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TAXES, BUDGET DEFICITS AND CONSUMER SPENDING: SOME NEW EVIDENCE

Martin Feldstein

Douglas W. Elmendorf

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Cambridge, MA 02138
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ABSTRACT

Because of the restrictive assumptions required to establish the theory of Ricardian equivalence, its relevance in practice is essentially an empirical question. The strongest direct evidence in favor of Ricardian equivalence is Roger Kormendi's (1983) article in the American Economic Review. That paper appeared to provide strong empirical support for Ricardian equivalence by showing that increases in government spending on goods and services depress consumer spending while changes in tax receipts have no effect on consumer spending.

The present study shows that Kormendi's results are a misleading implication of the experience during World War II when shortages, rationing and patriotic appeals to self-restraint caused an abnormally high rate of saving at the same time that the government deficit-financed a uniquely massive increase in defense spending. When those years are excluded from the sample, Kormendi's results are reversed.

The estimates presented here show that in the equation specified by Kormendi, but with the years 1941 through 1946 excluded, increases in tax receipts have had a substantial negative effect on consumption while increases in government spending on goods and services have had essentially no effect on consumption. This evidence is exactly the opposite of the implications of Ricardian equivalence. This conclusion is robust with respect to a variety of modifications in the way that the basic equation is estimated: using an AR1 correction to deal with serial correlation; limiting the analysis to the Federal government's fiscal variables; respecifying the variables as ratios to net national product to reduce collinearity; estimating for the most recent 35 years instead of for the period since 1931; and using an instrumental variable procedure to reduce the problem of endogeneity. In each of these specifications, the results indicate that taxes depress consumer spending while government outlays on goods and services have either a smaller or a totally insignificant effect.

Martin Feldstein
National Bureau of Economic Research
1050 Massachusetts Avenue
Cambridge, MA 02138

Douglas W. Elmendorf
National Bureau of Economic Research
1050 Massachusetts Avenue
Cambridge, MA 02138

Taxes, Budget Deficits and Consumer Spending: Some New Evidence

Martin Feldstein and Douglas W. Elmendorf*

Perhaps no issue has generated as much controversy among economists in the past decade as the proposition that an increase in the government deficit induces an equal offsetting increase in private saving. The truth of this so-called Ricardian equivalence proposition is central to whether budget deficits reduce capital accumulation, to the feasibility of expansionary tax reductions, and to the effects of social security on private saving and aggregate capital accumulation.

Although the basic idea that the future tax liabilities associated with government deficits and debt induce individuals to increase their saving has been around since the time of David Ricardo and was treated explicitly by Don Patinkin (1965), Martin Bailey (1971) and Levis Kochin (1974), the current debate was launched by Robert Barro (1974). The voluminous theoretical literature of recent years has shown that complete Ricardian equivalence would be expected to prevail only under very special conditions; see Douglas Bernheim (1987) for an especially useful

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*Martin Feldstein is Professor of Economics at Harvard University and President of the National Bureau of Economic Research. Douglas Elmendorf is a graduate student at Harvard University and a research assistant at the National Bureau of Economic Research. We are grateful to Greg Mankiw and Lawrence Summers for comments on an earlier draft. The research reported here is part of the NBER study of the Government Budget and the Private Economy.

survey and analysis. But the theoretical restrictiveness of the assumptions required for complete Ricardian equivalence does not constitute a practical refutation. Defenders of Ricardian equivalence can argue that the theory is only an approximation and can claim that, although the stringent conditions required for complete Ricardian equivalence do not hold, the economy's behavior in practice is close to the predictions of Ricardian equivalence.

The key empirical question is whether a higher level of taxes (with government spending constant) induces individuals to reduce their spending on consumption as traditional theory holds or has no effect on consumer spending as the Ricardian equivalence proposition predicts. The existence of a moderate negative effect of government outlays on consumer spending is not in itself evidence in favor of the Ricardian equivalence proposition that individuals increase their saving to finance anticipated debt service. As Feldstein (1982) explained, consumers may correctly believe that a rise in current government spending is a good indicator of a higher level of future government spending. Once a program is launched or budgets increased, the process is unlikely to be reversed. An increase in current government spending is therefore a good indication that future taxes will have to be higher to finance a higher level of future government spending. Individuals may rationally reduce their own spending when government outlays increase without a concurrent increase in taxes because they anticipate

higher future taxes to finance higher future government spending even if they give little or no weight to the debt service implications of the current deficit.

