household Variables

YD	=	Perceived disposable income
C	=	Consumption expenditures
S	=	Saving

Government and Monetary Variables

* G	=	Government expenditures
* T	=	Lump–sum taxes
B	=	Stock of outstanding government bonds
* M	=	Stock of money
P	=	Price level
R	=	Nominal rate of interest on bonds
* π	=	Expected rate of inflation

Business variables

Y	=	Level of production, level of income to households
* K	=	Capital stock
N	=	Amount of employed labor
MPK	=	Marginal product of capital
q	=	gap between marginal product of capital and the rate of return on capital
* δ	=	Depreciation rate of capital

2.2 SOURCES AND USES OF DISPOSABLE INCOME

A very important concept within the Classical framework is that of perceived disposable income, YD. Its components are income, Y; depreciation of the capital stock, δK; taxation by the government, T; changes in real obligations of the government to the public due to inflation in the form of real money balances, $[M/P]\pi$ and the real stock of government debt, $[B/P]\pi$; expected increases in equities, $q*dK/dt$; and the rate of capital formation, dK/dt.

The relationship takes the form:

$$YD = Y - \delta K - T - [(M + B)/P]\pi + (q - 1)dK/dt$$

In this formula, the government controls T, M and B while π and δ are also exogenous. It can readily be seen that an increase in taxes will reduce disposable income with all other variables held constant. Also, a rise in the real stock of government bonds will decrease YD so long as expected inflation is positive.

Households divide disposable income among consumption and saving so that:

$$C + S = YD$$

The allocation of the income flow between saving and consumption is influenced by the the real rate of return on bonds which is given by taking the nominal interest rate minus the expected inflation rate. So the consumption and saving functions are:

$$C = C(YD, R - \pi)$$
$$(+) \quad (-)$$
$$S = S(YD, R - \pi)$$
$$(+) \quad (+)$$

2.3 INVESTMENT

Investment is the change in the capital stock over time:

$$dK/dt = I = I\{(MPK + \delta - (R - \pi))/(R - \pi)\}$$
$$I' > 0$$

Where we define:

$$q = (MPK + \delta - (R - \pi))/(R - \pi) + 1$$

So investment is a function of q:

$$I = I(q - 1)$$

As the the Marginal Product of Capital plus the depreciation rate rises above the real rate of interest, investment increases.

Investment and saving are related through substituting the national accounting identity,

$$Y = C + I + G + \delta K$$

into the consumption and saving function,

$$C + S = YD = Y - T - \delta K + (q - 1)I.$$

which yields,

$$G - T = S - I$$

This equation shows that the government deficit, G − T, is equal to the gap between household saving and business investment. From this relationship we may deduce that investment is affected by deficit spending only if saving is increased by less than the amount of the deficit.

The government budget constraint is:

$$G = T + (dB/dt)/P + (dM/dt)/P,$$

This identity shows that the government may support its expenditures through a combination of taxation, bond issues or by printing money. So the relationship between the government deficit and the gap between saving and investment can be written as:

$$G - T = (dB/dt)/P + (dM/dt)/P = S - T$$

Once again, this relationship shows that saving must rise by the exact amount of the government deficit for investment to be unaffected.

2.4 EFFECTS OF A GOVERNMENT DEFICIT

By taking the derivatives of the interest rate with respect to government expenditures and the level of taxation, it can be determined whether government deficit spending crowds out investment within the context of the Classical model. The derivative of the nominal interest rate with respect to taxation is negative ($dR/dT < 0$) and the derivative of investment with respect to taxation is positive ($dI/dT > 0$)[1]. These results show that if government expenditures are maintained at a given level and taxes are reduced, thus creating a deficit, the nominal interest rate rises and investment decreases. The Classical model therefore has the characteristic that government deficit spending due to reduced taxes raises the nominal interest rate and crowds out private investment.

The same results hold if the government maintains the current level of taxation and increases its expenditures. Sargent's work shows that the derivative of the nominal interest rate with respect to government expenditures is positive ($dR/dG > 0$) and the derivative of investment with respect to government outlays is negative ($dI/dG < 0$).

[1] See Sargent (1979) page 23 for derivation.

Now, as before, when a deficit is run by leaving taxation unaltered and increasing government expenditures, the interest rate rises and investment falls. It can be concluded that within the Classical model a government deficit raises the nominal interest rate and crowds out private investment whether it is due to a decrease in taxation, an increase in government outlays, or both.

2.5 INTEREST RATES AND INFLATION

The behavior of interest rates deserves further comment. The nominal interest rate, R, is made up of two components, the real rate of return on investments, r, and the inflation expectation, π. The relationship is:

$$R = r + \pi + r*\pi$$

Because the expected inflation component of the nominal interest rate is exogenous in that it was determined in a previous time period, the relationship between the nominal interest rate and government policy that was discussed previously is due to the real rate of interest responding to government policy.

