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https://github.com/emmayoung3/empirical

How Did the Government Shutdown Affect Donald Trump's Popularity?

Introduction/Executive Summary

From December 22, 2018 to January 25, 2019, the longest government in American history occurred, lasting 35 days. The shutdown came in the aftermath of an extremely expensive midterm election and amidst an era defined by highly partisan politics, and it was the first shutdown in American history to occur under single-party control of the government. The American government is funded by laws, appropriations that must be passed in Congress and signed by the President. When Congress fails to pass a spending bill, the government shuts down, halting all "nonessential" activity and furloughing all government workers associated with them. Most simply put, this most recent shutdown was the confrontation of the growing tensions between Republicans and Democrats on immigration policy, most notably regarding President Trump's proposed wall for the southern border of the United States. His insistence on over five billion dollars in border wall funding, and the subsequent partial shutdown, resulted in the furloughed status of over 800,000 government workers, slowed economic growth, and has forced a conversation about the role of the executive. In the aftermath of this shutdown, data is only now being collected about the effect of the shutdown. There has been both major backlash against Donald Trump as well as the reinvigorated support of his fans. In the following report, we seek to parse out the relationship between the shutdown and the approval rating of Trump.

We utilized a multiple regression analysis in order to determine a causal relationship.We identified our variables of interest, including the effect of shutdown as well as the effect from after the shutdown ended. We opted to include this second variable since the actual occurrence of the government shutdown had not been forgotten in its aftermath, especially since the threat of a shutdown still existed in the weeks following the government's reopening. We will describe these variables both by dummy variables and continuous variables, and augmented our model by controlling for fluctuations in the stock market over time.

We concluded our research by confirming our intuitive hypotheses that Trump's popularity was negatively correlated with the presence of the shutdown in the moment, the duration of the shutdown, and even still with the fact that the shutdown had occurred. Also, we confirmed that Trump's popularity was positively correlated with the passing of time after the end of the shutdown.

Data Description

In order to understand how the longest government shutdown in American history affected the popularity of Donald Trump, we needed to find data that described the approval rating from day to day. We looked to Nate Silver's platform FiveThirtyEight[4] which focuses on opinion poll analysis, politics, economics, etc. To create their trendline and determine the approval/disapproval rating for Trump on any given day, they do a rigorous analysis of all of the polls tracking approval and weight each poll based on "their methodological standards and historical accuracy" (Silver). While the data can be separated into "polls of adults" and "polls of likely or registered voters," we chose to use all polls. We did this to understand how approval rating has been affected across as large of a population as possible. While both the raw data and the trendline data are available for download, we opted to work with the trendline data in our econometric analysis. This was done so that the weighting of the polls was already accounted for, and so each day had just one approval and disapproval metric associated with it.

We knew that we were interested in the effects on approval, so this naturally became our dependent variable. The main independent variable was the government shutdown that occured from December 22, 2018 to January 25, 2019[1]. Again, we were interested in all polls, so we removed the subgroups of "voters" and "adults" from the data. In examining our independent variable, we wanted to understand the effect of the shutdown occuring, as well as examining how the duration of the shutdown had influence. As a result, we assigned a dummy variable to describe the shutdown. Everyday during which the government was shut down was assigned a 1, with all other days being 0. Additionally, we assigned a separate shutdown variable to account for duration, ranging from 1 on the first day of the shutdown to 35 on the final day. We repeated this process with post-shutdown data (days 1/26/19 to 2/17/19) and assigned both a dummy variable and a variable describing duration. The post-shutdown data was an important addition to our independent variable, because it helped us understand the enduring effects of the government shutdown on Trump's approval. Even though the shutdown ended, it seemed plausible that the harm that it had caused and the political posturing used to justify it would still be sources of frustration for many people. We also added a variable labeled "preshutdown" to assign a dummy variable for the days before the shutdown occurred, where all the days before the shutdown were assigned a 1 and all the days during and after the shutdown were assigned a 0. This was primarily done to easily calculate approval before the shutdown started since we omitted it in the regression. The final variable that we supplemented the data with was a general measurement of stock market performance. This was added as a control variable, since stock market fluctuation has historically accounted for changes in presidential approval ratings[2].

To describe the performance of the markets, we used a 5-day Simple Moving Average calculated from the closing prices of the S&P 500 index, which describes the 500 largest publicly traded companies in the U.S. and is typically used as an indicator for the health of the American stock market. We were able to view this data from the St. Louis Branch of FRED[3]. The Simple Moving Average calculated the average closing price for the previous five days. We assigned this metric to each day instead of using that day's closing price for two reasons: the first was to account for day-to-day market fluctuations that would likely balance out over a business week, and the second was to account for the lag between changes in the market translating into changes in public perception of Trump. We also manipulated the data to reflect a reasonable time period in which to measure significant deviations in approval ratings. Since Donald Trump has been in office for over two years and has experienced multiple scandals and problems, we did not want to use public opinion data spanning the entire time period of his term. For this reason, we eventually chose to only work with data from July 2018 onward. This shorter time frame allowed for a more accurate measurement of the shutdown's effect on popularity.

