THE DEBT INDEX AND ITS RELATION TO ECONOMIC ACTIVITY: AN EXTENSION

John J. Bethune, Barton College

INTRODUCTION

During the 1970s and 80s the concept of a "misery index" was used as a proxy to describe how well, or poorly, the macro economy was performing. In its simplest form the misery index was calculated by adding the rate of inflation to the rate of unemployment, thus a higher index indicated an economy preforming poorly.

In the past two decades, with inflation seemingly under control and, until recently, a modest level of unemployment, the misery index has not been the subject of policy discussions or political discourse. Rather, concern about the national debt and soaring budget deficits seems to be the focus of those who worry about our economic future.

With expanding national indebtedness and seemingly endless deficit spending the world's economies appear to face different issues that move beyond inflation, unemployment, and sluggish growth rates. While there are clearly empirical relationships for these variables to debt and deficit levels, until recently we did not have an index that shows explicitly how debt affects economic activity.

This paper expands on a previous publication that combines debt to GDP and deficit to federal spending ratios to develop a "debt index" for several national economies. While the earlier effort used measures of the debt index to compare with various macroeconomic variables, this work will compare the movement of the debt indices through time with the movement of macroeconomic variables across 14 countries. Given the characteristics of the data, this approach is more appropriate than my previous effort. Also, this paper includes regression analysis to gauge the explanatory power of the relationships. Given the characteristics of the data (see below) this is appropriate for the relative change data used in this analysis, but would have been inappropriate for use in the prior data set.

The Debt Index and Prior Research

There are both short run and long run issues involving the debt problem in the United States and elsewhere. In the short run, the deficit represents a problem for policy makers while in the long term, the national debt is an issue that must be addressed.

To construct a "debt index" I combine the value of the annual federal budget deficit divided by federal government spending with the national debt divided by nominal GDP.
Put simply:

Deficit/Spending + Debt/GDP = Debt Index

This combines the temporal aspects of our short and long term debt problems into one measure.

In a recent article I use correlation coefficients to show how the debt index is associated with private investment and the rate of unemployment for 15 industrialized countries. [Bethune,

2013] For the United States, I show how the debt index is more closely correlated, in most instances, with private investment and unemployment than any of the component parts. Other topics are addressed as well.

Another recent article finds a relationship between budget deficits and economic growth, which reinforces my more comprehensive study. [Cebula, 2013] Focusing only on budget deficits, Cebula finds that "the higher the budget deficit (expressed as a percent of GDP), the lower the percentage growth rate of real per capital GDP." [p.86]

While there are other studies examining the relationship between deficits, debt and various macroeconomic variables, none use the temporal index I developed in the previous article, thus an extensive literature review is not possible. These prior studies only focus on how deficits affect economic growth and do not address the issue of overall debt. The basic content of this research approach is unique.

Extensions of the Relationships

While the earlier work just used the values of the variables as they moved through time, it is possible to make additional meaningful statistical comparisons by examining the data in the form of percentage change from one time period to the next. Using the Pearson product movement correlation coefficient, Table I presents the relationship between the debt index and private investment for 14 industrialized countries. [The data set for Iceland, included in the previous study, was corrupted, and I did not take the time to reconstruct it, given that it added little overall relevance.] Unless noted otherwise, all coefficients are significant at the one percent level.

Table I
Debt Index Correlations with Private Investment (Percentage Change)

USA	-.672
Greece	-.501
Italy	-.686
Japan	-.782
Sweden	-.787
UK	-.723
Germany	-.392 **
Australia	-.365**
New Zealand	-.467*
Canada	-.818
France	.653
Ireland	-.533
Spain	-.550
Portugal	-.665

*Significant at the 05 percent level.
**Significant at the 10 percent level.
@ Not significant at the 10 percent level.

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In the initial study, 13 of the 15 countries demonstrated significant relationships between the two variables. Using the percentage change in the variables, all the countries here demonstrate some significant correlation. In most cases, however, the correlation is somewhat weaker. For example, the data for the USA correlated at -.831, but using the percent change in the variables results in a -.672 coefficient. Both remained significant at the one percent confidence interval.

Table II presents the relationship between the debt index and unemployment. In the previous study the UK, Germany and France showed no significant relationship. Using this method, only Germany continues to exhibit a weak and insignificant relationship. For Greece, the sign change was reversed, indicating unemployment and debt are not related in a manner similar to the rest of the countries.

For the USA, the relationship strengthened from .479 to .802, indicating a strong positive association with debt and the rate of unemployment.

Table II
Debt Index Correlations with the Unemployment Rate (Percentage Change)

USA	.802
Greece	-.174
Italy	.601
Japan	.804
Sweden	.608
UK	.661
Germany	.183@
Australia	.623
New Zealand	.533
Canada	.845
France	.505*
Ireland	.448
Spain	.843
Portugal	.481*

*Significant at the 05 percent level.
**Significant at the 10 percent level.
@ Not significant at the 10 percent level.

