THE EFFECT OF THE INTRODUCTION OF THE INTERNET SUBMISSION METHOD ON SERVICE REQUEST VOLUME IN THE CITY OF CINCINNATI

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Paul Lovachy Kostoff, B.A.

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Paul Lovachy Kostoff B.A.

Thesis Advisor: Erica Johnson, Ph.D

ABSTRACT

This paper looks at the relationship between the promotion of the Internet submission method and Service Request (SR) volume in the City of Cincinnati. The volume of Service Requests (SRs) that the City of Cincinnati received followed an increasing trend from 2005 to 2015. However, regression analysis conducted in this paper does not support the hypothesis that the promotion of the Internet submission method in 2011 led to an increase in SR volume between January 2011 and June 2015, when compared to SR volume between January 2005 and December 2010. This paper contributes to growing literature on the topics of Digital Government, Smart Cities, and the Internet of Things (IoT).
The research and writing of this thesis is dedicated to my family, thesis advisor Erica Johnson, and my last two years at the McCourt School of Public Policy

Many thanks,
Paul Lovachy Kostoff
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Introduction

The term “Service Request” (SRs) refers to non-emergency services that city residents desire to bring to the attention of the city government. A popular method to input SRs is the 3-1-1 system, in which city residents dial 3-1-1 to be connected directly to a call center. The call taker will typically log the SR and direct it to the city agency that is responsible for addressing it. Common SRs include pothole repair and special trash collection.

The City of Cincinnati does not utilize the 3-1-1 System, but does maintain a call center dedicated to logging SRs that can be reached at (513) 591-6000. The city also accepts SRs through other methods, such as over the Internet (including a mobile app), direct contact of a city agency, mail, and walk-in submission. Phone submission is by far the most common SR submission type in Cincinnati, with over 60% of all SRs being input by phone in 2014. However, the percentage of SRs submitted by phone has been steadily decreasing over the past 10 years.¹

The decrease in percentage of SRs submitted by phone is correlated with the introduction of the Internet submission method, which was developed by the Cincinnati Area Geographical Information System (CAGIS) and first implemented in 2005. CAGIS automated the storage of SRs in 2005, and the dataset used for this study comes from the CAGIS internal database. Initially, the percentage of SRs submitted by Internet remained low, and phone submissions peaked in 2006, when over 87% of all SRs were submitted

¹ If not specified otherwise, all statistics, graphs, and models are derived from the City of Cincinnati SR dataset downloaded from the CAGIS database. For access to SR data through 2014 visit https://data.cincinnati-oh.gov/browse and select "Cincinnati 311 (Non-Emergency) Service Requests."
by phone. The percentage of SRs submitted by phone decreased every year from 2006 to 2012, but slightly increased during 2013 and 2014. As we might expect given their inverse relationship, the percentage of SRs submitted through the Internet increased from 2006 to 2008, slightly decreased in 2009, and then increased every year from 2010 to 2014. Figure 1 is a visualization of this trend.

Figure 1: Percent Phone vs. Percent Internet Usage by Year

The rate of increase in Internet submissions and the rate of decrease in phone submissions have not remained constant, however. Between 2010 and 2011, CAGIS launched a concerted effort to revamp the SR website, the link for which is footnoted.

The effects of CAGIS’ efforts are clearly visible the data. Between 2010 and 2011, the percentage of SRs submitted via phone fell from 91% to 71% while the
percentage of SRs submitted over the Internet increased from 9% to 27%. By 2014, SR submissions were dominated by phone and Internet, with the third highest-ranking method in terms of percentage of total submissions being direct contact to the City Manager’s Office at 1.31% of total submissions. However, this has not always been true. In 2004, the year before the introduction of the Internet submission method, direct contact to the various City of Cincinnati agencies corresponded to 38% of the total SR volume received by the city. Figure 2 illustrates the top three SR submission methods in the year preceding the introduction of the Internet submission method. Residents frequently contacted the incorrect agency with SRs, which led to confusion and long wait times, prompting the city to standardize phone submissions by redirecting calls to a call center dedicated to SR input.

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2 [http://cagismaps.hamilton-co.org/csr/cincinnati](http://cagismaps.hamilton-co.org/csr/cincinnati)

3 Data from 2004 was also obtained from CAGIS. However, according to CAGIS, this data may be incomplete, as thorough records of SRs were kept beginning in 2005 with the introduction of the Internet SR method.
Figure 2: 2004 Submission Methods by Percent

Generally, the Internet is the preferred choice for SR submissions among city agencies. The City of Cincinnati has about 300,000 residents in the city proper. Since 2004, the city has received more than 90,000 SRs in a single year on four separate occasions. So, in a high volume year, the city will receive an SR for nearly 1 in every 3 residents. Averaged out on a daily basis, we arrive at about 247 SRs per day, about 149 of which are going to the call center. Meanwhile, on average, only four call takers are accepting calls at any given time. SRs tend to peak in the late morning to early afternoon.
The high volume of SRs directed to the call center can result in long wait times, especially since the number of call takers was reduced from eight in 2010 to four in 2011. For this reason the city has pushed the Internet submissions method since 2011. Figure 3 depicts SR volume from 2005 to 2014.

