

Special Events and DC Sales Tax Revenue

Vijay Dey

Office of Revenue Analysis
Office of the Chief Financial Officer

Issued September 2017

1. Background

The District of Columbia regularly hosts some of the largest events across the globe, including presidential inaugurations, peaceful protests, international conferences, and the annual Cherry Blossom Festival. While these events are of great political and social importance, there is a surprising lack of consensus on the extent to which they generate additional revenue for the District. For example, Stephen Fuller of George Mason University projected an economic boost of over \$1 billion due to President Trump's inauguration, Anirban Basu of Sage Policy predicts between \$60-100 million for the host city of a Major League Baseball (MLB) All-Star game, and some experts estimate that the yearly Cherry Blossom Festival generates approximately \$400 million in economic impact. On the other hand, researchers at the College of the Holy Cross find that inaugurations generate insignificant benefits, while large sporting events actually generate insignificant negative benefits to their respective host regions. With such a wide range of figures, yet no conclusive answer to the question, we investigated the effect of special events on DC sales tax revenue. Of the special events we analyzed, we found that on average, they each generated \$2.5 million in additional tax revenue for the District of Columbia.

2. Data

We split our analysis into three sections: first we analyzed only inaugurations. We made this decision since inaugurations regularly attract hundreds of thousands of attendees, therefore having the greatest likelihood of fueling additional spending. Thus, if inaugurations cannot significantly increase tax revenues in the District, smaller events such as the Capitol Fourth concert and the 2018 MLB All-Star Game are unlikely to do so. Then we analyzed the whole set of special events, which we defined as events with a magnitude of over 250,000 people (including inaugurations), including events that brought more than 250,000 people into the city, such as the Million Man March, as well as events that kept more than 250,000 people out of the city, such as the "Snowmageddon" in 2010, to extend our conclusions to significant events as a whole, rather than just inaugurations. Thirdly, we conducted two checks for robustness: first, we analyzed only the special events of the past 20 years to see if the effect of these events has changed over time. For our second check, we analyzed a subset of events that brought less than 250,000 people into the city, studying professional playoff games of the Washington Capitals, Nationals, and Wizards, to determine if these smaller events have any impact on sales tax revenue.

To do so, we utilized total monthly sales tax revenues from October 1969 to the present day. As seen in Figure 1, where monthly sales tax data is plotted, with the month of the special event highlighted in red, attempting to observe a significance in the data is not very revealing. This is due to many factors, including natural fluctuations, seasonality, economic cycles, inflation, and population changes.

Special Events vs. Monthly Sales Tax Revenue (Thousands)