To investigate how inflation expectations may adjust to forecasted government deficits, an understanding of how the price level responds to other variables is necessary. First, the price level will rise in response to a higher interest rate[2]. Second,

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[2] Sargent [1979] page 27.

the price level rises in response to the printing of money. Inflation expectations can be affected by forecasted government deficits through both channels. Because, a deficit raises the interest rate and the higher interest rate implies a rise in the price level, a forecasted deficit will drive rational economic agents to raise their expectations of inflation for that period to take into account the higher price level. Additionally, if households foresee that deficit spending that will be financed partially or wholly with the printing of money, they will raise their expectations of inflation for that period.

The higher inflation expectation due to a forecasted government deficit has further ramifications for the economy. As described previously, the deficit will, according to the Classical model, affect the price level. So rational households will adjust their expectations of inflation to take this information into account. Therefore when a deficit is forecasted, the inflation component of the nominal interest rate will be higher than if the deficit is unexpected. This relationship implies that more crowding out of private investment will take place if a deficit is expected than if it is unexpected.

2.6 THE RICARDIAN EQUIVALENCE THEOREM

If the formulation of perceived disposable income is modified to include the present value of the taxes implied by the outstanding stock of government bonds, then government deficits cease to have any effects on investment, the interest rate or the price level. In this case, households view the bond stock as a form of wealth, as they did previously, but now this positive wealth is offset by the taxes that will be levied when the bonds mature. This line of argument is the Ricardian Equivalence Theorem.

The Ricardian equivalence doctrine proports that people view the issue of government debt and current taxes as the same. It therefore denies any wealth effects from the issue of debt. People will willingly hold bonds in order to pay the higher future taxes implied by the deficit. An example serves to bring out the major points of the argument. If the government wishes to maintain its current level of expenditures and reduce taxes by $100 then a bond for that amount is issued. If that bond matures in one year, taxes of $100*(1 + R), where R is the nominal interest rate, must be raised on order to pay back the holder. The holder of the bond will receive $100*(1 + R) from the government which will exactly offset the additional taxes he will have to pay. Similarly, if the bond matures several periods in the future, the tax payer will save $100 in current taxes, but will need to pay $100*(R) in taxes to offset the interest payment on the bond in each period before it matures and $100*(1 + R) in the period of maturity. All of these higher future taxes can be exactly offset by buying a government bond. For this reason, the Ricardian equivalence doctrine states that all government bonds are willingly held without crowding out private investment and are not perceived as net wealth by the public.

Aggregate demand is, in this case, unaffected by bond financed deficits because perceived disposable income remains unchanged. The positive wealth of the increase of government obligations to the public in the form of bonds is exactly offset by the negative wealth of the present value of the future taxes implied by those bonds. The level of saving will rise by the amount of the deficit which will leave the level of private investment intact. Additionally, because aggregate demand is unchanged, the price level and the interest rate also remain unchanged. In this special case, where the

Ricardian Equivalence Theorem is active, deficits and taxes are viewed as equivalent so deficit spending has no wealth effects, nor does it crowd out private investment.

3. EMPIRICAL INVESTIGATION

3.1 DESCRIPTION OF ROBERT BARRO'S CONSUMPTION MODEL

The empirical model set forth by Barro[3] is a permanent income model that attempts to include economic variables which influence the consumption versus saving decision by their effects not only on present income, but also on future expected income. The variables included are: consumption, personal disposable income, corporate retained earnings, the government surplus, a weighted measure of the unemployment level, the capital stock, and the durable goods stock. The permanent income approach directly takes into account the notion that people consider their future levels of income when deciding their amount of current consumption and saving. If they foresee lower income in the future, the present level of saving will be increased to allow a higher level of future consumption than would otherwise be enjoyed. On the other hand, if a higher level of future income is predicted, then current consumption may be raised.

The presence of each variable is justified by permanent income theory. Personal disposable income is the amount available in a year for consumption or saving. Its value can be thought of as cash in the pockets of consumers. A one period lag of its value is included in the regression to take account of people basing their estimate of future income on past levels of disposable personal income in addition to the present

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[3] Barro (1978)

level. Significantly positive coefficients on both verify that people predict future income given present and past disposable income. Corporate retained earnings is a form of saving that influences the level of future income. As its value rises, consumption should increase as consumers predict a rise in their next period income. The government surplus variable shows the amount current income is raised or lowered at the expense of future income. If the government engages in deficit spending (a negative value of the surplus variable) future taxes implied by the deficit will reduce future income. Therefore, the theory predicts that current saving will be increased during times of deficit spending in order to offset future taxes. The unemployment rate, weighted by multiplying its value by the level of disposable income, accounts for the cyclicality in the economy. For a given level of income, a high value of this variable indicates a higher level of future income. It indicates that as unemployment declines, as in the end of a recession, the future level of disposable income will rise. The capital stock reflects long-term accumulated economic wealth and the future expected production levels. The consumer durables stock represents short-term accumulated wealth. As its value rises, consumers may reduce current consumption due to a reduced need for present household investment.