The strongest direct evidence in favor of Ricardian equivalence is Roger Kormendi's 1983 article in the American Economic Review. He presents consumption regression equations that relate an estimate of consumption[1] to net national product, wealth, government debt, government spending on goods and services, taxes, transfers, corporate retained earnings and government interest payments. His parameter estimates appear to show that an increase in taxes does not affect consumption at all while an increase in government spending on goods and services does reduce consumption. Thus whatever the theoretical shortcomings of the Ricardian equivalence theory, it would appear from Kormendi's results that in practice consumers behave as the Ricardian equivalence theory predicts.[2]

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[1]Kormendi defines consumption as the sum of current expenditures on services and nondurables plus 10 percent of current expenditures on consumer durables and 30 percent of the stock of consumer durables.

[2]There have of course been other tests of Ricardian equivalence. John Seater and Roberto Mariano (1985) interpret their evidence as supporting Ricardian equivalence while the evidence of Michael Darby et. al. (1987) and of Feldstein (1982) is inconsistent with Ricardian equivalence. There have also been indirect tests of Ricardian equivalence based on examining the effects of government deficits on real interest rates and on the exchange rate. The results of these tests have been mixed. Some researchers, including Charles Plosser (1982) and Paul Evans (1985), found that budget deficits do not change interest rates or the value of the dollar while others, including Feldstein (1986) and Michael Hutchinson and Adrian Throop (1986), have found the opposite. A discussion of these articles lies beyond the scope of this paper.

Kormendi's analysis has been criticized by James Barth et. al. (1986) and by Franco Modigliani and Arlie Sterling (1986). Although we are unconvinced by Kormendi's analysis, we do not find that either of those comments is a persuasive refutation of the Kormendi study. While Barth et. al. conclude that their results "raise sufficient questions about the robustness and interpretation of Kormendi's original findings that more empirical work in this important research area is clearly needed" (page 1165), their estimates generally support Kormendi's principal finding that consumer spending is sensitive to government outlays on goods and services but not to taxes. Their analysis extends the Kormendi sample through 1983, separates federal government debt from state and local debt, estimates for alternative subperiods, and tries substituting the par value of government debt for the market value of the debt even though they recognize that the latter is the conceptually appropriate measure. The only estimates in which the effect of government spending is not at least marginally significantly negative are in equations estimated for the postwar period that contain the theoretically inappropriate par value of the government debt. In no equation do taxes have a significant negative effect.

The essential feature of the Modigliani and Sterling analysis is to replace the separate tax, transfer and government interest variables with a combined "net tax" variable that is equal to government taxes net of transfers including government net domestic interest payments. The sum of the distributed lag

coefficients of this net tax variable is significantly negative in the Modigliani-Sterling consumer expenditure equations and is not significantly different from the sum of the lag coefficients of net national product. In this specification the coefficient of the government spending variable is small and not significantly different from zero. Modigliani and Sterling interpret their estimates as "strikingly and unmistakenly consistent with a `Life Horizon'-Life Cycle approach to consumption behavior and equally inconsistent with the infinite horizon Ricardian Equivalence Proposition formulation" (page 1178).

Unfortunately, however, Modigliani and Sterling do not provide an explicit test of the effect of taxes per se on consumption but only of the combined "net tax" variable. Since the coefficient of the transfers variable in the original Kormendi analysis was positive, large, and statistically significant, it is not surprising that the variable created by subtracting transfers from taxes has a coefficient that is negative, large and statistically significant. This should be expected regardless of any additional changes in variable definitions or estimation procedures. Although the variable is correctly labeled as "net taxes," its coefficient is essentially an indication of the effect of transfers. Similarly, although Modigliani and Sterling do present two specifications that include transfers as a separate variable, in both of those equations they constrain the coefficient of the net tax variable

to equal the coefficient of net national product, so no separate estimates of the effects of taxes and transfers can be inferred.

These objections do not detract from the force of the Modigliani-Sterling argument that transfers are negative taxes and that the two should therefore be treated symmetrically in any analysis of Ricardian equivalence. If this is accepted, Kormendi's own estimates of the effect of transfers on consumption provide a strong refutation of the Ricardian equivalence proposition. Kormendi's reply that transfers are received by a subgroup of the population that is liquidity constrained suggests at a minimum that not all taxes and taxpayers should satisfy the Ricardian equivalence proposition.