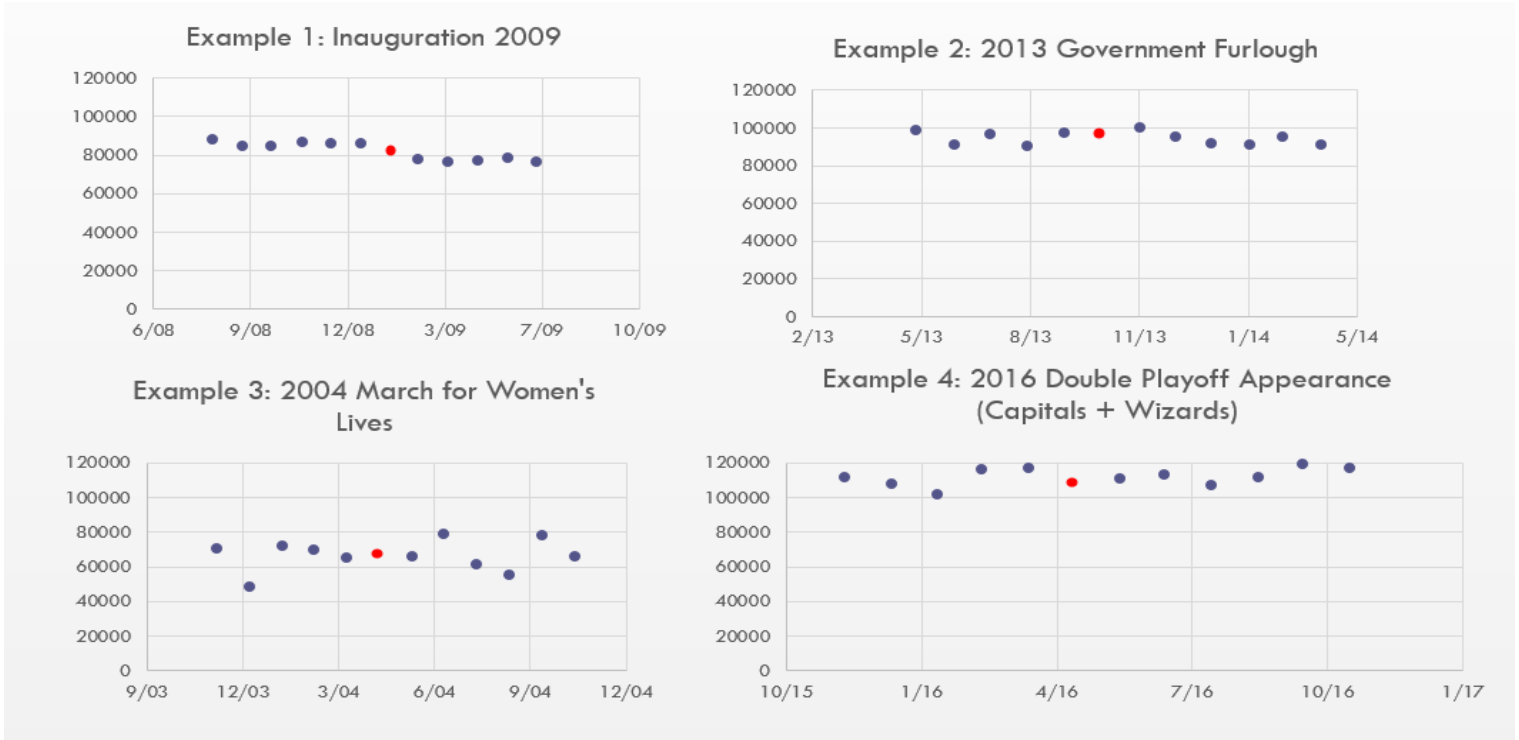


Figure 1

3. Methodology

Therefore, we developed three different models for each of the two data sets (inauguration only, all special events): linear, the simplest representation; exponential, to model economic growth at a constant rate; and polynomial¹, to model the effects of business cycle expansions and contractions²;

$$T_{1t} = \beta_1 + \delta_{t \bmod 12}(\sigma_1 S_t + \alpha_{1i} X_t) + \varepsilon_{1t}$$

$$T_{2t} = \beta_2 + \delta_{t \bmod 12}(\sigma_2 S_t + \alpha_{2i} e^{X_t}) + \varepsilon_{2t}$$

$$T_{3t} = \beta_3 + \delta_{t \bmod 12}(\sigma_3 S_t + \sum_{i=1}^5 \alpha_{3i} X_t^i) + \varepsilon_{3t}$$

where T_{nt} is the monthly sales tax revenue; β_n is a constant; $\delta_{t \bmod 12}$ is a monthly seasonal adjustment using the X11 procedure for time period t ; S_t is a dummy variable indicating whether a positive, negative, or no special event occurred during time period t ; X_t is the set of controlled factors such as

¹ Higher order terms controlling for National Personal Income were extremely statistically insignificant, so estimates using the final model utilized only a first order term for National Personal Income.

² Since there were a total of five business cycle expansions and contractions lasting longer than 18 months from 1969 to the present day (according to the National Bureau of Economic Research), we used a fifth order expression for the polynomial model to constrain the number of inflections to five. We omitted half-cycles lasting a period less than 18 months to prevent the model from correcting for every variation in the data.

National Personal Income and time sensitive effects such as inflation and population; and ϵ_{nt} is an error term.

Because sales tax filings are due the 20th of each month (or the first business day after if the 20th falls on a weekend or holiday), any special event happening on or after this date are counted in the next month's filings. In addition, since our model adjusts for seasonality, events that occur on a yearly basis, such as the Cherry Blossom Festival, were not included in our study, as the yearly effect would be negated by the adjustment.

