John T. Knadler

The Consequences of the Federal Deficit: An Empirical Analysis

Faculty Mentors: Professor Chris Bollinger and Professor Jim Fackler

Abstract

One of the major issues of political debate in the United States during the past 20 years has been the potential consequences of rising federal deficits. Some politicians and economists argue for the traditional view that says deficits increase interest rates and erode private savings, while those who hold the Ricardian equivalence view believe that economic agents are forward looking and will realize that a tax cut today will cause a future deficit, thus they will not change their behavior in response to the increase in wealth from the tax cut. My research will attempt through econometric regression analysis to see if deficits cause an increase in interest rates and or a reduction in private saving. When I used standard two stage least squares regression I found deficits only a significant factor in decreasing savings; however, when I used an instrumental variable regression I found that deficits were significant in increasing interest rates and had no impact on private savings. Thus, I concluded that the both the Ricardian and the traditional view of deficits are valid depending upon one's methodology.

One of the clearest economic results from the Great Depression that crippled the economies of the Untied States and the world in the first half of the 20th century was the coming to fashion of Keynesian economics. The basic thrust of the theory, from a policy perspective, was an intense focus on the short run business cycle theory with little attention paid to the long run because, as Keynes stated, "in the long run we are all dead". Keynesians advocated low taxes and large increases in spending to stimulate the demand for goods. The corollary of this theory is that large deficits are given little attention; however, the experience of the United States in the 1970's of high unemployment, high inflation, and increasing interest rates made many economists rethink the Keynesian system. Beginning in the 1980's, the deficit began to become an intense political issue that led to various movements toward a balanced budget amendment that never passed. The common fear of the deficit is that it leads to high interest rates; however, currently we are experiencing ever-increasing deficits yet our interest rates remain at historical lows.

Research in this area is not an especially new topic, indeed, some of the most famous macroeconomic thinkers, including David Ricardo, Martin Feldstein, Robert Barro, Milton Freidman, have thought of this issue. However, what has not been a constant in this debate is the context in which government deficits are discussed. Edward Nelson points out, "During the 1970's emphasis was on the inflationary consequences of deficits. By contrast, the concerned voiced since the 1980's about deficits rests on the argument that they put upward pressure on real interest rates" (Nelson 2004). However, before I discuss the recent literature and the empirical study of the consequences of the deficit, I feel it is relevant to make a note about the macroeconomic theory debate that underlies and motivates work on this topic. Essentially the debate is between two schools of thought: the traditional view and the Ricardian view. The traditional view holds that deficits have real consequences in that they produce high interest rates, reduce private savings, and "crowd out" capital accumulation, thus inhibiting long run economic growth. The Ricardian view assumes agents are forward looking, and as Greg Mankiw states, "The forward looking consumer understands that the government borrowing today means higher taxes in the future. A tax cut financed by government debt does not reduce the tax burden; it merely reschedules it. It therefore should not encourage the consumer to spend more" (Mankiw 2003). One of the most noteworthy papers advocating the traditional view was a 1970 paper by Feldstein and Eckstein that examined the relationship in the period from 1954 to 1969 on a quarterly basis. While the paper found that the federal deficit was not significant in explaining interest rates, they did find that "the decline in the real per capita publicly held Federal debt put downward pressure on interest rates."(Office of the Assistant Secretary for Economic Policy 1984).

