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Investment Spending and GDP

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Investment Spending and GDP

How should we choose?

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BUSN-212-01 Business Statistics

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5/17/2018

Introduction

As political perceptions widen in America, ideas as how to stimulate growth in the economy becomes the center of those campaigns. The economic performance of a nation is measured in terms of GDP (Gross Domestic Product); a higher GDP is usually related to higher standards of living with few exceptions. Government investment is known to have a positive impact on the economy in the short run. I conduct a least squares regression analysis to observe whether investments in health care, state and local expenditure in infrastructure, federal expenditure in infrastructure, capacity utilization, and the rate of inflation have long term linear relationships with GDP. Through 50 years of data, this model suggests that state and local investment in infrastructure has a significant (P-value 0.0006) negative impact on GDP (-4.984 for every dollar increase in that sector). Other implications worth noting from the study imply that increases in healthcare investment from the government decreases GDP value by -0.3096 though not a significant independent variable (P-value 0.0582). Chen (2016), on the relationship of GDP and government investment finds that overinvestment can actually lead to 'growth-retardation'.

Literature Review

Fogel's (1962) stance on the impact of the railroad as an important contributing factor to the growth of the American economy is negative. One of the most staple icons of the boom in the American economy is reduced to 'a small aggregate of social saving'. We in America have one of the least sophisticated transportation methods in the developed world. Economies like Japan and China for example, contain some of the best. China is one of the best examples of how infrastructure investment has led into one of the fastest growing economies in the world.

What a least squares regression analysis can do is explain the correlation between the independent and dependent variables. What is still missing in this report, are the numerous sophisticated policies that work to fuel investment at a scale such as China. However, we can speculate that it has to do with the growth of foreign direct investment in special economic zones that China set forth.

There may be a more complicated relationship between the balance of federal, private, and foreign investment. Friedman (1970) argues that the role of businesses are to solely make profit. This study serves to put to question such theory. Chen (2016) says 'excessive government investment would increase financing demand, tax-enhancing, high private burden and public debt, all which are harmful to economic growth'. This implies that in the attempt to save money and help people through business success, government is forced to improve the living conditions and may have a higher economic burden for business and individuals alike.

Methodology

Data was collected from the Federal Reserve Bank of St. Louis Economic database and from the National Health Expenditures Account (NHEA). The data spanned from 1947 to 2017 but some years were removed completely if there were inconsistencies within the data. The data was also formatted so that monetary values would be formatted into millions of dollars. To analyze the relationship between the independent variable GDP and the dependent variables health care, state and local expenditure in infrastructure, federal expenditure in infrastructure, capacity utilization, and inflation rates; ($\beta_1 x_1$, $\beta_2 x_2$, $\beta_3 x_3$, $\beta_4 + x_4$, $\beta_5 x_5$ respectively) the model used is the following:

$$Y = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 + x_4 + \beta_5 x_5$$

Inflation rate was included in the model because as inflation increases so does the value of goods. Capacity utilization is another variable added to the model because we expect to see a positive relationship when factories are working at higher capacities when there are higher levels in investment. The inclusion of both of these variables is intended to reduce specification bias issues that may arise from omitting important variables that may have an important impact on both the independent and dependent variables. Health care is measured as the total health care expenditure in the nation gathered from the NHEA. The variables of focus are health care, state and local, and federal expenses. A regression like this is used to look at the impact of each independent variable, holding all other variables constant. It is expected that health care would have a positive impact in GDP because of the presumption of healthier and happier workers lead to better economies. It is also important to note that all government expenditure is included in measuring GDP; therefor it would only be natural to presume it to be positive.

Model

A least squares regression test performed through SAS programming yielded these results:

Number of Observations Read 50

Number of Observations Used 50

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	91.73305	18.34661	7.52	<.0001
Error	44	107.34888	2.43975		
Corrected Total	49	199.08193			

Root MSE	1.56197	R-Square	0.4608	
Dependent Mean	2.80166	Adj R-Sq	0.3995	
Coeff Var	55.75165			

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	1	3.69441	10.39869	0.36	0.7241	0
HC	1	-0.30967	0.15925	-1.94	0.0582	6.97051
shSNL	1	-4.98420	1.34175	-3.71	0.0006	2.61542
shFED	1	0.07309	0.63515	0.12	0.9089	2.51931
CU	1	0.20528	0.07732	2.65	0.0110	2.02833
rates	1	-0.33999	0.16846	-2.02	0.0497	3.61441

An F-value less than 0.01 is an indication that independent variables can reliably predict the dependent variable. The R-squared value tells us that 46% of the variation in GDP in the United States can be explained using this model, granted the simplicity of the model and the complexity of GDP, contribute to this low explanatory power. State and local investment is the only significant variable in the model with a P-value less than .01, meaning we can be 99% confident that the relationship between GDP and that variable is -4.984. Inflation rates are significant at a 95% confidence level and the results display a contradictory result as to what was expected from that variable. The next step is to make sure that basic assumptions are met for normal linear regression models. These basic assumptions are: 1) Error terms are normally

distributed 2) expected value of error terms are equal to 0 3) the data is homoscedastic and 4) there is no autocorrelation present.