Figure 3: SRs by Year

The CAGIS Internet submission platform offers residents a quick online method for submitting SRs. In addition, CAGIS has recently developed a mobile application for SR submissions.

As of November 2015, there was no method in place to differentiate SRs coming in from the CAGIS website, mobile app, and mobile website. However, CAGIS plans on
developing a tracking tool to differentiate between mobile and website submission volume in 2016.

Although both Internet submission methods are quick and effective, the majority of Cincinnati residents still submit SRs by phone, as evidenced by the high percentage of SRs that are submitted through the call center. As illustrated, the relative SR input percentages and absolute figures are easily identifiable. The research question that I will examine is whether the introduction of the Internet SR submission method has led to an increase in total SR volume. This remainder of this paper will address this question, and fits into the literature on the development and tracking of SRs, as well as literature on the effects that digital and smart transformation may have on city capacity.

\[\text{See figure 1}\]
This study will contribute to the literature on Digital Government and Smart Cities. The idea is that the proper use of data at the municipal level, and later on the country level, will allow public leaders to address problems efficiently as we go forward. According to the UN (2014), 54% of the global population is urban, and the urban population percentage is expected to rise to 66% by 2050. According to Wetterich (2015), this is also true of U.S. cities including Cincinnati, which has seen its metropolitan area grow over the last decade. The World Bank has been a major proponent of the migration to digital and smart initiatives, has published widely on the subject, and actively works on smart initiatives including Mongolia’s smart government project and Smart Singapore.\(^5\) In addition to the World Bank, think tanks including Brookings and the Pew Research Center have contributed to literature on digital government and smart cities.\(^6\) More recently, consulting firms such as Deloitte have focused their public sector consulting practices on migration to digital and smart platforms.\(^7\)

Given the relative youth of the concepts of digital government and smart cities, academic literature is not particularly developed, but an increasing number of scholarly


The Pew Research Center’s page for IoT can be viewed here [http://www.pewinternet.org/2014/05/14/internet-of-things/](http://www.pewinternet.org/2014/05/14/internet-of-things/)

articles have been published in the last five years. From 1995-2000, when the potential of the Internet to increase government service provision was starting to be realized, scholarly articles focused on the concept of e-Government. e-Government was initially conceptualized as the process of moving from paper based to electronic record keeping, and using technology for better interaction between the government and citizens, according to the World Bank’s e-Government page.8

From 2000 to 2007, as Internet connectivity reached more people with ever-increasing bandwidth, a natural progression of e-Government practices was the migration of many or all government-citizen interactions to digital platforms. This concept is termed “Digital Government.” In essence, Digital Government is the second iteration of e-Government, and expands the concept beyond the initial framework set in e-Government literature, according to Andrea Di Maio (2014), vice president of technology at the research and analytics company Gartner. For example, instead of making an hour-long trip to city hall to have a business license stamped by a city employee, why not make business license approval a streamlined online process? Why not make the majority of government-citizen interactions efficient online processes?

From 2008 to the present, academic literature has begun to merge Digital Government best practices with advances in technology, to arrive at the concept of Smart Cities, or the more expansive version, Smart Nations. The idea of Digital Government is to streamline government interaction with citizens so that civic life is improved, and government processes expedite instead of hinder growth and development. The next step

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in the process is to make government smart, so that it can respond to real-time challenges, and predict future trends. Smart Cities are essentially a combination of Digital Government best practices, and the concept of the Internet of Things (IoT). According to Jacob Morgan (2014), the IoT conceptualizes interconnectivity as a key method to address the shortcomings of government, and to improve service provision.

Figure 49: Smart City Components

Components of the IoT include smart grids, smart homes, smart business, and smart public utilities, all of which will be interconnected and will ensure immediate data collection and

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sharing. The technology and software company Libelium, which specializes in IoT implementation, provides this visualization of the IoT.
As mentioned, more than half of the world’s population lives in cities, and the percentage of the global population living in cities is expected to increase until 2050, according to the UN (2014). As a result, demand for services in urban areas is increasing, but government capacity often remains limited. The motivation for moving towards Smart City models is therefore to close the gap between demand for services and the ability of the government to meet demand. City governments will always have limited resources. Victor Mulas (2015) of the World Bank Information and Communication Technology team (ITC) looks at the transition to smart cities as the key to closing the gap between service demand and supply, even in the face of limited resources.

According to Mulas (2015) Smart Cities have two main components: (1) they are technology intensive, with sensors that allow for real-time data transfer which results in efficient public service provision; (2) Smart Cities cultivate a healthy relationship between citizens and residents by leveraging available technology. A key component of this is open data, which is data that is released by the city and can be accessed by city residents.