We are nevertheless left without any direct test of Kormendi's conclusion that government spending depresses consumer spending while taxes do not. There are two ways in which Kormendi's research could be subject to further analysis. The first would be to develop a more general model of which Kormendi's is a special case and to evaluate the relative importance of government spending and taxes in that more general model. Such a model might include the real net interest rate, alternative measures of household wealth, the age distribution of the population, the income distribution, and other variables that could influence consumer spending but that are not part of the Kormendi analysis. The alternative and more modest but direct approach followed in the present paper is to see whether Kormendi's results remain when his equation is re-estimated by

different statistical techniques, using different functional forms, and for periods that exclude the World War II years when consumer spending was constrained by shortages and rationing. When this is done, the results are quite contrary to Kormendi's and reject the Ricardian equivalence proposition.

More specifically, the present paper shows that Kormendi's results are misleading and cannot be sustained when the war years 1941 through 1946 are excluded from the sample. Omitting this period of wartime shortages and rationing and estimating for the period through 1985 reverses Kormendi's principal finding and shows that higher taxes depress consumption while an increase in government spending has no significant effect on consumption. This conclusion is confirmed when Kormendi's procedure of estimating in first difference form is replaced by a more appropriate estimation using a first-order autoregressive transformation of an equation specified in levels.[3]

The paper begins (section I) by replicating Kormendi's estimates and extending the end of the sample period from 1976 to 1985. Section II then shows the critical importance of

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[3] A proponent of Ricardian equivalence might of course say that this reversal of Kormendi's empirical findings does not contradict Ricardian equivalence since current taxes may be a proxy for future government spending. This line of argument, carried to the extreme, would make it impossible to refute Ricardian equivalence with estimates of consumer behavior. There is also a conceptual problem since taxes finance not only government spending on goods and services but also the empirically more important transfer payments and debt service. Moreover, regression equations estimated with our data (and similar equations estimated by Modigliani and Sterling) fail to find any predictive effect of current taxes on future spending.

Kormendi's practice of including the war years. Section III examines the effect of excluding state and local governments and focusing on federal government spending, taxes, transfers, and debt. The fourth section respecifies the equation in ratio form; this reduces the problem of collinearity and produces coefficients that imply stronger tax effects (with smaller standard errors) and no effect of government spending. The fifth section looks at estimates for the postwar period only while the sixth section presents instrumental variable estimates that treat the current values of taxes, transfers, government spending and NNP as endogenous. There is a final concluding section.

I. Replication and Basic Variations

Table 1 presents alternative estimates of Kormendi's basic specification relating consumer spending to net national product (Y_t), lagged net national product (Y_{t-1}), government spending on goods and services (GS_t), total tax revenue (TX_t), government debt at market value (GB_t), transfer payments (TR_t), private wealth excluding government debt (W_t), corporate retained earnings (RE_t), government interest payments ($GINT_t$), and a constant term. Standard errors of the parameter estimates are shown in parentheses beneath each coefficient.

Kormendi's original article presents detailed definitions and sources for these statistics. Since our purpose is to assess the sensitivity of Kormendi's conclusion to the inclusion of the World War II years, we have tried to stay as close as possible to

Table 1

Replication and Basic Variations of the Kornendi Specification

Equation	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Sample	1931-76	1931-76	1931-76	1931-85	1931-40 1947-85	1931-40 1947-84	1931-40 1947-85	1931-85
Data*	1	2	3	3	3	2	3	3
Estimation	FD	FD	FD	FD	FD	FD	AR1	AR1
Y_t	0.29 (0.04)	0.30 (0.05)	0.33 (0.06)	0.30 (0.06)	0.31 (0.07)	0.30 (0.06)	0.31 (0.06)	0.30 (0.07)
Y_{t-1}	0.07 (0.02)	0.11 (0.03)	0.08 (0.03)	0.09 (0.03)	0.09 (0.03)	0.09 (0.03)	0.09 (0.03)	0.11 (0.04)
GS_t	-0.23 (0.02)	-0.15 (0.03)	-0.12 (0.03)	-0.10 (0.03)	0.05 (0.09)	0.03 (0.09)	0.13 (0.09)	-0.11 (0.03)
TX_t	0.07 (0.08)	-0.08 (0.10)	-0.17 (0.11)	-0.15 (0.11)	-0.17 (0.13)	-0.13 (0.13)	-0.16 (0.12)	-0.07 (0.12)
GB_t	-0.055 (0.018)	-0.039 (0.029)	-0.014 (0.030)	-0.008 (0.026)	-0.0004 (0.030)	0.014 (0.029)	0.081 (0.032)	-0.010 (0.030)
TR_t	0.83 (0.15)	0.70 (0.21)	0.45 (0.23)	0.66 (0.21)	0.66 (0.20)	0.76 (0.20)	0.84 (0.14)	0.83 (0.19)
W_t	0.025 (0.008)	0.021 (0.011)	0.033 (0.013)	0.015 (0.009)	0.014 (0.008)	0.016 (0.007)	0.020 (0.006)	0.024 (0.008)
RE_t	0.10 (0.11)	-0.04 (0.15)	-0.13 (0.18)	-0.03 (0.17)	0.02 (0.18)	0.05 (0.17)	-0.04 (0.18)	0.16 (0.20)
$GINT_t$	1.15 (0.91)	2.15 (1.15)	1.71 (1.16)	1.13 (0.66)	0.88 (0.63)	0.66 (0.57)	0.89 (0.50)	1.31 (0.66)
R^2	0.91	0.83	0.79	0.75	0.79	0.83	0.999	0.999
SER	17.5	22.3	56.4	61.4	57.4	24.7	62.2	48.0
ρ	---	---	---	---	---	---	0.76	0.86
DW Stat.	n.a.	1.5	1.6	1.7	1.7	1.6	1.8	1.7