Table III presents the relationship between total spending in the private sector and the debt index. This relationship was not examined in the prior research. As indicated, except for Germany, there is generally a strong negative association between the debt index and private sector spending.

Table III **Debt Index Correlations with Private Sector Spending (Percentage Change)**	
USA	-.713
Greece	-.660
Italy	-.677
Japan	-.737
Sweden	-.740
UK	-.836
Germany	-.183@
Australia	-.439*
New Zealand	-.495
Canada	-.818
France	.712
Ireland	-.459
Spain	-.596
Portugal	-.604

*Significant at the 05 percent level.
**Significant at the 10 percent level.
@ Not significant at the 10 percent level.

Another relationship not presented in the previous article is that between the debt index and nominal GDP. Table IV shows these correlation coefficients. Germany, Australia and Spain do not exhibit any significant relationship, but the rest of the remaining countries show a significant negative relationship. Higher increases in the debt index coefficients are associated with slower or negative rates of growth in GDP.

Table IV **Debt Index Correlations with GDP (Percentage Change)**	
USA	-.527
Greece	-.815
Italy	-.329**
Japan	-.614
Sweden	-.760
UK	-.693
Germany	-.198@
Australia	-.293@
New Zealand	-.339**
Canada	-.850
France	.377*
Ireland	-.515
Spain	-.209@
Portugal	-.536

*Significant at the 05 percent level.
**Significant at the 10 percent level.
@ Not significant at the 10 percent level.

Overall, for most countries in most cases, increasing debt indexes are associated with decreasing (or negative) rates of growth for private investment, private spending levels and nominal GDP. Also the debt index movements are positively and significantly associated with the changes in the rate of unemployment.

The Debt Index and Explanatory Power

While correlation coefficients can show how closely two variables are associated this does not necessarily demonstrate the causal relationship between the variables. During the course of the prior research I attempted some simple regressions to test the explanatory power of the correlated relationships. These did not offer any additional insight.

In retrospect we should not expect simple regression models to offer much in the way of explanatory power. These models assume that Y is a linear function of X and are appropriate "when X and Y are stationary time series or cross-sectional (non-time-series) variables, and a scatter plot of Y versus X suggests a significant linear relationship." [Duke Website] It is much more probable that the percentage change in Y is a linear function of the percentage change in X, in which case a relative change model would be preferable. This model is also appropriate "when X and Y are nonstationary time series with nonlinear trends and/or heteroscedasticity--e.g., series with inflationary or compound growth . . ." [Duke Website] which would appear to be the case here. The variables do contain inflationary growth and heteroscedasticity is likely.

In the following four tables I present the results from a regression model that uses the percent change in the debt index as the independent variable to explain the percentage change in the variables addressed in the four previous tables.

Table V
Adjusted R-square Where Private Investment is the Dependent Variable and the Debt Index is the Explanatory Variable (Percentage Change)

USA	43.4 percent
Greece	0
Italy	44.6 percent
Japan	59.9 percent
Sweden	59.8 percent
UK	50.6 percent
Germany	10.9 percent
Australia	9.2 percent
New Zealand	18.7 percent
Canada	64.7 percent
France	40.8 percent
Ireland	26.0 percent
Spain	28.0 percent
Portugal	41.4 percent

Table VI **Adjusted R-square Where the Unemployment Rate is the Dependent Variable and the Debt Index is the Explanatory Variable (Percentage Change)**	
USA	63.2 percent
Greece	12.8 percent
Italy	33.2 percent
Japan	63.5 percent
Sweden	33.3 percent
UK	41.9 percent
Germany	0
Australia	35.9 percent
New Zealand	25.6 percent
Canada	69.5 percent
France	23.1 percent
Ireland	17.4 percent
Spain	70.1 percent
Portugal	19.3 percent

Table VII **Adjusted R-square Where Private Sector Spending is the Dependent Variable and the Debt Index is the Explanatory Variable (Percentage Change)**	
USA	49.2 percent
Greece	0
Italy	43.3 percent
Japan	52.7 percent
Sweden	52.2 percent
UK	69.0 percent
Germany	0
Australia	15.4 percent
New Zealand	21.4 percent
Canada	64.6 percent
France	49.1 percent
Ireland	18.4 percent
Spain	33.4 percent
Portugal	33.3 percent

Table VIII **Adjusted R-square Where Nominal GDP is the Dependent Variable and the Debt Index is the Explanatory Variable (Percentage Change)**	
USA	25.4 percent
Greece	3.1 percent
Italy	6.8 percent
Japan	35.6 percent
Sweden	55.3 percent
UK	46.2 percent
Germany	0
Australia	4.2 percent
New Zealand	8.0 percent
Canada	70.4 percent
France	11.4 percent
Ireland	24.0 percent
Spain	1.2 percent
Portugal	25.2 percent

With respect to private investment, the debt index has considerable explanatory power (greater than 40 percent) for the USA, Italy, Japan, Sweden, the UK, Canada, France, and Portugal. The other countries exhibit a moderate to weak causal relationship.