Furthermore, the aforementioned conclusion from Feldstein and Eckstein "is weak in that it is only of marginal statistical significance." (Office of the Assistant Secretary for Economic Policy 1984). Since its publication the Feldstein and Eckstein paper has been one up to much debate. One noteworthy criticism and the paper that has since become one of the most widely cited Ricardian papers is a 1985 paper by Paul Evans, an economist at Ohio State University. Evans' paper examines the period between October 1979 and December 1983 since "the Federal Reserve stabilized interest rates over most of the postwar period, perhaps hiding the true relationship," "prior to the 1980's the deficit was rarely large and did not vary much," and "during this period the Federal Reserve largely freed interest rates to seek their own levels" (Evans 1985). From his regressions Evans concludes "Not that the large deficits in 1982 and 1983 lowered interest rates, but rather that there is no evidence that they produced the high interest rates that have prevailed since October 1979" (Evans 1985). Evans offers two explanations for his findings. He cites the work of a 1983 paper by University of Michigan economist Roger Kormendi who "suggests that changes in the deficit have been offset by essentially equal changes in private saving, thereby removing the need for interest rates to change" (Evans 1985). Evans's second explanation comes from a theory of Harvard economist Robert Barro that refutes the standard notion that government deficits are essentially taxes on future generations. Barro states that most intergenerational transfers are among family members. Barro then concludes, "The shift from taxes to deficits does not offer the typical person a new opportunity to extract funds from his or descendants. Rather, the response to higher deficits would be a shift in the private transfers by an amount sufficient to restore the balance of income across generations that was previously deemed optimal. In this case, the shift from taxes to deficits has no aggregate wealth effect" (Barro 1990). Given the research we have shown, it is evident that there are no definitive conclusions to the question of the economic consequences of deficits; rather, many of the conclusions lie in the type of methodology employed by the researcher. However, overall, it would be a disservice not to note that the Ricardian view is the conclusion of the majority of empirical evidence for the United States that was presented in the 1984 Treasury report for the period we are discussing.

Therefore, the basic question my research will seek to answer is first, are deficits responsible for high interest rates or is it the reverse, and, second, if not, what can explain high interest rates. A secondary question will be to examine the effect of deficits on private savings to see if deficits erode private savings. Given that there are a multitude of interest rates, I have chosen to use the secondary market rate on a three month treasury bill (a standard nominal interest rate) as my dependent variable. The time period of my data is in quarterly sets beginning in 1948 as this was the first post-World War II year that contained all the data for independent variables I wanted to use. The data ends with the third quarter of 2003. My plan is to begin by running some simple single variable regressions that include interest rates, deficits, and savings relationships. Then I will run regression with almost all of my independent variables to capture the impacts of multiple variables. From there I plan to show some of the regressions used in previous empirical work that pertain to the data sets that I am using. Finally, I will use a series of instrumental variable regressions to see if that makes a difference in the relationships I am attempting to capture.

My independent variables (the parenthesis are how the variable appears in the output tables)are the following: currency in circulation (currency), civilian labor force participation rate (civilian), current government expenditure (currente), current government receipts (currentr), fixed private investment (fixedpri), GDP deflator measured in 2000 dollars (gdpdefla), net exports (netexpor), real GDP measured in 2000 dollars (realgdp), West Texas spot oil prices per barrel of oil (spottexa), federal non-defense investment (federaln), industrial production (with 1997=100) (industri), federal national defense investment (var1), real disposable personal income (realdisp), the number of United States active military (activemi), gross private savings (grosspri), and the deficit (deficit). The interest rate notation is nominali. All of the independent variables that are measured in dollars are measured in billions of dollars. I wanted to include some type of exchange rate; however, I could not find data available for some of the beginning years of my data set. For my interest rate I would have preferred the federal funds rate since it is more closely tied to policies of the Federal Reserve, however, it was not available prior to 1959, so I chose to capture more data by using the three month Treasury note rate. Furthermore, M2 would have been a better monetary aggregate, but it was also not available prior to 1959, so I used currency in circulation. All of the data that I have used has come from the FRED II section of the Saint Louis Federal Reserve's website database. All of the variables I used with the exception of the nominal interest rate, currency in circulation, civilian participation rate, spot oil prices, and industrial production were given quarterly. What I have done is taken those monthly sets and calculated a quarterly average for the three months of the respective quarters so that all data is now in quarterly form.