NOTE: The dependent variable is consumption. A constant term was included in the estimation but is not reported. Standard errors are in parentheses. See text for definition of variables.

*Data: [1]Kornendi [2]Pre-Benchmark [3]Post-Benchmark

his specification and his definitions in constructing the regression variables for our analysis. As far as we can tell, there are only two small differences between our definitions and Kormendi's. First, we use the personal consumption price deflator for all variables while Kormendi uses different price deflators for different variables. Second, we use the Federal Reserve Flow of Funds Balance Sheets for the U.S. Economy, 1946-85 as the source of data on "domestic net assets" to measure private nonhuman wealth while Kormendi rescales estimates of several types of wealth presented in the Survey of Current Business; the Federal Reserve data have the virtue of being directly comparable to the estimates by Raymond Goldsmith used by Kormendi and by us for the earlier years of the sample. Kormendi's series on the market value of the government debt is extended using the method developed in James Butkiewicz (1983). A complete listing of the data is available on request.

Equation 1.1 of Table 1 reproduces the parameter estimates reported in Table 5 of Kormendi. This is the only equation reported by Kormendi that includes both the tax variable and the government debt variable. Note that it is estimated in first difference form for the entire sample from 1931 through 1976 including the years of World War II. In this specification an extra dollar of government spending on goods and services reduces consumer outlays by 23 cents. By contrast, an extra dollar of tax revenue has no statistically significant effect; its coefficient is actually positive but less than its standard

error. The coefficient of the government debt variable also has an implausible negative sign but is actually statistically significant. Although this might have been interpreted as evidence that the equation is misspecified or misestimated, Kormendi just notes that the negative coefficient is clearly contrary to the traditional theory that implies that government debt is a form of wealth that should have a positive effect on consumption.

Equation 1.2 represents our attempt to replicate the original Kormendi estimation for his sample period of 1931-1976. Since Kormendi's equation was estimated with the data available before the major 1985 benchmark revision of the national income accounts, we used pre-benchmark revision data to estimate equation 1.2. Although the results are not identical to equation 1.1 (presumably because of earlier revisions in the national income and wealth statistics and perhaps because of inadvertent differences in the way that the data are constructed), the coefficients are quite similar to Kormendi's results in equation 1.1. In particular, the government spending coefficient is -0.15 with a standard error of only 0.03, implying a significant effect of government spending on consumption while the tax coefficient is only -0.08 with a standard error of 0.10. The coefficient of the debt variable remains negative and larger than its standard error.

Equation 1.3 repeats this estimation for the same sample period but with the most recent available data (as of July 1987).

The primary effect of this data revision is to increase the coefficient of the tax variable to -0.17 with a standard error of 0.11, implying that the hypothesis that the true tax coefficient is zero or positive can be rejected at a 7 percent significance level. The coefficient of the government debt variable is still negative but drops to less than half its standard error. The government spending variable is reduced in size but is still substantially greater than its standard error.

Extending the sample period through 1985 (equation 1.4) leaves these key parameter estimates essentially unchanged. The coefficient of the government spending variable is significantly negative while the coefficient of the tax variable, although absolutely larger than the government spending coefficient, is only significant at the 10 percent level.