Barro's model may be extended to include the stock of government debt. Its inclusion will allow tests to see if consumers treat the stock of debt as net wealth as they do the capital or durables stock. This modification and subsequent testing has been carried out by Seater (1984) and Tanner (1979) in previous studies. The test of whether consumers perceive the debt stock as net wealth is to see if the coefficient on the debt stock when included in the permanent income model is significant. In this

way, the test is the same as the one used by Barro (1978) and Feldstein (1978) to test whether Social Security wealth affects the consumption and saving decision.

Another extension of the model is to break the total government surplus or deficit into its federal and state and local government components. Additionally, the debt stock may be divided into its Federal and nonfederal components. These additional more specific measures will allow direct testing of the hypothesis that consumers treat State and Local deficit spending in a different manner than they do the Federal portion. Because State and Local deficits cannot be monetized, consumers may save a larger portion of this income in anticipation of higher future taxes.

3.2 SOURCES OF DATA

Data for the United States time series analysis was obtained from the most recently revised data presently available. The new data is more accurate than that used by Barro (1978) and Tanner (1979) and the re-estimated regressions fit the data better. The capital and durables stock measures used in the present study were released by the Commerce Department after the previous studies were completed. These series are far superior to those available to Barro and Tanner and this fact is displayed in much more significant coefficients appearing on both of these variables.

1.) National Income and Product Accounts of the United States,
1929 - 76
Statistical Tables.
Supplement to The Survey of Current Business
U.S. Department of Commerce
Bureau of Economic Advisors
September 1981.

2.) Business Statistics 1984, Summary NIPA Series, 1952 - 83
Survey of Current Business
August 1984.

3.) Economic Report of the President 1985.
U.S. Department of Commerce
Bureau of Economic Advisors.

4.) Fixed Reproducible Tangible Wealth in The United States,
1925 - 1979
U.S. Department of Commerce
Bureau of Economic Advisors.

5.) Fixed Reproducible Tangible Wealth in The United States,
1980 - 1983
John C. Musgrave
Survey of Current Business
August 1984.

6.) The Market Value of Outstanding Government Debt, 1919–1975
John J. Seater
Philadelphia Federal Reserve Bank Research Paper Number 49
June 1980

VARIABLE	YEARS	SOURCE (number corresponds to order above)
Consumption	1929 - 1952 1953 - 1983 1984	(1) pg. 1 (2) pg. 199 (3) Table B-14
Personal Disposable Income	1928 1929 - 1952 1953 - 1984	Barro pg. 12 & 13 (1) pg. 73 (2) pg. 221
Retained Earnings	1929 - 1952 1953 - 1984	(1) pg. 195 (3) Table B-82
Total Government Surplus	1929 - 1952 1953 - 1984	(1) pg. 195 (3) Table B-25
Durable Stock	1929 - 1980 1981 - 1984	(4) pg. (5) Table 17, Column 1
Capital Stock	1929 - 1980 1981 - 1984	(4) pg. (5) Table 2, Column 1 & Table 6, Column 2
Population	1929 - 1945 1946 - 1984	(1) pg. 393 (3) pg.
Unemployment Rate	1929 - 1949 1950 - 1984	Barro pg. 12 & 13 (3) Table B-33
Consumption Deflator	1929 - 1952 1953 - 1984	(1) pg. 345 (2) pg. 212
Durable Purchases Deflator	1929 - 1952 1953 - 1984	(1) pg. 345 (2) pg. 212
State and Local Government Debt	1929 - 1976	(6) pg. 5 MVSL series converted to beginning of year figures
Total Government Debt	1929 - 1976	(6) pg. 5 MVTOTG1 series converted to beginning of year figures
Federal Government Debt	1929 - 1976	(6) MVTOTG1 minus MVSL converted to beginning of year figures
State and Local Government Surplus	1929 - 1976 1977 - 1984	(1) pg. 195 (3) table B-25
Federal Government Surplus	1929 - 1976 1977 - 1984	(1) pg. 195 (3) table B-25

SERIES CONSTRUCTION

C	=	Per Capita Personal Consumption Expenditures
YD	=	Per Capita Disposable Personal Income
RE	=	Per Capita Corporate Retained Earnings
SUR	=	Per Capita Total Government Surplus or Deficit
U*YD	=	Unemployment Rate Multiplied By YD
DUR	=	Per Capita Stock of Consumer Durables
K	=	Per capita Stock of Private Residential & Business Capital
StDebt	=	Per capita Stock of State and Local Debt
FedDebt	=	Per capita Stock of Federal Debt
Debt	=	Per capita Stock of Government Debt
StSUR	=	Per capita State and Local Government Surplus
FedSUR	=	Per capita Federal Government Surplus

C, YD, RE, SUR, StSUR and FedSUR were constructed by dividing the yearly current dollar values by the population and then deflating the figures to 1958 dollars using the implicit deflator for consumption. U*YD is the unemployment rate multiplied by YD. DUR, K, StDebt, FedDebt and Debt were converted from end of year figures to beginning of the year. The population deflator used was the average of the previous year and current year population. DUR was converted to 1958 dollars using the implicit price deflator for durable purchases while K, StDebt, FedDebt and Debt were deflated using the consumption deflator.