As for the summary statistics (shown in Appendix 1), my data, for most of the independent variables, had sample sizes of 223 or 222, depending on the data available from the FRED database. The mean of the nominal interest rate was 4.89% with the minimum being an astounding .79% and the maximum making it to 15.05%. The currency in circulation had an average of 176 billion dollars in circulation, although it had a massive standard deviation as the maximum was 713 billion dollars in circulation. This is a variable that really shows the growth and change of the economy over the past 50 years. The average civilian participation rate was about 62.5%. The average current expenditure was 681 billion dollars and the average receipts were 619 billion dollars, which means that the United States government, on average, ran a deficit in the years that I have data for. Fixed private investment averaged 516 billion dollars, and this is another variable that is very spread out. The GDP deflator was around 50 in 2000 dollars, so this is the weighted average of various goods over the period measured in 2000 dollars. The average net exports of the United States were -62 billion dollars, which means that the United States on average ran a trade deficit. What is even more shocking is that the maximum is only 21.6 billion, so for what little time we have run a trade surplus it has been quite small. The real GDP average was 5012 billion dollars, which really means that on average the size of the United States economy was about 5.012 trillion dollars. The maximum is also interesting in that the maximum size of the United States economy was around 10.6 trillion dollars. The average price of a barrel of Texas oil was 13.2 dollars per barrel, which is quite low. This was an interesting variable in that the values were either quite high or quite low with there being more low than high, so the mean is fairly low. Indeed, oil topped out in the 1970's at 39.5 dollars per barrel. The next two variables are federal investments on non-defense initiatives and the second (var1) is defense investment. It is interesting that the mean for defense investment (28.8) is more than double the federal non-defense investment (12.2). Indeed, this relationship holds true for the minimums and maximums; therefore, we can see an investment priority given to defense investments. The mean for industrial production index is 57.9 in terms of 1997 being 100. The variable for real private sector disposable income is about 3.696 trillion dollars on average. It is interesting to note that this figure is more than half of the mean for real GDP, so there is a significant amount of disposable income (and thus consumption) that makes up our economy. Furthermore, the max and mins for this data set keep the same proportions as the mean in relation to real GDP. The average number of active military was 2,315,720 men and women. As one would expect the maximum military personal was achieved during the middle and late 1960's during the Vietnam era, and following Vietnam, the number was on a downward trend until the current period as technology began to have an ever increasing role in military affairs. Gross private savings for the country had a mean of 537 billion dollars. Finally over the period the United States did average a deficit, yet it was only a small one at about 62 billion dollars. The min and max of this variable are quite interesting in that the maximum surplus was a 212 billion dollar surplus and our largest deficit was 506 billion dollars. What is even more interesting about these numbers is that both of them are within the past decade.