II. Excluding the War Years

A crucial feature of the Kormendi estimates is that his sample includes the war years when consumption was reduced by widespread rationing, by shortages of consumer durables and other consumer goods, and by patriotic appeals to purchase saving bonds. The personal saving rate jumped from 4.0 percent in 1940 to 10.9 percent in 1941 and to more than 20 percent in each of the next three years before subsiding to 19.2 percent in 1945 and 8.6 percent in 1946. The war years were also a time in which government spending rose much more than tax revenue. Real government spending on goods and services in 1982 dollars jumped

from $150 billion in 1940 to $484 billion in 1942 and $791 billion in 1944, a level that has never been reached again. By contrast, real tax revenue only rose from $126 billion to $264 billion. The evidence presented below shows that the strong correlation between wartime government spending and the high saving rate caused by shortages and rationing causes a spurious negative relation between government spending and personal consumption in the sample as a whole.

Because of the very unusual nature of the consumer goods markets during the World War II period and the intense patriotic appeals for increased saving, the World War II years should be excluded in any regression analysis of saving behavior. Although Kormendi does present some estimates that exclude the war years, those equations never contain both the tax and government debt variables and therefore do not provide an explicit test of the Ricardian equivalence proposition.[4]

Equation 1.5 shows that when the six war years 1941 through 1946 are omitted, the remaining 49 observations tell a very different story. In particular, the coefficient of the government spending variable becomes very small and only about

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[4]Kormendi does present one equation in Table 4 without the war years and with both government spending and taxes but without government debt. We have followed Kormendi and re-estimated this equation in first difference form but, unlike Kormendi, we did not obtain a significant effect of government spending. Our estimated coefficient of government spending was 0.02 with a standard error of 0.08; by comparison, the tax variable had a coefficient of -0.18 with a standard error of 0.12. The difference in our finding may well reflect revisions in the national income statistics.

half as large as its standard error. In contrast, the coefficient of the tax variable is -0.17 with a standard error of 0.13 that implies that the null hypothesis of a zero or positive effect can be rejected at the 10 percent level. It is clear that including the war years produces very misleading results.

As a check that the reason for the very different conclusions implied by equations 1.1 and 1.5 is due to omitting the war years and not to the recent benchmark data revision, we have re-estimated equation 1.5 using the data available before the 1985 benchmark revision. The results, presented in equation 1.6, are quite similar to those of 1.5 and indicate that it is the exclusion of the war years rather than the data revision that is critical.

Kormendi explains that he estimates the equations in first difference form to reduce the risk of the spurious results that Clive Granger and Paul Newbold (1974) have shown can occur when the equations are estimated in level form and there is substantial serial correlation of the residuals. However, using first-difference estimation is less efficient than estimation in level form with an autoregressive transformation. Moreover, estimation by first-differencing has some further disadvantages. If variables are measured with error the use of first difference estimation increases the errors in variables bias. If the response of consumers to an explanatory variable is not immediate, the use of first difference estimation can cause a substantial underestimation of its true effect. The remaining

equations of table 1 therefore present estimates in level form after an AR1 transformation based on the estimated autocorrelation coefficient.

Equation 1.7 is estimated after an AR1 transformation with an autocorrelation coefficient of 0.76. The results again indicate that taxes have a negative effect while government spending has a positive coefficient. The coefficient of the government debt variable has the correct positive sign and is more than twice its standard error; if anything, the coefficient is implausibly large. Equation 1.8 shows the effect of including the war years with the AR1 estimation; once again government spending becomes significant while taxes and government debt are insignificant. It is clear that the choice between first difference estimation and an autoregressive transformation does not affect the conclusion that the evidence in favor of Ricardian equivalence rests on including the six years of World War II and that when these years are excluded Ricardian equivalence is clearly rejected.

III. Total Government or Federal Government

Federal taxes and spending are very different from the taxes and spending of state and local governments. Individuals can in principle avoid a very large part of the state and local taxes that they pay by moving to a different jurisdiction where they would also forego the benefits that higher tax dollars purchase. Moreover, while approximately 75 percent of federal government

spending on goods and services is for national defense, the goods and services spending of state and local governments is for education and other personal services of the local voters. State and local debt is also different in kind from federal debt since the value of such area-specific debt will tend to be reflected in local property values.

The equations presented in Table 2 compare the key fiscal coefficients based on equations using the spending, taxes and debt of all governments with the corresponding coefficients based on equations using Federal government spending, taxes and debt. Although only the coefficients of the three key fiscal variables are shown, they are obtained from estimates of the full equations of the form reported in Table 1; the full set of coefficients is available on request. Separate estimates are reported for the first difference and AR1 estimates.