4. Results

a. Inaugurations

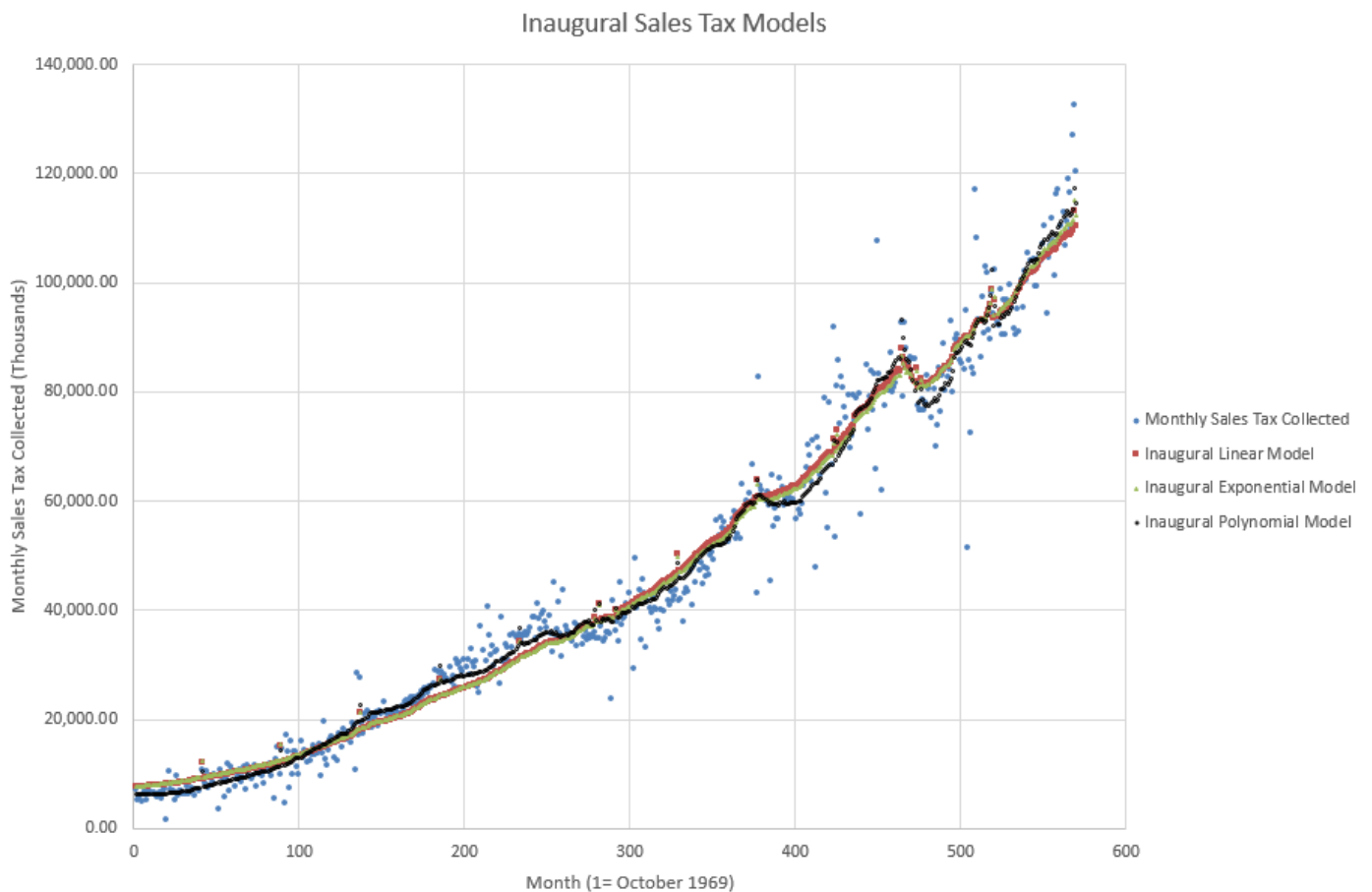


Figure 2

As displayed in data outputs #1-3 in Table 1 and Figure 2, each inaugural model very accurately describes the overall monthly sales tax collected, with R^2 values each between .97 and .975. Moreover, from Figure 2, we can see that the polynomial regression (shown in black), is able to better correct for economic upturns and downturns, giving it the best fit and highest R^2 value of the three models. Each inaugural dummy coefficient (σ_{nt}) was significant at the $\alpha=.05$ level, and estimates that presidential inaugurations generate on average a \$3.05 million in additional sales tax revenue. To add this much tax

revenue, since the average effective sales tax rate in 2016 was equal to 9.712%, each inauguration generates approximately \$31.4 million in economic activity.

b. *Special Events*

After observing a significant increase in tax revenue due to inaugurations, we wanted to see if a similar trend could be discerned from the set of all special events, which we previously defined as any event affecting a magnitude of more than 250,000 people.

