EFFECT OF GOVERNMENT DEFICIT SPENDING ON THE GDP IN THE UNITED STATES

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ABSTRACT

The relationship between government deficit spending and the growth domestic product is of extreme importance for economic policy making, especially in times of economic downturns as has been experienced in the US and around the world in recent years. The literature is mixed on this issue. There are studies arguing that deficit spending has an adverse effect on the GDP by way of increasing the interest rate and hindering business investment. Other studies argue for deficit spending at a time of recession as being beneficial in that it spurs demand and has no effect on interest rate.

It is important to look at data in order to determine if deficit spending has an effect on GDP in the presence of control variables such as interest rate, unemployment, and inflation which may have an effect on the GDP.

In this study, we analyze data from the US and develop a time series model showing the relationship between deficit spending and GDP. Results revealed that government deficit spending had a negative effect on GDP. Inflation rate and interest rate had no effect on the GDP. Only unemployment had a negative effect on the GDP in the presence of deficit spending. It is interesting to note that GDP was cointegrated (having a long-run equilibrium relationship) with unemployment rate, interest rate, and inflation rate.

INTRODUCTION

Deficit spending by a government and how it relates to the economy as measured by the GDP is of fundamental importance in shaping economic policy for a country, especially at a time of economic downturn. It is of importance to determine if deficit spending would have an influence on economic growth. The literature is mixed on this issue. Some economists are of the opinion that deficit spending has a negative effect on the economy in that it increases interest rate which leads to a decrease in investment. Others argue that deficit spending has a positive effect by increasing demand. On the other hand, there are those that argue for no effect on the economy.

If deficit spending has a negative effect on growth, then fiscal austerity would be legitimate as a remedy for an economic downturn. On the other hand, austerity measures would be detrimental to the economy if deficit spending is the right stimulus for growth.

From the arguments above, it is clear that empirical studies to determine the relationship between government spending and economic growth are of utmost importance. In this study, we employ time series analysis techniques to investigate the relationship between federal deficit spending and economic growth in the United States over the time period 1930-2010.

RELEVANT LITERATURE

Kiani (2007) showed that there was a positive effect of budget deficit in the US and long term interest rate. Also, a positive effect of budget deficit on interest rate in the United States was reported by Feldstein (1986) and Holster (1986). Posner (1987), Krueger (2003), and Macao (2003) argued that an increase in interest rate would cause a decrease in investment, which would decrease economic growth. On the other hand, studies by Makin (1983), Plosser (1982), and Evan (1985) showed no evidence of a relationship between budget deficit and interest rate.

Cebula (2008) provided evidence through co-integration analysis and an error correction model, indicating that federal deficit in the US, over the period 1973-1996, and interest rates on high-grade tax-free municipal bonds were positively correlated. An increase in budget deficit is accompanied by an increase in real interest rate. Also, there was some indication that high interest rate has a positive effect on federal deficit. This indicates a bidirectional relationship between the two variables. It is difficult, however, to infer cause and effect from a correlation.

Collins (1999) presented coefficients of correlation (on data between 1944 and 1994 in the US) between deficits and stocks and bonds as well as data on deficits and investment and interest rates. Results were not consistent with the argument that deficits cause an increase in interest rate and a decrease in GDP growth, investment, and stock performance.

Nikannen (1978) reported that budget deficit led to an increase in government spending, but had no effect on inflation over the period 1947-1976 in the United States

Pollin (2012) concluded from his study that the US government deficit related to the 2009 economic stimulus did not cause an increase in interest rate or inflation.

Siklos (1988) using spectral and time series analysis on quarterly (1950- 1984) and annual data (1871- 1984) in Canada found no empirical evidence to show that government spending had an effect on long term interest rate.

Giffin et al (1981) analyzing time series data over the years 1959-1979 in the US, reported that there was no significant correlation between deficit spending and inflation rate.

Ball and Markiw (1995) presented empirical evidence which showed that large deficits over the period 1982 to 1994 was accompanied by a decline in investment, export, and private saving..

Eisner (1989) and Domar (1993) argued that deficit spending can improve the economy at a time of economic slowdown

Hoelscher (1986), using regression analyses on time series data over the period 1953-1984 in the US, reported that deficit caused long term interest rate to rise. The author was of the opinion that other factors like short term interest rate and inflation were additional factors that may have affected long term interest rate.