Equations 2.1 and 2.2, estimated in first difference form, indicate that federal taxes have a more powerful and statistically more significant effect on consumption than the taxes of state and local governments. The other coefficients are similar with insignificant effects of government spending and government debt. In the AR1 estimates reported in equations 2.3 and 2.4 the principle difference is again that the tax coefficient is larger and statistically more significant in the federal specification than in the equation for all governments. This is even true when the war years are included (equations 2.5 and 2.6); the coefficient of taxes in the federal equation is -

0.30 (with a standard error of 0.12) and therefore about three times as large as the coefficient of the government spending variable. Thus when attention is restricted to the federal fiscal variables, taxes are important even when the war years are included although government spending is important only when the war years are included.

IV. A Ratio Specification

One of the problems in making precise inferences about the coefficient values is the collinearity among net national product and the various fiscal variables. The equations in Table 3 present an alternative specification that reduces the problem of collinearity by dividing each of the variables by the current value of net national product. These equations are estimated only for the specification without the war years.

Comparing the coefficients of Tables 2 and 3 shows that the coefficient of the tax variable is much larger both absolutely and relative to its standard error in the ratio specification than in the linear specification. The coefficients of the government spending variable generally remain positive and not statistically significant. The coefficient of the debt variable is positive, larger than its standard error and generally of a plausible magnitude.

The ratio specification thus provides even stronger evidence against the Ricardian equivalence proposition than the linear equations of Tables 1 and 2. The estimated autocorrelation

Table 2

Total Government versus Federal Government Only
Selected Coefficients*

Equation	Sample	Estimation	Govt	GS_t	TX_t	GB_t	R^2	SER	ρ	DWS
2.1	1931-40 1947-85	First Difference	All	0.05 (0.09)	-0.17 (0.13)	-0.0004 (0.030)	0.79	57.4	--	1.7
2.2	1931-40 1947-85	First Difference	Fed	0.02 (0.09)	-0.32 (0.14)	0.018 (0.034)	0.79	57.4	--	1.8
2.3	1931-40 1947-85	AR1	All	0.13 (0.09)	-0.16 (0.12)	0.081 (0.032)	0.9995	48.0	0.76	1.8
2.4	1931-40 1947-85	AR1	Fed	0.13 (0.09)	-0.31 (0.13)	0.150 (0.044	0.9995	48.3	0.84	2.0
2.5	1931-85	First Difference	All	-0.10 (0.03)	-0.15 (0.11)	-0.008 (0.026)	0.75	61.4	--	1.7
2.6	1931-85	First Difference	Fed	-0.09 (0.03)	-0.30 (0.12)	0.015 (0.028)	0.75	60.4	--	1.8

*The estimated equations include all of the variables presented in Table 1; standard errors are shown in parentheses.

Table 3

Variables as Ratios to NNP
1931-40, 1947-85; Selected Coefficients*

Equation	Estimation	Govt	GS_t	TX_t	GB_t	R^2	SER	ρ	DWS
3.1	First Difference	All	0.004 (0.11)	-0.51 (0.19)	0.045 (0.032)	0.91	0.010	--	2.3
3.2	First Difference	Fed	-0.02 (0.10)	-0.77 (0.16)	0.058 (0.032)	0.93	0.009	--	2.5
3.3	AR1	All	0.13 (0.09)	-0.69 (0.08)	0.039 (0.024)	0.996	0.007	.49	1.9
3.4	AR1	Fed	0.16 (0.08)	-0.69 (0.07)	0.079 (0.015)	0.997	0.007	.37	1.9

*The estimated equations include all of the variables presented in table 1; standard errors are shown in parentheses.

parameters also show that there is less autocorrelation in the ratio form than in the linear form.

V. The Postwar Period

Combining the prewar and postwar years provides a sample of 49 usable observations and substantial variation in government spending, taxes and national debt. It is nevertheless interesting to look at a more recent period that avoids the special conditions associated with the depression, the war and the immediate postwar years. Table 4 presents estimates based on the 35 years from 1951 through 1985. The four equations include the level and NNP-ratio specifications and are estimated for the federal government only as well as for all governments combined. The coefficients are estimated with an AR1 transformation; the estimated autocorrelation coefficients are all approximately 0.50.

In all of the estimates, the coefficient of the government spending variable is small, positive and much less than its standard error. In contrast, the coefficient of the tax variable is negative and larger than its standard error. With the federal fiscal variables the tax coefficient is quite large and more than twice its standard error. The coefficients of the government debt variable are always positive and generally more than double their standard errors but also typically larger than theory would suggest.