Given that my work is to see if deficits raise interest rates and erode private savings, my three special interest variables were deficit, the interest rate, and gross private savings. The logical point of departure for me was to regress each of these on each other to obtain a possible relationship among these variables. I first regressed the interest rate on the deficit (which was calculated from a comparison of the expenditure and receipts variables) in regression 0. The result of this was showing that there was a negative relationship, although this was statistically insignificant. When I did the reverse and regressed the deficit on the interest rate in regression one, I found a negative correlation, but it was also statistically insignificant. The lack of statistical significance would seem to again show Ricardian equivalence holding. Secondly, both of my regressions involving gross private savings and the deficit in regressions two and three showed a negative relationship that was highly statistically significant with t statistics of -5.816 and -6.454. I was also interested in the role inflation plays in deficits and regressed the deficit on the GDP deflator in equation four and the reverse in equation five. What I found was that there is a high amount of statistical evidence that the two have a negative relationship; however, since both regressions were statistically significant, I could not prove causation either way. Therefore, after having a flavor of some simple regressions, I decided to go to the opposite extreme and run a regression that regressed nearly every variable on the interest rate in regression six (see Appendix 2). The only variables that had a statistically significant impact at the five percent level were civilian participation rate (.425), GDP deflator (-.244), net exports (.022), spot Texas oil price (.256), federal nondefense investment (-.283), and federal defense investment (.063). What is also significant to note is that the deficit did not have a statistically significant impact upon the nominal interest rate. Given the lack of a statistically significant value for deficit, it would seem again that Ricardian equivalence would hold. I next decided to regress my entire data series on the deficit in order to see which factors were statistically significant, which is shown in regression seven. I found that at the five percent level the following variables were statistically significant: currency in circulation (-.288), fixed private investment (1.199), GDP deflator (-13.403), net exports (.724), spot Texas oil price (1.346), federal defense investment (1.793), and gross private savings (-.450). It is significant to note that the nominal interest rate was not significant at the five percent level, which again would buttress the Ricardian equivalence argument. My next two regressions are similar to regressions six and seven, except with fewer variables. Regression eight is a regression of the nominal interest rate on various factors (shown in Appendix 4). The ones that were statistically significant at the five percent level were: currency in circulation (-.016), civilian participation rate (.779), spot Texas oil prices (.203), and the deficit is significant in this regression (.007). So what this regression is telling us is that for a one billion dollar increase in the deficit, we will see interest rates rise by .007%. In regression nine I regressed a series of variables upon the nominal interest rate (shown in Appendix 5). The following variables were statistically significant: net exports (-.518), spot Texas price per barrel of oil (-4.593), federal defense investment (-3.835), federal nondefense investment (18.326), gross private savings (-.434), and the nominal interest rate (18.604). So what we are seeing is that a 1% increase in the nominal interest rate will increase the deficit by 18.6 billion dollars, which actually is quite small. In regression ten I tried to replicate the Evans' equation in which Paul Evans regressed the interest rate on government spending, the deficit, money supply, and inflation. I used current expenditure, the deficit, currency in circulation, and the GDP deflator in my regression so I do have a couple different measures than Evans. However, what is important is that my regression (shown in the table below) did reach the same conclusion as Evans: that the deficit does not have a statistically significant effect on the interest rate as my t statistic on the deficit was only 1.122. So using the variables that Evans used I have shown Ricardian equivalence; however, I have also run a regression in which the deficit had a significant effect.

nominali	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
deficit	0.0026655	0.0023753	1.122	0.263	-0.0020159	0.007347
currente	-0.0282032	0.0056795	-4.966	0	-0.0393969	-0.0170095
currency	0.0148534	0.0096351	1.542	0.125	-0.0041364	0.0338432
gdpdefla	0.5536981	0.0680048	8.142	0	0.4196671	0.6877291
_cons	-6.244723	1.228341	-5.084	0	-8.665668	-3.823778

My final regressions are an attempt to confront the relationships of deficits, interest rates, and private savings through the use of an instrumental variables approach. In regression 11 I used a series of variables and regressed them on the interest rate. The variable that is significant is the currency in circulation variable because it impacts the interest rate but not the deficit. After running regression eleven, I obtained a predicted value denoted as "n" that will be the instrumental variable that I will later regress on the deficit. In regression 13 I used a series of variables and regressed them on the deficit. Similar to my interest rate equation, I took this regression and obtained a predicted value denoted "d". The significant variable in regression 13 was the active military variable because it impacts the deficit but not the interest rate. In regression 15 (shown below) I used all of the previous variables that impact the interest rate and the instrumental variable "d" for the deficit.

Regression 15

nominali	Coef.	Std. Err.	t	P>|t|	[95% Conf.
civilian	0.589	0.288	2.045	0.042	0.021
currency	-0.016	0.009	-1.737	0.084	-0.034
fixedpri	-0.008	0.004	-1.944	0.053	-0.016
gdpdefla	-0.021	0.050	-0.430	0.668	-0.119
spottexa	0.206	0.025	8.114	0.000	0.156
realgdp	0.001	0.002	0.429	0.668	-0.003
industri	0.076	0.068	1.115	0.266	-0.058
realdisp	0.001	0.002	0.434	0.665	-0.002
d	0.011	0.003	3.637	0.000	0.005
_cons	-36.372	16.520	-2.202	0.029	-68.948

What I found was that the deficit has a statistically significant positive effect of .0111 on the interest rate. Essentially, a 1 billion dollar increase in the deficit will increase interest rates by just over one tenth of a percentage point. Other factors that were significant in explaining the interest rate were the following: civilian participation rate (.588) and oil prices (.206). Furthermore it should be noted that our regression model is fairly accurate in that the value of R squared is .823. In regression 16 (shown below) I regressed variables that impact the deficit and the instrumental variable "n" for the interest rate on the deficit.