PER CAPITA 1958 VALUES

YEAR	C	YD	RE	SUR	U*YD	DUR	K
1929	1146.2	1222.6	27.9	14.6	39.1	571.1	2683.0
1930	1058.9	1117.9	-7.8	-4.8	98.4	587.0	2782.1
1931	1017.1	1070.5	-56.2	-48.5	173.4	676.4	2927.9
1932	919.4	921.9	-89.9	-33.2	221.3	621.8	2878.4
1933	897.7	892.9	-84.4	-27.1	216.1	557.6	2640.0
1934	933.2	948.4	-44.3	-43.7	162.2	498.1	2444.2
1935	986.1	1034.2	-22.5	-35.7	158.2	496.1	2411.4
1936	1082.0	1157.0	-20.7	-54.8	115.7	490.6	2385.8
1937	1111.0	1183.1	-8.6	5.8	108.8	490.0	2425.1
1938	1080.4	1100.2	-7.8	-29.8	136.4	504.9	2610.4
1939	1133.3	1184.9	2.2	-36.8	132.7	501.8	2623.4
1940	1180.7	1253.1	29.8	-11.4	119.0	504.9	2621.9
1941	1243.2	1418.5	32.1	-58.1	82.3	509.7	2582.0
1942	1198.8	1578.2	49.2	-424.4	45.8	539.9	2505.0
1943	1213.7	1624.1	61.1	-538.7	24.4	556.3	2402.3
1944	1236.5	1664.7	69.4	-592.4	16.6	536.9	2342.6
1945	1305.8	1629.5	41.0	431.6	26.1	512.0	2339.1
1946	1442.7	1594.5	19.2	54.3	59.0	450.0	2309.9
1947	1440.6	1502.5	41.9	128.2	57.1	457.3	2478.0
1948	1448.1	1557.8	82.7	70.0	57.6	518.2	2826.3
1949	1461.5	1541.3	79.8	-27.6	87.9	590.2	3164.2
1950	1521.0	1636.6	57.2	63.4	85.1	639.4	3148.8
1951	1509.0	1647.1	55.3	44.2	52.7	712.5	3283.7
1952	1522.5	1667.3	57.5	-26.5	48.4	803.2	3491.8
1953	1563.8	1716.9	49.0	-47.0	48.1	846.8	3582.4
1954	1563.7	1704.9	55.7	-47.1	92.1	917.2	3649.6
1955	1647.6	1785.9	85.1	20.1	76.8	925.1	3745.2
1956	1661.3	1829.3	66.8	32.5	73.2	941.3	3898.4
1957	1668.8	1836.6	61.3	5.4	77.1	968.9	4026.4
1958	1655.4	1824.1	46.9	-72.0	120.4	999.2	4056.0
1959	1725.3	1878.5	76.6	-8.9	99.6	989.9	4073.9
1960	1747.5	1893.2	65.1	16.7	102.2	1008.8	4110.7
1961	1755.3	1916.6	65.5	-22.5	124.6	1010.1	4132.9
1962	1815.2	1976.7	93.0	-19.4	106.7	995.1	4157.7
1963	1865.7	2021.6	101.6	3.5	111.2	998.4	4210.9
1964	1943.3	2137.9	116.0	-11.2	106.9	1024.5	4236.7
1965	2035.9	2250.7	141.9	2.4	99.0	1067.2	4386.1

PER CAPITA 1958 VALUES

YEAR	C	YD	RE	SUR	U*YD	DUR	K
1966	2122.2	2343.9	146.0	-5.9	86.7	1112.2	4508.2
1967	2156.8	2410.2	130.6	-62.5	89.2	1184.2	4744.4
1968	2255.5	2492.9	117.2	-25.2	87.3	1243.2	4850.8
1969	2316.3	2543.7	92.0	39.4	86.5	1335.2	5090.6
1970	2338.1	2614.9	55.7	-39.9	125.5	1409.0	5326.5
1971	2392.8	2676.1	81.2	-69.1	155.2	1456.5	5488.4
1972	2505.0	2753.8	103.7	-11.2	151.5	1510.8	5711.9
1973	2585.9	2912.4	102.9	24.8	139.8	1589.3	5908.7
1974	2544.9	2860.7	38.4	-13.5	157.3	1635.1	6118.2
1975	2573.7	2889.3	76.7	-168.2	239.8	1718.3	6653.1
1976	2693.5	2967.0	91.7	-90.7	225.5	1760.6	6767.4
1977	2800.3	3055.2	124.9	-41.4	210.8	1818.6	6947.1
1978	2894.1	3168.2	133.7	1.7	190.1	1880.6	7306.1
1979	2939.8	3218.7	106.3	27.9	186.7	1961.6	7708.2
1980	2918.9	3200.3	56.2	-53.7	224.0	1998.4	7797.7
1981	2948.2	3255.3	67.4	-42.6	244.1	2073.8	7963.3
1982	2958.6	3250.2	43.5	-171.9	308.8	2116.9	8173.1
1983	3070.3	3332.6	108.9	-191.5	316.6	2136.4	8090.8
1984	3203.6	3524.3	158.1	-170.1	260.8	2233.6	8098.1