Keith (2005 examined the link between deficit and inflation and came to the conclusion that there is little to no link between the two for the US economy.

Hutchison and Pyle (1984), Ford and Lawton (1995), and Tanzi and Fanizza (1995) provided empirical evidence indicating that higher deficits in industrial countries have increased interest rates.

Studies by Barro and Sali-I-Martin (1990) and Evans (1987) support the Ricardian view, namely that a tax induced budget deficit has no effect on interest rate.

Using Granger causality analysis on US data between 1947 and 2002, Liu et al (2008) reported that public expenditure had a positive effect on the GDP. However, GDP did not have any effect on increasing the public expenditure.

Barth and Wells (1999) argued that budget deficit increases interest rate, which can lead in turn to a reduction in investment. This can have a negative effect on economic growth and exports. Barrow (1974) argued that bond-financed deficits will have no effect on economic investment or export.

Palley (2011) argued that deficit financed public investment is needed for economic growth and that austerity measures slows growth. Taylor et al. (2012) presented evidence showing that an increase in public spending in the US had a positive effect on economic growth.

DATA

Data for the United States on federal spending relative to revenue (spending – revenue) and GDP was in billions of dollars. Positive values for spending indicated deficit spending and negative values non-deficit or surplus spending. The data were obtained from the on line source ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt

http://www.economagic.com/em-cgi/data.exe/blsln/lns14000000

http://www.usgovernmentspending.com/spending_chart_1930_2016USk_13s1li011mcn_G0f

Data was over the years 1930-2010. Spending was mostly deficit spending (DS). Plots of the GDP, federal deficit spending (DS), unemployment rate (UER), interest rate (INR), and inflation rate (IR) over years are presented in the Appendix.

METHODOLOGY

The SAS software was used in the data analysis. The Johansen cointegration analysis was performed in order to determine if cointegration exists between GDP and deficit spending, unemployment rate, interest rate, and inflation rate. Also, time series transfer function analysis was used to determine the relationship of GDP to federal deficit spending, unemployment rate, inflation (measured as CPI), and one year fixed deposit interest rate. The final time series model included GDP as a function of federal spending and unemployment. Inflation and interest rate had no significant effect on GDP.

Cointegration

Two time series variables that are in a long-run equilibrium relationship are cointegrated. Cointegrated series do not diverge over time. Any divergence is usually short term and eventually the two series come back together. It is important to realize that co-integrated variables may or may not be correlated.

Table 1 presents the co-integration analysis results for GDP and DS using the Johansen cointegration test (Johansen, 1988).

In the US, government deficit spending relative to revenue (DS) and GDP are cointegrated since the trace value is larger than the critical value when the rank is 0, but less than when the rank is 1. This says that there is a long-term linear relationship between the two variables. A similar analysis showed also that GDP is cointegrated with each of employment, interest, and inflation rate. However, as is shown from the time series analysis, GDP is influenced

only by DS and UER and not by INT or IR. Note that cointegration does not imply correlation or functional relationship in the short run.

Table 1. Johansen cointegration rank test for government deficit spending (DS) and GDP

Variables	H_0: rank = r	H_a: rank > r	Trace	Critical Value
DS GDP	0	0	86.67	12.21
	1	1	2.80	4.14

Multivariate time series modeling using the transfer function approach

The transfer function analysis is the state of the art modeling approach to determine the functional relationship between series, the input or independent series and the output or dependent series. The interest in this study is in determining if federal spending relative to revenue does have an effect on GDP in the presence of control variables, namely unemployment, inflation, and interest rates. Hence, the input variables are DS, UER, IR, and INR and the output series is GDP. This approach is especially relevant when there is no feed- back between the output and input series as determined by the cross-correlation function. If the cross-correlation between two stationary series is significant for only zero or positive lags, then there is no feed- back between the output and input series (Wei, 2006). This was the case for the series considered in this study.

The time series analysis is valid only if the series are stationary. The first difference for each of GDP, UER, and INR was stationary as determined by the Dickey-Fuller unit root test and the dampening patterns of the autocorrelation function (ACF) and the partial autocorrelation function (PACF). On the other hand, the second difference for IR was stationary. Therefore, the analysis that follows is based on the first difference for each of GDP, UER, INR and the second difference for IR.