Table 4

Postwar Sample: 1951-85*
Selected Coefficients

Equation	Functional Form	Estimation	Govt	GS_t	TX_t	GB_t	R^2	SER	ρ	DWS
4.1	Level	AR1	All	0.02	-0.19	0.078	0.999	47.2	0.52	1.8
				(0.13)	(0.17)	(0.043)				
4.2	Level	AR1	Fed	0.02	-0.36	0.113	0.999	46.4	0.53	2.0
				(0.14)	(0.17)	(0.051)				
4.3	Ratio	AR1	All	0.06	-0.62	0.136	0.95	0.006	0.51	2.0
				(0.14)	(0.15)	(0.042)				
4.4	Ratio	AR1	Fed	0.08	-0.60	0.190	0.96	0.005	0.53	2.0
				(0.12)	(0.16)	(0.034)				

*The estimated equations include all of the variables presented in table 1; standard errrors are shown in parentheses.

The estimates based on postwar data are therefore strongly contrary to the predictions of the Ricardian equivalence hypothesis.

VI. Instrumental Variable Estimation

The parameter values reported by Kormendi were all estimated without any attempt to deal with the problem of the endogeneity of net national product and of the fiscal variables. That is also the approach that has been followed until this point in the present paper. It is easy to believe, however, that the current values of NNP and the fiscal variables will be correlated with the error of the consumption equation. A surprisingly large level of consumer spending would probably raise NNP and taxes and might reduce transfers, countercyclical government spending, and the national debt. To the extent that this is true, the ordinary least squares estimates would be biased and inconsistent.

An instrumental variable estimation procedure can provide consistent and asymptotically unbiased estimates in this context. The practical problem is to find satisfactory instrumental variables that are uncorrelated with the current disturbance to consumer spending but highly correlated with the endogenous explanatory variables. Variables like population that satisfy the first criterion completely generally do poorly by the second criterion. In the present study we have used as instruments the past values of the endogenous variables lagged two, three and four years; i.e., NNP_{t-2}, NNP_{t-3}, NNP_{t-4}, GS_{t-2}, GS_{t-3}, GS_{t-4},

TX_{t-2}, etc. These variables are clearly correlated with the fundamental movements and short-term trends in the corresponding variables but will only be correlated with the disturbance in the consumption equation to the extent that those disturbances have a high degree of serial correlation. While the instruments are not perfect, the use of instrumental variable estimation provides a check on the general qualitative properties of the ordinary least squares estimates.

Table 5 presents instrumental variable estimation for the entire sample with the war years omitted. In order to obtain the lagged values needed as instrumental variables it was necessary to drop the first four years from the sample; the sample therefore begins with 1935. In addition to instrumental variable estimates in first difference form, we have also used Fair's method to combine instrumental variable estimation and a consistently estimated first-order autoregressive correction.[5]

Although the instrumental variable estimates inevitably appear less precise than ordinary least squares estimates, the implications of Table 5 are very similar to those of the previous ordinary least squares estimates. The coefficient of government spending is generally positive and insignificant while the coefficient of the tax variable is generally negative and larger

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[5]Since our computer program could not apply Fair's method to a sample with a gap in the data, we have applied Fair's method to estimate our equation for the entire period from 1935 through 1985 but with individual dummy variables for each of the six war years.

Table 5

Instrumental Variable Estimates for Full Sample
1934-40, 1947-85 for Fair's method; 1935-40, 1947-85 for First Difference
Selected Coefficients*

Equation	Functional Form	Estimation	Govt	GS_t	TX_t	GB_t	R^2	SER	ρ	DWS
5.1	Level	First Difference	All	0.22 (0.21)	0.05 (0.25)	0.059 (0.039)	0.56	66.0	--	2.1
5.2	Level	Fair's Method	All	0.26 (0.10)	-0.13 (0.18)	0.039 (0.028)	0.999	56.2	0.84	1.6
5.3	Ratio	First Difference	All	-0.11 (0.22)	-0.39 (0.35)	0.053 (0.043)	0.80	0.012	--	1.7
5.4	Ratio	Fair's Method	All	0.15 (0.09)	-0.36 (0.15)	0.080 (0.023)	0.99	0.007	0.98	2.1
5.5	Level	First Difference	Fed	0.17 (0.25)	0.10 (0.31)	0.053 (0.056)	0.34	80.9	--	2.2
5.6	Level	Fair's Method	Fed	0.19 (0.10)	-0.46 (0.16)	0.052 (0.033)	0.999	59.0	0.88	1.9
5.7	Ratio	First Difference	Fed	-0.29 (0.27)	-0.51 (0.42)	0.065 (0.047)	0.78	0.012	--	1.7
5.8	Ratio	Fair's Method	Fed	0.07 (0.07)	-0.70 (0.08)	0.084 (0.015)	0.99	0.007	0.52	2.2