Errors in the Model

A graphical plot of the residuals will suffice enough to identify, if any, patterns of variation in the error terms that will violate the basic assumptions of a normal linear regression model.

Fit Diagnostics for growth
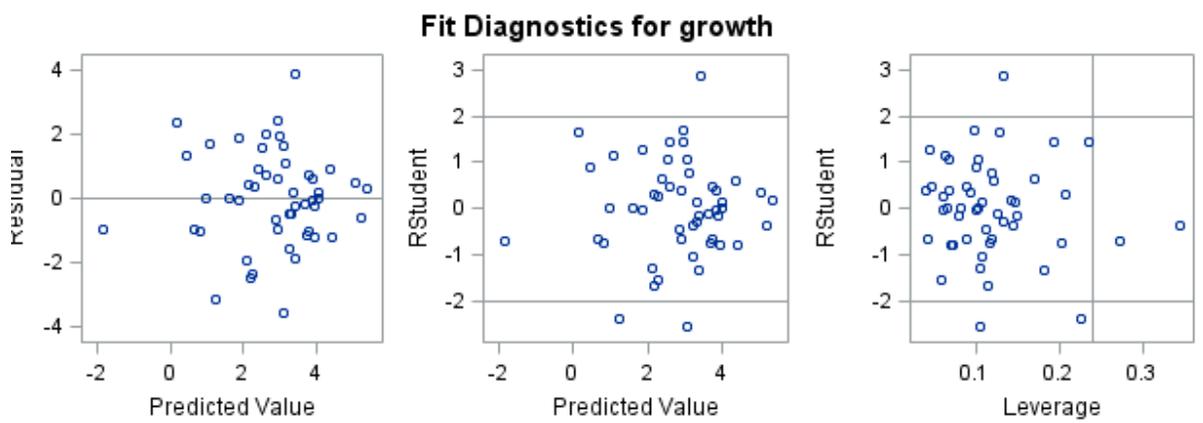
It seems evident that the data is heteroscedastic, meaning that this data is no longer the best fit. We can also run tests to check for presence of autocorrelation. When autocorrelation is present, we can see inflated T-values as well as Inflated R-squared values. Models with these errors will be inaccurate to use for predictions and may cause other values to misrepresent themselves (such as a flip in signs +/-). The Durbin-Watson value is a value used to predict

autocorrelation. Values close to 0 indicate a positive autocorrelation, values close to 2 signifies

no autocorrelation, and values close to 4 results in negative autocorrelation.

The REG Procedure
Model: MODEL1
Dependent Variable: growth

Durbin-Watson D	1.649
Number of Observations	50
1st Order Autocorrelation	0.158

In this model there is some presence of 1st order autocorrelation which is a common error in

time series data. I believe federal and state level spending are variables that could be

correlated over time because decreases in federal spending may lead to increases in state

spending.

Discussion and Next Steps

The model present is a beginning for further research in the field of investment and how

imbalances in investment sources can impair economic development. Furthermore, I believe

there are other more important variables to include, but are limited to small sample sizes

because data on, for example, renewable energy has not existed long enough to test. Including

a lag variable can further improve the accuracy of the model in fixing 1st order autocorrelation

issues. This study aims to continue challenging the role of fiscal policy and roles of businesses

within our nation. Further research should look at the impact of federal funding, local funding,

and private funding on GDP in the long run.

References

Chen, Chuanglian, et al. "Optimal Government Investment and Public Debt in an

Economic Growth Model." China Economic Review (1043951X), vol. 45,
Sept. 2017, pp. 257-278. EBSCOhost, doi:10.1016/j.chieco.2016.08.005.

Fogel, Robert William. "A Quantitative Approach to the Study of Railroads

in American Economic Growth: A Report of Some Preliminary Findings." The
Journal of Economic History, vol. 22, no. 2, 1962, pp. 163–197. JSTOR,
JSTOR, www.jstor.org/stable/2114353.

Milton, Friedman. "The Social Responsibility Of Business Is To Increase Its Profits".

The New York Times Magazine, 1970, pp. 173-178, Accessed 15 May 2015.