A transfer function model between an output series y and input series x_i (i = 1, 2, …,k) is expressed in general as

$$y_t = \sum_i^k v(B)_i \, x_{it} + a_t \quad (1)$$

Here, $v(B) = \sum v_j B^j$, where B is the backshift operator, $Bx = x_{t-1}$.

The function $v(B)_i$ is determined from the cross correlation between xi and y (Wei, 2006).

Once $v(B)_i$ is identified, one can express et in Eq. (1) as

$$a_t = y_t - \sum_i^k v(B)_i \, x_{it} \quad (2)$$

and identify the appropriate model for Eq. (2 from which one can determine the final model in Eq. (1).

RESULTS

First, the transfer function analysis was performed on the full model with GDP(1) as the output or dependent variable and DS(1), UER(1), INR(1), and IR(1.1) as the input or independent variables. Here, GDP(1), DS(1), UER(1), INR(1) indicate the first difference for each series and IR(1,1) the second difference. Results of the analysis showed that INR(1) and IR(1,1) had no significant relationship to GDP(1). Their p values were 0.30 and 0.83, respectively. As a result, INR and IR were deleted from the model and the analysis repeated using GDP(1), DS(1) and UER(1). The resulting model was

$$Gdp(1)_t = - 0.37DS(1)_t - 49.33UER(1)_t + e_t /(1- 0.85B) \text{ ,} \quad (3)$$

where e_t is white noise and B is the backshift operator as explained above.

The model in Eq. (3) satisfied the assumption that the error term is independent of the input series. This was the case since there was no cross correlation between the noise series and the independent or input series.

From the model in Eq. (3), it is seen that deficit spending, DS (1), has a negative effect on GDP(1) (-0.37 with $p< 0.0001$). Also, as expected UER(1) has a negative effect on GDP(1) (-29.33 with $p <0.0001$).

Furthermore, the cross correlation between GDP(1) and DS(1) was -0.404 ($p = .0097$) and that between GDP(1) and UER(1) was -0.542 ($p < 0.0001$). Based on the Granger test (1969), it was found that UER(1) Granger caused GDP(1) and DS(1) Granger caused GDP(1). These results due to the model in equation (1), the cross correlation and the Granger test, are consistent in showing a negative correlation between GDP(1) and each of UER(1) and DS(1). However, it should be noted that correlation does not necessarily mean causation and that is true also of the Granger causation test, in spite of its name.

For forecasting, equation (3) can be expressed as:

$$GDP(1)_t (1-0.85B) = -0.37 DS(1)_t (1-0.85B) – 49.33 UER(1)_t (1-0.85B)_t \quad (4)$$

Or

$$GDP(1)_t = 0.85 GDP(1)_{t-1} -0.37 DS(1)_t + 0.31 DS(1)_{t-1} -49.33 UER(1)_t +41.93UER(1)_{t-1} \quad (5)$$

Also, from the time series analysis, we have that

$$DS(1)_t = 0.212 DS(1)_{t-1} \quad (6)$$

and

$$UER(1)_t = 0.31 UER(1)_{t-1} \quad (7)$$

Hence, from Eqs. (5), (6), and (7), one can predict $GDP(1)_t$ from observations on

$DS(1)_{t-1}$, $UER(1)_{t-1}$ and $GDP(1)_{t-1}$.

From the predicted $GDP(1)_t$, one can obtain GDP_t from the relation

$$GDP(1)_t = GDP_t – GDP_{t-1} \quad (8)$$

CONCLUSION

The Johanssen co-integrated analysis revealed that GDP has a long-term equilibrium relationship with unemployment, interest and inflation rates. This implies that GDP does not diverge over time from unemployment, interest rate or inflation rate. Any divergence is usually short term and eventually the series come back together. This long-run relationship may be due to direct cause and effect or may be due to a third variable or group of variables that were not observed. Likewise, a functional relationship, as represented by Eqs. (5), (6) and (7) may not be due to direct cause and effect.