For the unemployment rate, the debt index has considerable explanatory power for the US, Japan, the UK, and Spain. The other countries exhibit a moderate to weak causal relationship.

For private sector spending, the debt index has considerable explanatory power for the USA, Italy, Japan, Sweden, the UK, Canada and France. The other countries exhibit a moderate to weak causal relationship.

Finally, for nominal GDP, only the UK, Sweden and Canada show an explanatory power of greater than 40 percent. Moderate (adjusted R-squares between 20 and 39.9 percent) are present for the USA, Japan, Ireland and Portugal.

The growth (or lack of) in GDP is often considered as having considerable explanatory power with respect to private investment, private sector spending and the unemployment rate. Using USA data I ran a simple regression where nominal GDP was used as the explanatory variable.

The percentage change in nominal GDP does outperform the debt index in explaining the percent change in private investment (56.1 percent v. 43.4 percent) and the percent change in the private sector (85.6 percent v. 43.4 percent). The power of nominal GDP to explain these variables was generally stronger in all countries where the debt index had considerable explanatory power as well.

However, the debt index did outperform nominal GDP with respect to unemployment (63.2 percent v. 37.5 percent). This was true in all the countries that showed considerable explanatory power for the debt index: Japan (63.5 percent v. 21.4 percent), the UK (41.9 percent v. 33.7 percent), and Spain (70.1 percent v. 10.7 percent).

The Debt Index and Forecasting

The International Monetary Fund forecasts future data through the year 2016. Table IX shows the percentage change from one year to the next for the USA in these annual forecasts. [The debt index forecast is calculated based on the IMF forecasted data of the component parts.] It is predicted that the debt index will fall in 2013 and then gradually rise each year through 2016.

Also predicted is relatively robust growth in private investment, the private sector, and GDP, while unemployment declines significantly.

Table IX
IMF Annual Forecasts for the USA (Percent Change)

Year	PC Debt Index	PC Private Investment	PC Private Sector	PC GDP	PC Unemployment
2013	-01	7.2	4.1	3.2	-5.6
2014	00	9.0	3.5	4.0	-8.6
2015	1.6	9.1	3.7	4.7	-11.0
2016	2.1	8.2	3.6	4.9	-12.7

If these predictions are accurate the relationship between the debt index and these variables will change significantly over the next four years. Table X compares the past correlation coefficients (taken from Tables I through IV) of the debt index and the relevant variable with the forecasted correlations.

Table X
Correlation Comparisons

Private Investment		Unemployment		Private Sector		GDP	
Previous	Predicted	Previous	Predicted	Previous	Predicted	Previous	Predicted
-.672	.272@	.802	-.595@	-.713	-.030@	-.527	.131@

@ not significant at the 10 percent level

While, since 1980, there have been strong negative correlations (significant at the one percent level) between the debt index and private investment, the private sector, and GDP, the forecasted associations are insignificant and change signs in two instances. The same holds true for the predicted association between the debt index and unemployment (a sign change and no significance).

Table XI
Adjusted R-square Comparisons with the Debt as the Explanatory Variable

Private Investment		Unemployment		Private Sector		GDP	
Previous	Predicted	Previous	Predicted	Previous	Predicted	Previous	Predicted
43.4 percent	0.0 percent	63.2 percent	13.9 percent	49.2 percent	0.0 percent	25.4 percent	44.9 percent**

** Indicates a positive relationship between the two variables, opposite sign of the previous relationship.

Table XI shows the comparison between previously calculated adjusted R-squares (from Tables V through VIII) and those predicted using the IMF data.

The relationships between the IMF's predictions and the debt index are clearly at odds with the previous relationships held between these variables. The IMF is forecasting a moderately rising debt index concurrent with robust growth in private investment, the private sector, and GDP. It is also suggesting accelerating decreases in the unemployment rate.

The results of the research presented here suggest that, if the debt index continues to rise, much more anemic growth will occur in private investment, the private sector, and GDP. We would also expect very little progress towards reducing the unemployment rate. Further, if the IMF forecasts that call for moderate growth in the debt index are overly optimistic then we would expect an even worse performance from these macro-variables. Time will tell.

SUMMARY AND CONCLUSIONS

As noted in my earlier work, policy makers and commentators do not currently have a useful index to track or use to show how debt affects current and future economic activity. The debt index offers such a tool and combines both short term and long term considerations.

Using correlation coefficients and relative change regression analysis it can be shown that, for a variety of countries, the debt index is significantly and adversely related to such variables as private investment, unemployment, private spending, and nominal GDP. Correcting both short term problems (the deficit to government spending ratio) and longer term problems (the national debt to GDP ratio) might well be the key to increasing levels of private sector investment and spending and, thus, increasing GDP.

Conventional wisdom holds that increasing GDP is the key to reducing unacceptably high levels of unemployment. This study has suggested that reducing the debt index may well be the best approach to reducing unemployment levels.

REFERENCES

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