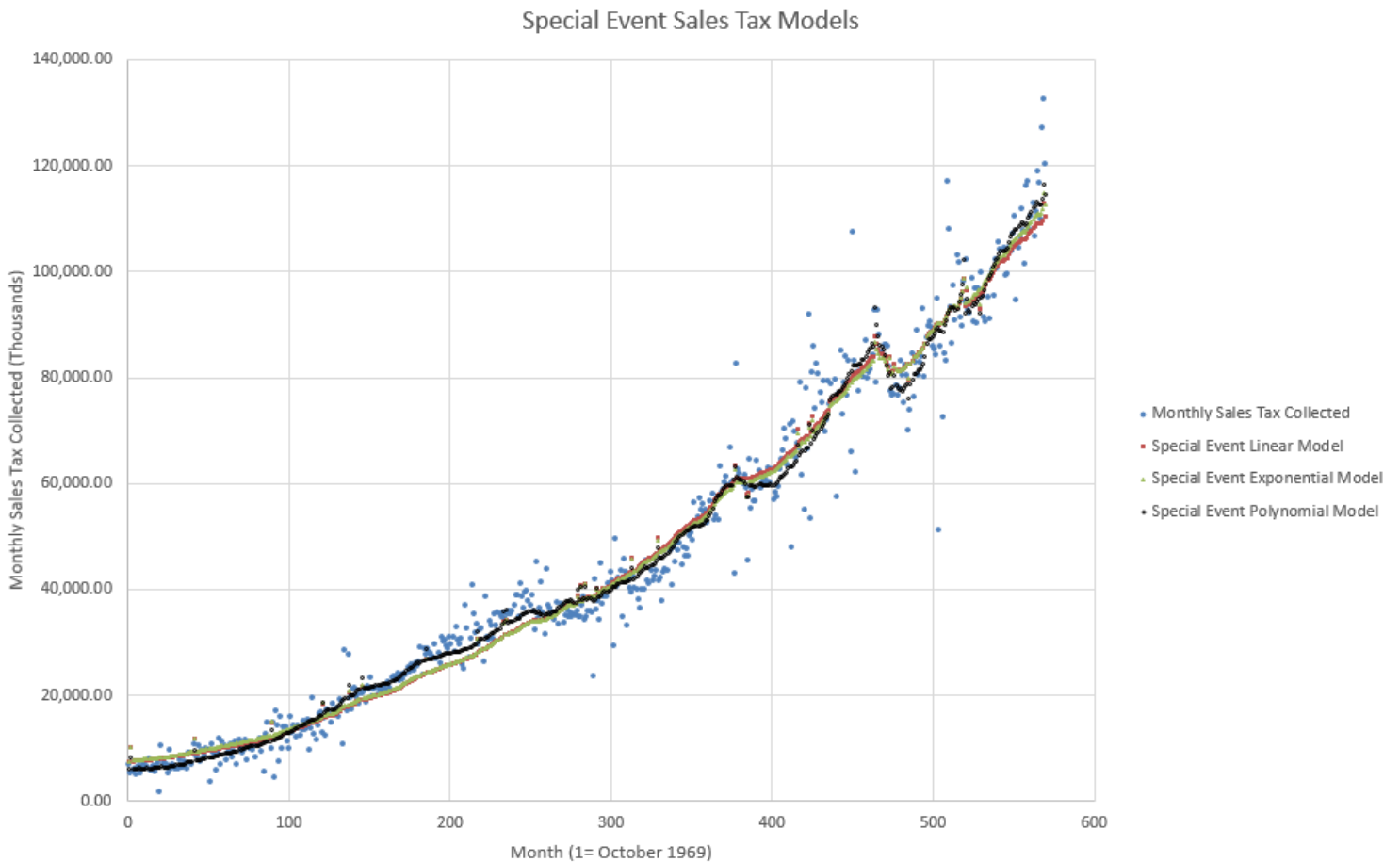


Figure 3

Again, as shown in outputs #4-6 in Table 1 and Figure 3, each special event model also displayed R^2 values between .97 and .975, with the polynomial regression representing the most accurate model. This time, however, the models estimate approximately a \$2.5 million increase in sales tax revenue in months with a positive special event (and decrease in months with a negative special event). In addition, in this general model, we see the dummy coefficient p-values drop to the range of .015-.035, showing that with a larger treatment group, the results became more significant.