PER CAPITA 1958 VALUES

YEAR	StDebt	FedDebt	Debt	StSUR	FedSUR
1929	200.8	233.4	434.1	-2.9	17.4
1930	206.8	225.1	431.9	-9.0	4.3
1931	242.3	239.8	482.1	-12.6	-35.9
1932	267.0	269.5	536.5	-5.3	-27.9
1933	307.9	301.0	608.9	-1.4	-25.8
1934	274.0	296.5	570.5	8.2	-51.9
1935	298.0	315.1	613.1	9.8	-45.5
1936	309.4	288.9	598.3	8.6	-63.3
1937	323.3	375.5	698.8	11.7	-6.0
1938	297.5	377.6	675.1	6.2	-35.9
1939	319.1	439.2	758.3	0.5	-37.4
1940	331.0	503.3	834.3	10.6	-22.0
1941	341.6	543.5	885.1	19.9	-77.9
1942	296.2	654.5	950.7	24.0	-448.4
1943	251.9	1086.2	1338.0	30.1	-568.8
1944	227.4	1532.5	1759.9	30.5	-622.9
1945	210.5	1951.8	2162.3	28.1	403.4
1946	200.1	2317.4	2517.5	19.0	35.3
1947	176.3	1908.4	2084.7	9.0	119.2
1948	165.8	1651.0	1816.8	1.1	68.9
1949	180.7	1534.9	1715.6	-5.9	-21.6
1950	203.8	1516.3	1720.0	-9.5	72.9
1951	229.5	1421.0	1650.6	-3.2	47.4
1952	229.7	1207.0	1436.8	-0.3	-26.2
1953	235.5	1199.5	1435.0	1.0	-47.9
1954	254.7	1203.4	1458.1	-7.4	-39.7
1955	298.2	1207.3	1505.5	-8.3	28.4
1956	309.3	1181.2	1490.6	-5.5	37.9
1957	294.5	1073.9	1368.5	-8.1	13.4
1958	306.0	1054.9	1360.9	-13.5	-58.6
1959	306.9	1031.9	1338.8	-2.5	-6.4
1960	313.6	1026.5	1340.1	0.3	16.4
1961	358.3	1036.4	1394.7	-1.9	-20.6
1962	385.0	1027.6	1412.7	2.4	-21.8
1963	443.8	1035.8	1479.6	2.3	1.2
1964	461.0	1002.2	1463.2	4.8	-16.0
1965	500.9	988.9	1489.8	.0	2.4

PER CAPITA 1958 VALUES

YEAR	StDebt	FedDebt	Debt	StSUR	FedSUR
1966	491.6	934.3	1425.9	2.3	-8.2
1967	495.6	903.5	1399.1	-4.6	-57.8
1968	471.5	859.9	1331.4	0.4	-25.6
1969	465.0	854.3	1319.3	6.0	33.4
1970	369.4	762.2	1131.6	7.0	-46.9
1971	442.2	783.2	1225.5	9.2	-78.2
1972	484.9	783.7	1268.6	45.9	-57.1
1973	519.9	765.9	1285.7	42.7	-17.9
1974	512.6	674.4	1187.0	19.5	-32.9
1975	403.0	652.2	1055.3	14.4	-182.6
1976	397.6	814.7	1212.3	41.2	-131.8
1977	NA	NA	NA	65.1	-106.5
1978	NA	NA	NA	65.1	-63.4
1979	NA	NA	NA	59.3	-31.4
1980	NA	NA	NA	53.5	-107.3
1981	NA	NA	NA	60.0	-102.5
1982	NA	NA	NA	49.0	-220.9
1983	NA	NA	NA	62.8	-254.3
1984	NA	NA	NA	71.1	-241.3

The regression equation takes the form:

$$CONS_t = A_1 YD_t + A_2 YD_{t-1} + A_3 RE_t + A_4 SUR_t + A_5 UYD_t + A_6 K_t + A_7 DUR_t + e_t$$

3.3 REGRESSION RESULTS OF BARRO AND OF PRESENT STUDY

Time-Series Including 1929-1940 And 1947-1974

	YD	YDLAG	RE	SUR	UYD	K	DUR	R**2	ESS
A:	.80	.10	.20	.21	.40	.025	-.11	.999	5637
	(18.7)	(2.62)	(2.13)	(3.33)	(4.84)	(1.73)	(-7.87)		
	**	*	*	**	**	*	**		
B:	.79	.06	.12	.17	.29	.091	-.28	.999	7357
	(16.8)	(1.21)	(1.10)	(2.18)	(2.88)	(4.87)	(-8.89)		
	**			*	**	**	**		