Shown below are all relevant summary statistics for our variables, followed by their interpretations in the context of our question at hand.

Approval Rating summary:

```
. *look at average approval since the beginning of July*
. summ approval
```

Variable	Obs	Mean	Std. Dev.	Min	Max
approval	232	41.51464	.9217155	39.2754	43.10784

```
. *look at approval DURING shutdown*
. summ approval if shutdown>=1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
approval	35	40.92272	.7752081	39.2754	42.16323

```
. *look at approval only BEFORE shutdown*
. summ approval if preshutdown>=1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
approval	174	41.80309	.7456904	39.86902	43.10784

```
. *look at approval only AFTER shutdown*
. summ approval if postshutdown>=1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
approval	23	40.23319	.8287157	39.2754	41.84582

This figure shows Trump’s average approval rating since the beginning of July, during the shutdown, before the shutdown, and after the shutdown. It is clear that his average approval rating was higher before the shutdown than both during and after. A simple t-test revealed significant differences in approval based on days the government was shutdown versus running.

S&P 500 5-day SMA summary:

```
.
. *incorporate stock info*
. summ stocks
```

Variable	Obs	Mean	Std. Dev.	Min	Max
stocks	232	2743.896	124.976	2410.788	2920.66

```
. summ stocks if shutdown>=1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
stocks	35	2532.795	76.45913	2410.788	2651.07

```
. summ stocks if preshutdown>=1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
stocks	174	2792.836	88.35262	2533.286	2920.66

```
. summ stocks if postshutdown>=1
```

Variable	Obs	Mean	Std. Dev.	Min	Max
stocks	23	2694.895	35.06018	2644.508	2745.78

This figure shows the mean 5-day Simple Moving Average of the S&P 500 stock index since the beginning of July, during the shutdown, before the shutdown, and after the shutdown. We can observe that, among these different periods in time, the SMA was the highest before the shutdown and the lowest during the shutdown. The obvious correlation between the shutdown/post-shutdown data and the SMA indicates that it was an appropriate control variable to include.

Econometric Analysis

In conducting our econometric analysis, we used a model of multiple regression to understand how changes in our independent variables affected our dependent variable of approval. We also wanted to understand how much of the variation in approval was accounted for by the regressors, given by terms like R-squared. The general population regression model that we are using is described below:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots \beta_p x_{ip} + \varepsilon_i$$

We used estimators for the constant and coefficients to determine an estimator for our dependent variable, described by $\widehat{Y}$. The estimators for our variables of interest included $b1$, a dummy variable indicating whether the shutdown was occuring on a given day (0 or 1), $b2$ describing the length of the shutdown up to 35 days, $b3$ describing the binary occurance of a day being post-shutdown (0 or 1), and $b4$ describing the duration of days post-shutdown up to 23 days (we stopped our data collection on February 17, 2019). Before including control variables, our constant, estimated by $b0$, implicitly described the pre-shutdown data. This is why our constant term was 41.80, identical for our summary statistic describing the average approval rating before the shutdown ever occured. Keep in mind that before the shutdown occurred, all of the other terms would equal zero, and thus this constant makes logical sense. The stock market data, inserted as a control variable, was not meant to act as a causal variable, but was included to try and reveal a non-spurious relationship between our independent and dependent variables of interest. The more robust regression, including stock market data, alters the constant of the final regression, but the original logic still holds in our model and explains why “preshutdown” is not a variable.

```
. *regression no stocks
. reg approval shutdown postshutdown lengthshutdown lengthpost, r

Linear regression                               Number of obs     =        232
                                                F(4, 227)         =     194.34
                                                Prob > F          =     0.0000
                                                R-squared         =     0.4864
                                                Root MSE          =     .66633
```

approval	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
shutdown	.4176854	.0930695	4.49	0.000	.2342948	.6010761
postshutdown	-2.897513	.1557919	-18.60	0.000	-3.204496	-2.59053
lengthshutdown	-.0721146	.0039758	-18.14	0.000	-.0799487	-.0642804
lengthpost	.1106338	.0119655	9.25	0.000	.0870561	.1342114
_cons	41.80309	.0569854	733.58	0.000	41.69081	41.91538

```
. *regression with stocks
. reg approval shutdown postshutdown lengthshutdown lengthpost stocks, r