Regression 16

deficit	Coef.	Std. Err.	t	P>|t|	[95% Conf.
realgdp	0.078	0.057	1.367	0.173	-0.035
fixedpri	0.709	0.095	7.468	0.000	0.522
netexpor	-0.109	0.137	-0.791	0.430	-0.380
spottexa	-7.672	1.706	-4.498	0.000	-11.035
var1	-2.494	0.384	-6.495	0.000	-3.251
federaln	-8.216	3.268	-2.514	0.013	-14.661
realdisp	-0.223	0.057	-3.923	0.000	-0.336
activemi	0.000	0.000	1.139	0.256	0.000
n	31.774	6.195	5.129	0.000	19.558
_cons	108.269	25.831	4.192	0.000	57.335

What I found was that there was a highly statistically significant positive relationship again of 31.77. So what this means is that for a 1 percent increase in the interest rate, the deficit will increase by 31.77 billion dollars. Other variables that were significant in explaining the deficit were the following: fixed private investment (.709), oil prices (-.109), federal defense investment (-2.494), federal nondefense investment (-8.216), and real disposable personal income (-.223). In my final regression (regression 17) I wanted to find a relationship among deficits and private savings. So I regressed various factors that impact private savings plus my two instrumental variables, "n" and "d" (shown below).

Regression 17

grosspri	Coef.	Std. Err.	t	P>|t|	[95% Conf.
n	(dropped)				
d	-0.190	0.105	-1.807	0.072	-0.397
currency	0.406	0.115	3.536	0.001	0.179
civilian	-10.524	4.198	-2.507	0.013	-18.801
fixedpri	0.186	0.073	2.554	0.011	0.043
gdpdefla	12.645	1.592	7.944	0.000	9.506
realgdp	-0.051	0.042	-1.210	0.228	-0.134
spottexa	-0.847	0.438	-1.934	0.054	-1.710
industri	0.805	0.723	1.114	0.267	-0.620
realdisp	0.035	0.055	0.640	0.523	-0.073
_cons	469.608	237.595	1.977	0.049	1.111

I found that deficits do not have a statistically significant impact upon private savings. Factors that did have statistically significant effects on gross private savings included the following: currency in circulation (.406), civilian participation rate (-10.524), fixed private investment (.186), and the GDP deflator (12.645). With this equation the R squared value of .996 means that we have captured almost all of the factors that influence private savings.

Therefore, my instrumental variable regressions have only proven one of the traditional view's propositions. Indeed, there was no impact on private savings; however, we have learned that deficits do indeed raise interest rates. Nonetheless, we must also remember that some of out earlier regressions, including the Evans' equation, did not show a statistically significant relationship among deficits and interest rates. Therefore, the conclusion of this paper must be that, similar to the finding of the 1984 Treasury Report, the empirical proof of the relationship among deficits and interest rates is very much a question of econonometric methodology with different methods that can each prove either the Ricardian and the traditional view of deficits.

Appendix 1

Variable	Obs	Mean	Std. Dev.	Min	Max
timeperi	0				
nominali	223	4.893677	2.913971	0.79	15.05

currency	223	175.8953	186.6453	27.037	713.313
civilian	223	62.49865	3.202835	58.5	67.3
currente	223	681.2287	673.9049	36.3	2289.9
currentr	223	619.2444	624.6365	36.2	2088.5
fixedpri	223	516.0561	511.5049	38.6	1747.5
gdpdefla	223	50.39539	30.93509	16.111	106.126
netexpor	223	-61.90179	114.2617	-505.5	21.6
realgdp	223	5011.952	2548.519	1616.1	10599.2
spottexa	222	13.28039	11.04978	2.57	39.5
federaln	223	12.24395	11.09157	0.7	36
var1	223	28.8426	21.60979	1.8	69.2
industri	223	57.87772	28.42724	16.811	116.072
realdisp	223	3696.79	1927.879	1107.3	7872.3
activemi	212	2315720	631925.9	1384338	3635912
grosspri	223	537.9395	489.1485	36.7	1748.6
deficit	223	-61.98431	110.1006	-506.2	212.7