*The estimated equations include all of the variables presented in table 1; standard errors are shown in parentheses.

than its standard error. The coefficient of the government debt variable is always positive, generally greater than its standard error and of a roughly appropriate size. The use of Fair's method to correct for autocorrelation is generally helpful in obtaining more precise and more stable coefficients. As we noted with the OLS estimates of Tables 2 and 3, the results are generally stronger for the Federal government fiscal variables and for the ratio specification.

Table 6 presents instrumental variable estimates for the postwar sample. The pattern of coefficients is again incompatible with the Ricardian equivalence proposition: generally positive and insignificant coefficients on government spending, negative and generally significant coefficients on the tax variable (with particularly strong effects in the ratio specification), and positive effects of the government debt.

VII. Concluding Comment

Because of the restrictive assumptions required to establish the theory of Ricardian equivalence, its relevance in practice is essentially an empirical question. Roger Kormendi's paper appeared to provide strong empirical support for Ricardian equivalence by showing that increases in government spending on goods and services depress consumer spending while changes in tax receipts have no effect on consumer spending.

The present study shows that Kormendi's results are a misleading implication of the experience during World War II when

Table 6

Instrumental Variable Estimates for Postwar Sample: 1951-85*
Selected Coefficients

Equation	Functional Form	Estimation	Govt	GS_t	TX_t	GB_t	R^2	SER	ρ	DWS
6.1	Level	First Difference	All	-0.16 (0.21)	0.24 (0.30)	-0.008 (0.061)	0.53	67.6	--	1.3
6.2	Level	Fair's Method	All	0.07 (0.10)	-0.11 (0.18)	0.030 (0.039)	0.999	57.7	0.996	1.6
6.3	Ratio	First Difference	All	0.21 (0.18)	-0.76 (0.35)	0.102 (0.058)	0.82	0.008	--	2.2
6.4	Ratio	Fair's Method	All	0.11 (0.09)	-0.66 (0.15)	0.113 (0.037)	0.95	0.006	0.82	2.3
6.5	Level	First Difference	Fed	-0.17 (0.23)	0.20 (0.34)	-0.017 (0.079)	0.48	70.8	--	1.2
6.6	Level	Fair's Method	Fed	0.14 (0.09)	-0.33 (0.15)	0.091 (0.048)	0.999	56.1	0.997	1.9
6.7	Ratio	First Difference	Fed	0.22 (0.16)	-0.81 (0.30)	0.137 (0.064)	0.84	0.008	--	2.4
6.8	Ratio	Fair's Method	Fed	0.15 (0.08)	-0.60 (0.15)	0.164 (0.045)	0.95	0.006	0.86	2.4

*The estimated equations include all of the variables presented in table 1; standard errors are shown in parentheses.

shortages, rationing and patriotic appeals to self-restraint caused an abnormally high rate of saving at the same time that the government deficit-financed a uniquely massive increase in defense spending. When those years are excluded from the sample, Kormendi's results are reversed.

The estimates presented here show that in the equation specified by Kormendi, but with the years 1941 through 1946 excluded, increases in tax receipts have had a substantial negative effect on consumption while increases in government spending on goods and services have had essentially no effect on consumption. This evidence is exactly the opposite of the implications of Ricardian equivalence. This conclusion is robust with respect to a variety of modifications in the way that the basic equation is estimated: using an AR1 correction to deal with serial correlation; limiting the analysis to the Federal government's fiscal variables; respecifying the variables as ratios to net national product to reduce collinearity; estimating for the most recent 35 years instead of for the period since 1931; and using an instrumental variable procedure to reduce the problem of endogeneity. In each of these specifications, the results indicate that taxes depress consumer spending while government outlays on goods and services have either a smaller or a totally insignificant effect.

The present study has been limited to an analysis within the specification used by Kormendi. A different or more general specification might lead to different conclusions. But the

present study has purposely been restricted to the Kormendi formulation because of the importance that has been attributed to Kormendi's evidence. The only proper inference that can be drawn from the present study is that Kormendi's own conclusion is wrong and that, within his own specification, the evidence decisively contradicts the Ricardian equivalence proposition and supports the conventional view that higher taxes reduce consumption and that budget deficits caused by tax reductions therefore depress national saving.

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