Of interest is the finding that deficit spending had a significant negative effect on economic growth in the presence of unemployment, interest rate and inflation rate as control variables. The data used (1930-2010) included the great depression and the recent severe recession. It is not clear why deficit spending had a negative effect when interest rate had no effect. It may be that one year interest rate is not long term to show any effect. Krugman (2012) argued that deficit spending did not help the economy in the recent recession because it was not enough to cause an increase in demand and economic growth. In fact data in this study show that since 2002 and especially after 2007 deficit spending grew significantly while the GDP was stagnant or showed weak growth. Based on this, we analyzed the data for the period 1930 to 2006 and for the period 1930 – 2001. In both cases there was no significant relationship between deficit spending and the GDP. Also, there was no significant cross correlation or Granger causation. This indicates that the last years were the contributing factor for the negative relationship between deficit spending and growth. If Krugman's argument is correct, then the observed negative relationship between deficit spending and GDP may not indicate cause and effect. If deficit spending has a negative effect, it would be because of its effect on raising long term interest rate. In a future work we will examine the relationship between government spending and long term interest rate for the time period after 2000 in the US and other countries.

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APPENDIX

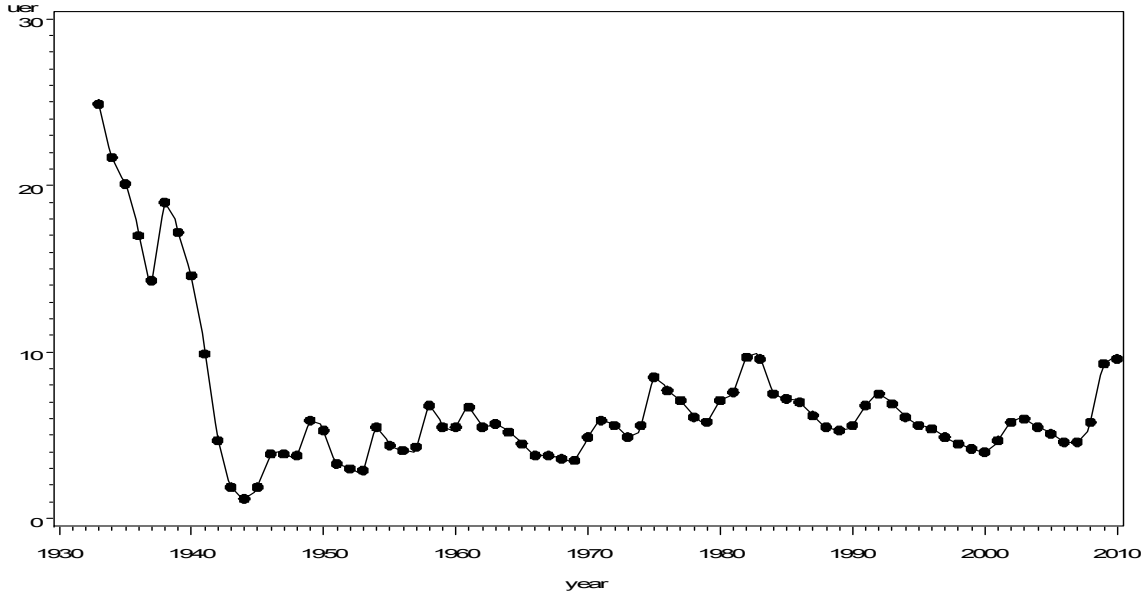

Figure1. Plot of unemployment rate (UER) over years.