Time-Series Including 1947-1974

	YD	YDLAG	RE	SUR	UYD	K	DUR	R**2	ESS
A:	.72	.18	.31	.23	.33	.023	-.092	.999	3688
	(10.4)	(2.97)	(2.37)	(3.33)	(2.81)	(1.40)	(-5.16)		
	**	**	*	**	*		**		
B:	.68	.16	.33	.21	.19	.082	-.229	.998	5693
	(6.8)	(1.90)	(1.87)	(2.22)	(1.06)	(3.41)	(-4.67)		
	**	*	*	*		**	**		

Time-Series Including 1929-1940 And 1947-1984

	YD	YDLAG	RE	SUR	UYD	K	DUR	R**2	ESS
B:	.82	.03	.26	.19	.43	.080	-.257	.999	13655
	(15.9)	(.55)	(2.44)	(2.83)	(4.07)	(4.73)	(-7.19)		
	**		*	**	**	**	**		

Time-Series Including 1947-1984

	YD	YDLAG	RE	SUR	UYD	K	DUR	R**2	ESS
B:	.70	.14	.51	.20	.37	.068	-.191	.999	11264
	(6.9)	(1.42)	(2.89)	(2.56)	(2.43)	(3.36)	(-3.67)		
	**		**	*	*	**	**		

A: Barro's results
B: Results using improved data
** = Significant at the 1% level
* = Significant at the 10% level

In comparing the regression results reported by Barro with those using the improved data series, several differences may be noted. In the analysis including observations from both before and after World War Two, the most apparent change is that the lagged value of disposable income and the retained earnings variable, which are both significant at the 10% level using Barro's data, are now insignificant even at the 20% level when the improved data is used. Additionally, the government surplus variable declined in significance from the 1% to the 10% level. The coefficients of both the capital and durable stock variables greatly increased in significance reflecting the superior series that were used in place of Barro's estimates. In comparing the magnitudes of the coefficients, it is interesting to note that they decline in all cases when the newer data is used except for those of the capital and durable stocks.

For the post war regressions, the differences are similar. The coefficients of all variables except for the capital and durables stock decline in magnitude when the improved data is used. Both the lagged personal disposable income variable and the government surplus decline in significance and UYD becomes completely insignificant even at the 20% level. Once again, the significance of the capital and durable stock variables increases reflecting the drastic improvement of these series.

Examining the effects of using the different sample periods reveals that the coefficients of YD, UYD, K and DUR decline when only the post World War Two data is used. Also the coefficients of YDLAG, RE and SUR increase when the smaller sample period is used. These results are true when either the improved data or that of Barro is used. Another notable observation is that when the newer data is used, both

YDLAG and RE are significant at the 10% level only when the shorter sample period is used. Additionally, UYD is reduced from a 1% level of significance to insignificance when the pre World War Two observations are omitted.

3.4 EFFECTS OF DEFICIT ON REGRESSION VARIABLES

Robert Barro's permanent income model uses three forms of income to explain consumption behavior in the United States. These measures, disposable personal income, the total government deficit and corporate retained earnings, represent total private sector resources that may be consumed or saved. Their relationship is expressed in the national income accounting identity, NNP − G = YD + SUR + RE, where NNP is the Net National Product and G is expenditures of the government sector. The left hand side represents the flow of resources available to the private sector while the right hand side shows the distribution of that flow between households, YD, corporations, RE and the amount that is due to the government surplus or deficit, SUR.

The national income accounting relationship that is used directly in Barro's study is C + S = YD + SUR + RE. In the previously reported regression results, the coefficients of the right hand side variables represent the propensity to consume out of each form of income. The capital stock and the stock of consumer durables are included as forms of tangible wealth that also influence consumption.

To the extent that the coefficients of YD, RE and SUR differ, the government may affect the level of consumption by increasing or decreasing taxes thus changing the

size of SUR and the other two variables. For example, with NNP - G held constant, the government may choose to reduce personal taxes and run a deficit. In this case, YD will increase and SUR will decrease. Given the coefficients from the regression on the pre and post World War Two periods, if the deficit is $100 billion, YD will grow by $100 billion and SUR will equal -$100 billion. The overall effect of this deficit on consumption will be:

dC = A[1]*dYD + A[2]*dSUR.
dC = (.82)*($100 billion) + (.19)*(-$100 billion)
dC = $73 billion

dS = $100 billion - dC
dS = $27 billion

Where dC is the change in consumption, dS is the change in saving and A[1] and A[2] are the regression coefficients. So given these historical propensities to consume, a government deficit caused by reducing personal taxes by $100 billion will boost consumption by $73 billion and saving by $27 billion.