Appendix 2

nominali	Coef.	Std. Err.	t	P>|t|	[95% Conf.
currency	-0.007	0.007	-1.031	0.304	-0.022
civilian	0.425	0.179	2.376	0.018	0.072
fixedpri	0.005	0.004	1.269	0.206	-0.003
gdpdefla	-0.244	0.084	-2.924	0.004	-0.409
netexpor	0.022	0.005	4.624	0.000	0.013
realgdp	0.000	0.002	0.315	0.753	-0.003
spottexa	0.256	0.029	8.743	0.000	0.198
federaln	-0.283	0.083	-3.392	0.001	-0.447
var1	0.063	0.025	2.493	0.014	0.013
industri	0.030	0.048	0.624	0.533	-0.065
realdisp	0.003	0.002	1.427	0.155	-0.001
activemi	0.000	0.000	1.716	0.088	0.000
grosspri	0.002	0.003	0.760	0.448	-0.003
deficit	0.005	0.003	1.753	0.081	-0.001
_cons	-26.322	10.167	-2.589	0.010	-46.373

Appendix 3

deficit	Coef.	Std. Err.	t	P>|t|	[95% Conf.
nominali	3.000	1.623	1.849	0.066	-0.201
currency	-0.288	0.136	-2.122	0.035	-0.556
civilian	4.566	4.037	1.131	0.259	-3.396
fixedpri	1.199	0.116	10.362	0.000	0.971
gdpdefla	-13.403	1.920	-6.981	0.000	-17.190
netexpor	0.724	0.161	4.485	0.000	0.405
realgdp	-0.006	0.060	-0.096	0.923	-0.125
spottexa	1.346	0.678	1.985	0.049	0.009
federaln	0.109	2.278	0.048	0.962	-4.384
var1	1.793	0.635	2.824	0.005	0.541
industri	1.024	0.899	1.139	0.256	-0.749

realdisp	0.010	0.082	0.121	0.904	-0.153
activemi	0.000	0.000	-1.253	0.212	0.000
grosspri	-0.450	0.150	-3.008	0.003	-0.746
_cons	-88.315	222.782	-0.396	0.692	-527.672

Appendix 4

nominali	Coef.	Std. Err.	t	P>|t|	[95% Conf.
currency	-0.016	0.007	-2.181	0.030	-0.030
civilian	0.779	0.380	2.049	0.042	0.029
gdpdefla	0.025	0.056	0.451	0.652	-0.085
spottexa	0.203	0.022	9.370	0.000	0.160
grosspri	-0.002	0.004	-0.501	0.617	-0.010
activemi	0.000	0.000	1.123	0.263	0.000
deficit	0.008	0.003	2.789	0.006	0.002
_cons	-44.324	21.820	-2.031	0.044	-87.347

Appendix 5

deficit	Coef.	Std. Err.	t	P>|t|	[95% Conf.
currency	0.034	0.452	0.076	0.940	-0.857
netexpor	-0.518	0.249	-2.084	0.038	-1.008
spottexa	-4.593	1.038	-4.424	0.000	-6.639
var1	-3.835	1.193	-3.216	0.002	-6.186
federaln	18.326	7.403	2.475	0.014	3.733
grosspri	-0.434	0.199	-2.178	0.030	-0.826
nominali	18.604	3.529	5.272	0.000	11.649
_cons	-10.620	17.442	-0.609	0.543	-45.000

Acknowledgements

I would like to thank Professor Chris Bollinger and Professor Jim Fackler for their willingness to advise my work in such a knowledgeable manner and for being all around nice people. I would also like to thank Professor Dick Gift for captivating my interest in economics.

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