Linear regression                               Number of obs     =        232
                                                F(5, 226)         =     232.00
                                                Prob > F          =     0.0000
                                                R-squared         =     0.6896
                                                Root MSE          =      .5192

------------------------------------------------------------------------------
               |               Robust
      approval |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
---------------+----------------------------------------------------------------
      shutdown |  -1.641597   .2376462    -6.91   0.000    -2.109883   -1.173311
  postshutdown |  -3.742823   .1651253   -22.67   0.000    -4.068205    -3.41744
lengthshutdown |  -.0352666   .0069558    -5.07   0.000    -.0489731   -.0215601
    lengthpost |   .1372603   .0120697    11.37   0.000     .1134768    .1610438
        stocks |  -.0053684   .0005676    -9.46   0.000    -.0064869     -.00425
         _cons |   56.79627   1.563306    36.33   0.000     53.71575    59.87679
------------------------------------------------------------------------------
```

The values of our estimated coefficients, all of which are statistically significant, offer insights into the causal relationships of our chosen variables and Trump's popularity. For example, regarding the dummy variables, the presence of a shutdown would decrease approval rating on average by 1.64% with each additional day decreasing approval rating by .04%. Similarly, the average effect of a previous shutdown on approval rating is a decrease of 3.74% with each additional day since the end of the shutdown increasing approval rating by .14%. This confirms our original suspicion that popularity would decrease more and more as the shutdown continued and slowly increase after the end of the shutdown. We can also observe that the coefficient of the stock market variable, though it can not be interpreted in a causal manner, is negative (albeit very close to zero). The logic behind this control variable is fairly straightforward, as it represents a host of unseen variables (such as investors faith in the market) that cannot be measured as easily. It allows for a sense of the health of the economy, a general indicator of presidential popularity. The inclusion of stock information increased the R-squared value of our regression from .49 to .69, which signifies a lower sum of squared residuals. More relevant (and not pictured) is the change in Adjusted R-squared, as an increase in normal R-squared is to be expected with the addition of regressors and does not necessarily indicate a better model. The adjusted R-squared is calculated to be 0.683.

Discussion of Key Assumptions

The first condition that we want to confirm is that the conditional mean of the error terror, given the included Xs, is zero. This is to avoid a correlation between X and the error term, and mitigate any effects of omitted variable bias. However, our introduction of a control variable, the stock market data, likely violated that assumption. Although we are unconfident in this first assumption, we can still plausibly assume conditional mean independence. This adjusted first assumption means that the expected value of the residual given an observed variable of interest and control variable equals the expected value of the residual given only an observed control variable. In other words, the expected residual for a given S&P SMA value should be the same regardless of whether or not the government is shut down. This assumption holds because SMA values do not actually have a direct causal effect on approval rating, but rather, serve as a general indicator of the economic condition. An important achievement in this assumption is having the variables of interest uncorrelated from the error term. Assuming the 2nd and 4th Least Squares assumptions (i.i.d. and no perfect multicollinearity, respectively) hold as well, the coefficients on our variables of interest can be interpreted as a causal change in approval due to a shutdown and is unbiased. In addition, it is likely that the coefficient on the control variable is biased and thus should not be interpreted in a causal manner.

That being said, the second of the Least Squares assumptions, or that the data is identically independently distributed from joint distributions, is violated in this instance due to the fact that we are dealing with time series data. For example, both “lengthshutdown” and “lengthpost” have ranges where their values are equal to the previous day’s value plus 1. Also, 80% of any given day’s S&P 500 5-day SMA value is dependent on the value observed on the previous day. We could not consolidate our data from a random sample, thus this assumption was likely violated.

The third of the Least Squares Assumptions, or that there are no large outliers, is easily verifiable by a quick glance through the dataset.

The fourth of the Least Squares Assumptions, or that there is no perfect multicollinearity, is verified by the omission of "preshutdown" from our list of independent variables. Without such an omission, this variable could be modeled simply as $x_1 = |x_2 - 1|$, where x_2 represents the binary variable of "postshutdown." This means that "preshutdown" could be modeled as a linear combination of "postshutdown," which is the definition of multicollinearity.

Conclusion

After a rigorous analysis using a multiple regression model, we can conclude with confidence that the government shutdown negatively affected Donald Trump's approval ratings. The significance of each coefficient incorporated into the model and our fairly large R-squared term indicate the validity of the conclusions from our analysis. Furthermore, in the aftermath of the government shutdown, we observed enduring effects on public opinions, and found that the shutdown was not quickly forgotten. Trump's insistence on border wall funding at the cost of a functional government has failed to be validated by the sentiments of border cities, and has likely left the American public more exhausted than energized.

Works Cited

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