This effect of fiscal policy, displayed in the United States time series, opposes macroeconomic theory based on the Ricardian Equivalence Theorem. For this theory to be valid, the coefficients of YD and SUR would have to be equal in order for deficit spending to have no effect on consumption. In this case, any effect of a change in SUR would be directly offset by the same change in YD. An example will effectively illustrate this point. If the coefficients on these variables were equal at a value of .80, then the effect of a deficit of $100 billion on consumption would be:

dC = A[2]*dSUR + A[3]*dYD
dC = (.80)*(-$100 billion) + (.80)*($100 billion)
dC = $0

dS = $100 billion - dC
dS = $100 billion

From this example it is apparent that saving rises by the full amount of the deficit when the coefficients on YD and SUR are equal. In this case, the pool of saving will rise to absorb all of the deficit so private investment will not be crowded out. Therefore, it may be concluded that because the time series analysis clearly shows different propensities to consume out of disposable income and deficit income, the Ricardian Equivalence Theorem is not supported by empirical evidence.

3.5 ADDITION OF THE STOCK OF OUTSTANDING GOVERNMENT DEBT

The addition of the stock of outstanding government debt to the model will allow direct testing of whether the stock of debt affects consumption and saving. If it is viewed as positive net wealth, private saving would be depressed by government debt. This result, which is the same as that already obtained for the capital stock, would be displayed by a significantly positive coefficient on the stock of debt outstanding. The interpretation would then be that the existence of government debt depresses private saving which is equivalent to saying that it crowds out private investment. In this case,

consumers do not take into account the future taxes implied by the debt and view government bonds as equivalent to private bonds or other means of investment.

If, on the other hand, the stock of outstanding government debt is not viewed as net wealth, as displayed by an insignificant coefficient, then its magnitude will have no effect on private saving. Consumers then do take into account the future taxes implied by the debt and alter their saving in anticipation

REGRESSION RESULTS WITH THE STOCK OF GOVERNMENT DEBT

Time-Series Including 1929-1940 And 1947-1974

YD	YDLAG	RE	SUR	UYD	K	DUR	DEBT	R**2
.82	.03	.05	.22	.27	.086	-.26	.007	.999
(16.2)	(.53)	(.45)	(2.78)	(2.52)	(3.96)	(-5.27)	(.65)	
**			**	*	**	**		

Time-Series Including 1947-1974

YD	YDLAG	RE	SUR	UYD	K	DUR	DEBT	R**2
.72	.08	.35	.18	.17	.041	-.04	.038	.999
(7.1)	(.78)	(2.05)	(1.87)	(.91)	(.93)	(-.33)	(1.67)	
**		*	*					

Tanner's Results For 1947-1974

YD	YDLAG	RE	SUR	UYD	K	DUR	DEBT	R**2
.72	.20	.26	.29	.33	.028	-.13	-.014	.999
(7.8)	(2.53)	(1.25)	(3.23)	(1.94)	(1.56)	(-1.17)	(0.38)	
**	*		**	*				

** = Significant at the 1% level
* = Significant at the 10% level

The regression results show that, when either time period is used, the stock of government debt insignificantly affects the level of private consumption and saving. This conclusion supports the hypothesis that government debt is not perceived as net wealth, and therefore that consumers do take into account the future taxes implied by the debt.

In Ernest J. Tanner's paper, "An Empirical Investigation of Tax Discounting," he reports that the United States time series supports the notion that the future taxes implied by a government deficit are fully capitalized by consumers. This conclusion is based on his interpretation of the coefficients in a regression model which is the same as Barro's except for the addition of the government debt stock. Based on Tanner's interpretation of the coefficients, he concludes that government debt is not perceived as net wealth; i.e. that future taxes are fully capitalized. After repeating his study with improved data and correcting his improper interpretation of the results, his conclusion is invalidated.

In Tanner's description of the Barro life–cycle model, he says that "the government surplus is also included as a potential source of accrued income."[4] In addition to being the present value of future tax obligations from or to the government, it is also the current amount of disposable personal income that is due to government fiscal policy. It is the willingness or propensity to consume out of this extra income that determines the extent to which future taxes are discounted. As previously stated, if the coefficients on disposable personal income and the government surplus are equal then future taxes are fully discounted because then the propensity to save out of a deficit is one.

In his investigation, Tanner uses the same life cycle model as Barro extended to include the stock of government debt. When a regression is run on the data from 1947 to 1974, he obtains a positive and significant coefficient for the SUR variable and an

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[4] Tanner page 215.

insignificant coefficient for the stock of government debt. The insignificance of the debt stock would show that it is not viewed as net wealth as is the capital or durable stock.

Careful analysis of Tanner's summary of how the regression results should be interpreted reveals several misconceptions on his part. First, he states that "the hypothesis that government debt is net wealth implies that the coefficient of DEBT is approximately equal to the coefficient on K." This statement appears flawed. By noting that the capital stock is a productive asset, while the government debt is an interest bearing form of saving that is unproductive, it appears that expecting the coefficients on the two to be equal is simply ignoring the differences in their constitution. It would be more plausible to expect that the coefficient on the debt be equal to that on a similar measure of private saving like the outstanding stock of corporate bonds. To reiterate, it is objectionable to assume that two different forms of wealth have equal coefficients when that are both unsimilar in form.