c. *Robustness Checks*

I. Past 20 years

Next, since the District of Columbia, along with the rest of the country and world, has experienced tremendous change since 1970, we wanted to analyze whether a similar trend is visible in

just the past 20 years. We utilized the same data set, including all events affecting a magnitude of greater than 250,000 since 1997. As seen in data output #7 in Table 1, the effect almost doubles in magnitude to approximately \$4.7 million, up from \$2.5 million. Even though the R^2 value of this regression dropped to .89 since there are less than half the original observations and a slightly greater variance in data values in more recent years, the p-value for the special event dummy stayed approximately the same at .0223, signaling that the effect of special events is significant no matter if it occurred recently or further in the past.

II. Playoff Appearances

Finally, to extend our study to events that attract fewer than 250,000 people, we replicated our study, this time with playoff appearances for DC professional teams, beginning with the opening of the Verizon Center in 1997. The Verizon Center and Nationals Park hold approximately 20,000 and 40,000 people respectively, and thus would require at least 13 and 7 additional games respectively in a given month to reach the threshold population, which has not occurred. As seen in output #8 in Table 1, the teams' playoff appearances yielded statistically insignificant results, with a p-value equal to .176, far above the $\alpha=.05$ threshold. Moreover, the actual coefficient for the "playoff dummy" variable was -1859, meaning that each time a Washington sports team made the playoffs, in the month the playoff occurred, we actually observed an average loss of \$1.86 million in sales tax revenue, which is consistent with the findings of researchers at the College of the Holy Cross. However, since the result is statistically insignificant, the data only suggests playoff appearances have no effect on sales tax revenue.

5. Conclusions

Monthly Sales Tax Collection



Inauguration Sales Tax Collection Increase



Special Event Sales Tax Collection Increase



\$10 Million=



Figure 4

Overall, we observed approximately a \$2.5 million increase in tax revenue due to a special event impacting more than 250,000 people, and a \$3.05 million increase in tax revenue for every inauguration, correlating to approximately \$25.7 million and \$31.4 million in respective additional economic activity, a much more modest figure than the hundreds of millions projected by various experts. The scale of these figures are displayed in Figure 4, which compares each increase to a month's total sales tax collections.

It is likely that these lower-than-expected values are largely due to the crowding-out effect, where hundreds of thousands of daily commuters do not enter the city either due to official workplace closings or to avoid the unusual crowds of people in the city, which some other studies may not have accounted for. Therefore, the impact found represents the net impact of people coming into the city due to these events minus the people who usually commute to the city who were crowded out, not a gross impact. Another reason for these figures may be that our study does not take into account many cash transactions to street vendors and other individuals who do not report revenues off of these sales. While these figures are statistically significant in that the tax revenue increase can be seen consistently with respect to special events occurring, in the scope of a month, quarter, or year, an increase in tax revenue of a few million dollars is analogous to a drop in a bucket: an inauguration would only account for .026% of the city's operating budget for a year. Finally, although we studied all events with a magnitude of over 250,000 people, this was an arbitrarily set value as a categorical variable. Therefore, if an event is able to draw a million people, our study does not prove it will create quadruple the tax revenue increase projected, as the relationship between attendance and tax revenue is likely nonlinear. Simply, if any event can draw a population over the set threshold, we can expect a \$2.5 million increase in tax revenue, or \$3.05 million for any inauguration.

For our first robustness check, we found that events occurring in recent years had almost double the impact of an event in general, with tax revenue gains of approximately \$4.7 million, revealing that structural changes in the local economy over 49 years have not significantly lowered the impact of these events on tax revenue; the revenue gains in the present day are in fact larger. On the other hand, for our second check, events that attracted fewer than 250,000 attendees (professional playoff appearances), we observed a *decrease* in sales tax revenue collected, although this result was statistically insignificant. While we hypothesize that a similar insignificant result would be found in all smaller events, further conclusions about events that attract an attendance lower than the threshold population outside of our subset would require more investigation.