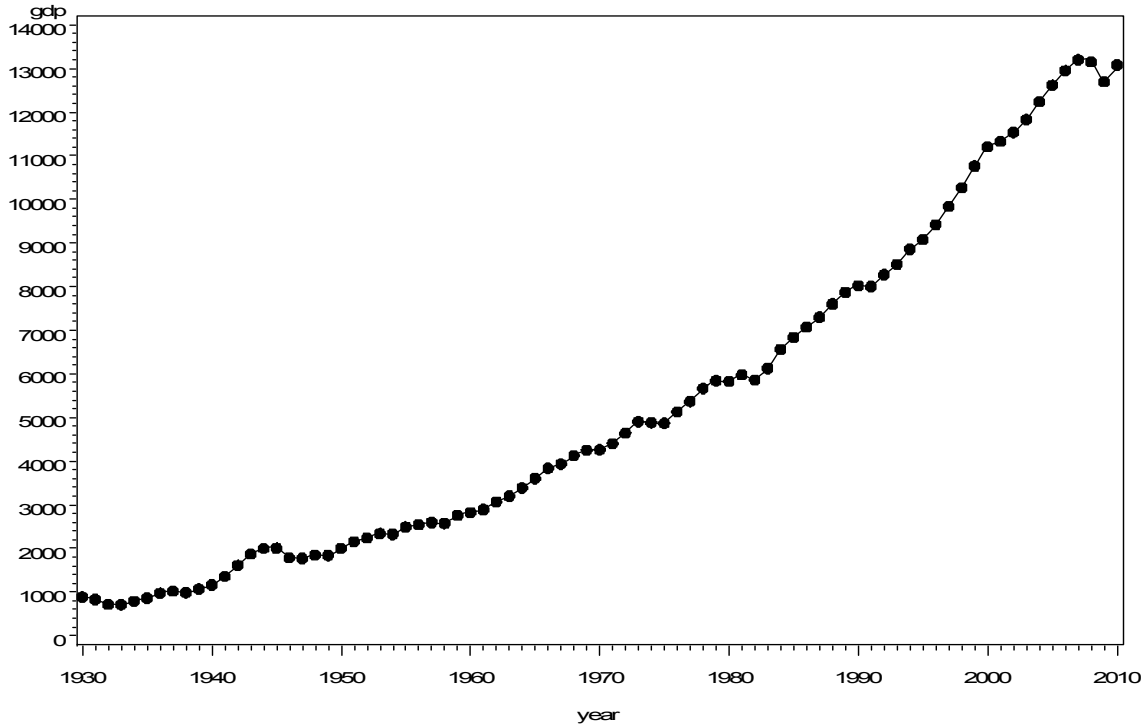

Figure 2. Plot of GDP over years.

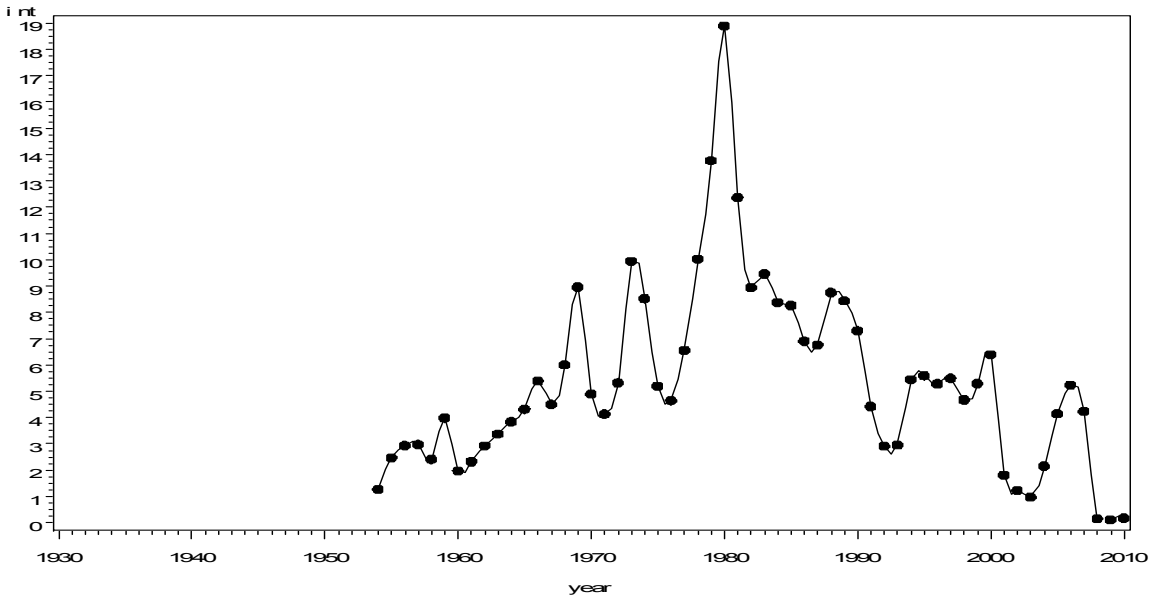

Figure 3. Plot of interest rate (INT) over year.