His second statement on interpreting the results is that "if consumers do not discount the future tax liabilities implicit in a government deficit and treat government debt as net wealth, then the coefficient on the government surplus would be expected to equal zero." This statement is correct, but should be modified to include the expectation that the coefficient on the stock of government debt be significantly positive as it is perceived as net wealth in this case and taxes are not discounted.

Tanner's third statement is that "a zero coefficient on DEBT and a significantly positive coefficient on SUR would imply that government debt is not net wealth but

that the discounted present value of the future taxes required to service the debt just equals the present value of the benefits." Given the discussions in the previous sections, this statement is in error. The coefficient on the surplus variable must be equal to that on the disposable income variable for full tax discounting to be implied. Furthermore, any significantly positive value that is less than this magnitude implies partial tax discounting. In contrast to his statement a zero coefficient on the government debt implies that this stock is not viewed as net wealth, while a significantly positive coefficient on the government surplus implies partial tax discounting unless it is equal to the coefficient on disposable income in which case there is full tax discounting.

It is desirable to repeat his study because of the better data presently available. Tanner's study was done in 1979 presumably using the data presented in Robert Barro's paper or similar data also available at that time. All of the series were completely revised by the Department of Commerce in 1981 and the best estimates of the capital and durables stock presently available were not released until that same year. Additionally, John Seater published "The Market Value of Outstanding Government Debt, 1919 - 1975" in which he criticized Tanner's debt stock measure and provided a more accurate series. It is therefore worthwhile to redo Tanner's study to determine if the improved data affects his results.

Tanner's results and those of the present study show the debt stock to be insignificant and the surplus coefficient to be significantly positive although much less that the coefficient on disposable income. Given his interpretation on the results,

Tanner concludes, "the aggregate U.S. data support the view that consumers take account of all the future tax liabilities implicit in today's government deficits and in the stock of accumulated government debt." Tanner's conclusion is, however, in error because while the zero coefficient on the debt stock does indicate that it is not viewed as net wealth, the coefficient on the government surplus which is significantly less that that on disposable income indicates partial tax discounting. The correct conclusion is that the stock of government debt is viewed only partly as net wealth and the future taxes implied by government deficit spending are only partially discounted by consumers.

3.6 INCLUSION OF FEDERAL AND NONFEDERAL DEFICITS AND DEBT

By breaking the total government budget deficit into its federal and its state and local components, the hypothesis that these two forms of deficit spending have different effects on consumption and saving may be tested. State and local governments operate in a more Ricardian environment than the Federal government in that the principal on their debt must eventually be paid off and that they are unable to print money to retire their debt. A plausible hypothesis then is that the Ricardian equivalence theorem will be valid for state and local governments while being invalid for the Federal government. The expected results in this case would therefore be a coefficient on the state and local surplus variable, STSUR, that is equal to that of personal disposable income, YD. As previously discussed, this condition would assure that private saving is increased by the exact amount of the deficit and that private investment is therefore not crowded out.

REGRESSION RESULTS WITH THE FEDERAL AND STATE AND LOCAL

SURPLUS AND DEBT

Time-Series Including 1929-1940 And 1947-1974

YD	YDLAG	RE	STSUR	FEDSUR	UYD
.76	.05	.02	.45	.17	.14
(12.6)	(.90)	(.13)	(1.63)	(2.02)	(1.01)
**				*	

K	DUR	STDEBT	FEDDEBT
.09	-.25	.10	.02
(4.10)	(-4.93)	(1.84)	(1.40)
**	**	*	

Time-Series Including 1947-1974

YD	YDLAG	RE	STSUR	FEDSUR	UYD
.66	.16	.60	.37	.19	.177
(5.99)	(1.38)	(2.28)	(1.14)	(1.67)	(.92)
**		*			

K	DUR	STDEBT	FEDDEBT
.01	.06	-.06	.05
(.23)	(.42)	(-.61)	(1.91)
			*

** = Significant at the 1% level
* = Significant at the 10% level

No conclusions may be drawn from these results. In neither time period are both STSUR and FEDSUR significant so no comparisons can be made on the size of their coefficients. It is not useful to break the government deficit into its federal and state components.

4. CONCLUSIONS

This empirical investigation has allowed several conclusions about the effects of government deficits to be reached. Foremost of these is that the Ricardian equivalence theorem is refuted by the United States time series. The data do not support the notion that taxes and deficits financed by bond issues are viewed as equivalent by consumers. Indeed, fiscal policy is an effective means of stimulating consumption. Furthermore, because saving does not increase by the amount of the deficit, private investment is crowded out. The prediction of the Classical Model that investment is crowded out is upheld by empirical evidence. Therefore, the discounted value of future tax obligations should not be used as an argument in household's perceived disposable income in the Classical Model. Finally, the regression results show that consumers only partially discount the future taxes implied by a deficit and that the stock of outstanding government debt is viewed only partly as net wealth by consumers.

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