The costs of hosting these events, such as increased security, emergency services, and street maintenance, also far outweigh the increase in tax revenue noticed: in 2017 the inauguration was estimated to cost the District of Columbia \$32 million, though this sum was expected to be reimbursed by the Federal government. However, services provided for various other events held in the District are paid for by the DC government. Therefore, while there are statistically significant benefits associated with special event occurrences, the net fiscal gain of such events may tend to be negative due to the various costs of providing public services for these events.

All in all, the District hosts some of the greatest events in the country, if not the world. But these special concerts, parades, festivals, and political events should be appreciated at face value for their popularity, beauty and historical significance, not held by the city for the marginal economic benefits associated with them.

Table 1:

<i>Model #</i>	<i>Regression</i>	<i>R Square</i>	<i>Adjusted R Square</i>	<i>σ_n Coefficient (thousands)</i>	<i>P-value</i>
1	INAUGURAL LINEAR	0.97136	0.97120	3122.27	0.04346
2	INAUGURAL EXPONENTIAL	0.97178	0.97163	3019.95	0.04914
3	INAUGURAL POLYNOMIAL	0.97472	0.97130	2974.86	0.04153
4	SPECIAL EVENTS LINEAR	0.97145	0.97130	2664.51	0.01474
5	SPECIAL EVENTS EXPONENTIAL	0.97187	0.97172	2607.78	0.01618
6	SPECIAL EVENTS POLYNOMIAL	0.97473	0.97442	2184.69	0.03448
7	1997-PRESENT	0.88906	0.88767	4732.61	0.02227
8	PLAYOFF APPEARANCES 1997-PRESENT	0.87128	0.86958	-1859.09	0.17592

Appendix of Events:

<i>Event</i>	<i>Expected Effect</i>
Various Inaugurations (1973-Present)	+
1969 Vietnam Moratorium	+
1981 Solidarity Day March	+
1987 Second National March on Washington for Lesbian and Gay Rights	+
1989 March for Women's Lives	+
1993 March on Washington for Lesbian, Gay and Bi Equal Rights and Liberation	+
1995 Million Man March	+
2001 9/11 Terrorist Attacks	-
2004 March for Women's Rights	+
2010 Snowmageddon	-
2013 Government Shutdown/Furlough	-
2017 Women's March	+
Various Playoff Appearances (1997-Present)	+

Sources:

"13 Interesting Facts About the Presidential Inauguration." *Heads Up by Boys' Life*. N.p., 23 Jan. 2017. Web. 24 July 2017.

Amadeo, Kimberly. "U.S. GDP by Year Compared to Recessions and Events." *The Balance*. N.p., 19 Apr. 2017. Web. 14 July 2017.

Baade, Robert; Baumann, Robert; and Matheson, Victor, "Selling the Big Game: Estimating the Economic Impact of Mega-Events through Taxable Sales" (2005). *Economics Department Working Papers*. Paper 83.

Baumann, Robert; Engelhardt, Bryan; and Matheson, Victor, "Hail to the Chief: Assessing the Economic Impact of Presidential Inaugurations on the Washington, D.C. Local Economy" (2009). *Economics Department Working Papers*. Paper 42.

McCray, Q. "Flowerless Cherry Blossom Festival Could Financially Impact D.C." *WJLA. ABC7*, 16 Mar. 2017. Web. 17 July 2017.

McDermott, Ryan M. "Inaugural Events Expected to Generate \$1 Billion for D.C. Economy." *The Washington Times*. The Washington Times, 28 Dec. 2016. Web. 17 July 2017.

Merelli, Annalisa. "The Largest Marches on Washington DC Topped 1 Million People." *Quartz*. Quartz, 21 Jan. 2017. Web. 17 July 2017.

"Office of the Chief Financial Officer." *CFOInfo - District of Columbia Financial Information*. N.p., n.d. Web. 19 July 2017.

Public Information Office. "US Business Cycle Expansions and Contractions." *The National Bureau of Economic Research*. National Bureau of Economic Research, Inc., n.d. Web. 14 July 2017.

U.S. Bureau of Economic Analysis, Personal Income [PI], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/PI>, July 23, 2017.

U.S. Department Of Labor. "Consumer Price Index." *U.S. Bureau of Labor Statistics*. U.S. Bureau of Labor Statistics, 20 Feb. 2014. Web. 19 July 2017.

All other data are from the Office of the Chief Financial Officer, Office of Tax and Revenue.