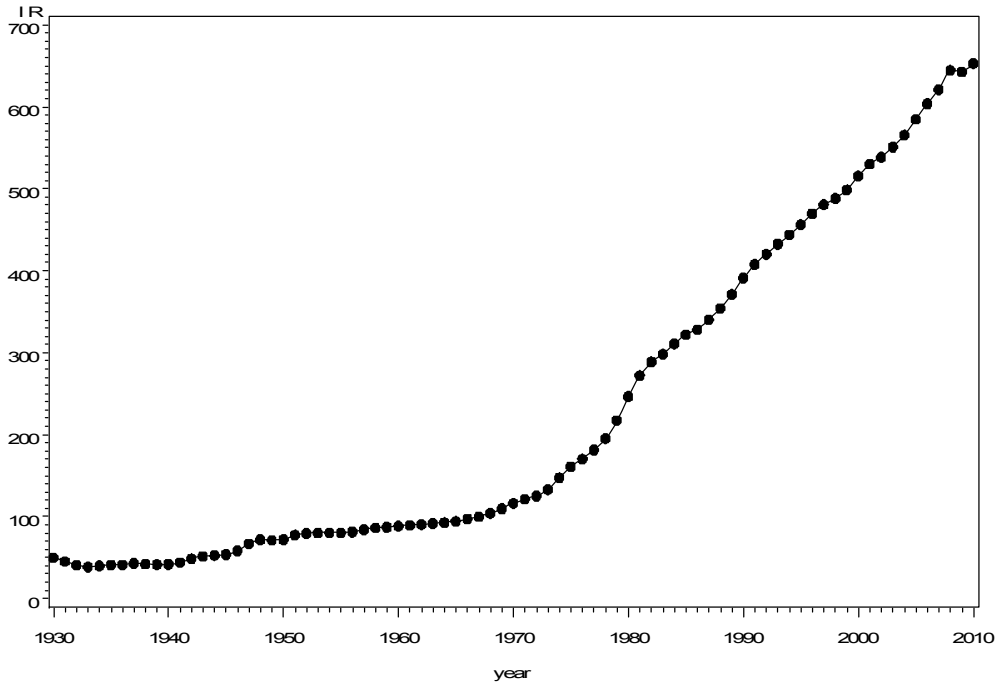

Figure 4. Plot of inflation rate (IR) over years.

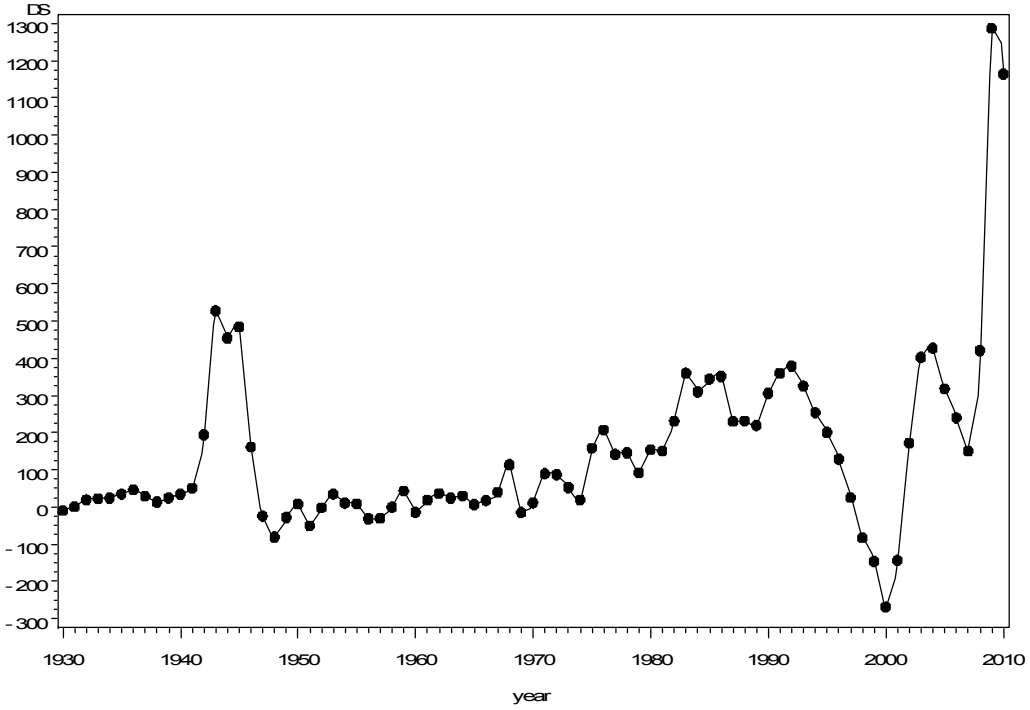

Figure 5. Plot of government deficit spending (spending – revenue), DS, over years.