In regards to Digital Government, Randeep Sudan (2015) argues that a key component in Smart City transformation is the “3 C’s” approach. The three C’s are (1) contextualization; (2) coordination; (3) Cognitive Support. According to Sudan (2015), the contextual component is necessary because service provision is becoming increasingly data driven. If governments are quick to use platforms that allow users to be
seamlessly connected to government agencies, service provision can be individualized or **contextualized** to the requester.

Interoperability, the ability of technological systems to exchange and process information, is also a key component to **coordinated** service delivery. For this reason, government platforms should be standardized on an enterprise wide basis. Finally, advanced artificial intelligence will eventually contribute to the digital processes of cities. For example, developments from information technology (IT) companies, including IBM’s super-computer “Watson” which defeated outstanding human players in a game of Jeopardy, are helping inform fields ranging from medicine to service provision even today. These technologies can be incorporated into service provision at the city and perhaps even national level, giving **cognitive** support to service providers.

The World Bank has built its work on academic literature concerning Digital Government and Smart Cities. The literature on these two concepts is not extensive, but continues to grow as the realization of both concepts becomes more realistic in cities with strong infrastructure.

An early contribution to the Digital Government literature comes from Marchionini et al. (2003). The authors detail the benefits of leveraging IT for creative problem solving and service provision. Machionini et al. (2003) see Digital Government as a key component of predictive government service provision. By 2008, five year later, scholarship began incorporating the early framework for smart transformation, or the migration of existing infrastructure to smart infrastructure, the result being Smart Cities. For example, Gottschalk (2009) introduced the idea of interoperability as a key component of Digital Government best practices. Gottschalk argued that city
governments should ensure interoperability between city agencies. Interoperability is the ability for multiple parties to share data and information quickly and efficiently, due to the use of compatible systems. Gottschalk (2009) also argued that city government should move towards becoming interoperable with the private sector as well. The concept of public-private interoperability is important conceptually for smart transformation, because Smart Cities cannot be realized unless the public and private sectors operate on compatible platforms that allow instant data transfer.

Janssen et al. (2008) focus on the importance of shared knowledge as a Digital Government best practice. This component, they argue, is essential for crafting good legislation and promoting collaboration between public and private entities. By 2012, literature that had previously focused on Digital Government began shifting towards discussion of Smart Cities. Chourabi et al. (2012) identified “eight critical factors” that must be considered for smart transformation to be effective. They are, management and organization, technology, governance, policy context, people and communities, economy, built infrastructure, and natural environment.

Smart transformation should be aimed at improving each of these categories. Management and organization can be improved by data driven decision-making. Technology should incorporate information transferring capacity. Governance should become streamlined and move its processes to digital platforms. The emerging policy context must include regulations for smart transformation, and protect against a possible invasion of privacy. People and communities should be prioritized during smart transformation through opportunities provided by a smart economy. Built infrastructure should be smart, meaning it should include data collecting microchips. And finally, the
natural environment should be prioritized by the construction of smart and energy efficient infrastructure that reduces pollutants.

Finally, academics are starting to expound the benefits of the “Internet of Things” (IoT) in their research. Again, the IoT is the concept of having interconnected infrastructure that transmits data in real time between the government, the private sector, and eventually private residents. Zanella et al. (2014) developed the concept of using the IoT for the development of digital service provision, and the transformation to Smart Cities. The IoT is essentially the connecting link between Digital Government and Smart Cities.
**Conceptual Framework**

The conceptual framework will visualize the process of change in SR submission method and SR volume that the city has experienced since promoting the Internet SR method in 2011. It will do so looking at peak years in terms of SR volume (2008-pre Internet promotion, 2014-post Internet promotion) both before and after the promotion of the Internet submission method. Cincinnati has traditionally received a majority of SRs by phone. Other methods of SR input include through the City Manager’s Office, individual City Departments, and email. Historically, discounting Internet submission, the three most popular submission types have been phone, City Departments, and City Manager’s Office.

![Figure 5: Framework 2008](image)

**Figure 5: Framework 2008**

Figure 5 shows total SR volume in 2008, the highest volume pre-Internet promotion, and the breakdown of SRs submitted through the phone vs. all other submission types. The research question I examine is whether the promotion of the Internet as the preferred SR
submission method has had an impact on the total volume of SRs received by the City of Cincinnati between 2011 and 2015. SR volume peaked in 2014, and is shown in figure 6.

![Diagram showing SR Volume by Method for 2014]

**Figure 6: Framework 2014**

2014 set a SR volume record for the City of Cincinnati, with over 3,000 more SRs than in the second highest volume year, which was 2008.

In addition to being the highest volume SR year in city history, note that between 2008 and 2014 the percentage of SRs submitted by Internet among the all other methods category rose from 41% to 90%. The city expects this percentage to approach 100% in the next 5 years.\(^\text{10}\) If there were a positive relationship between the promotion of the Internet submission method and SR volume, we would expect total SR volume to increase, phone SR volume to decrease, and all other submission method volume to increase, with the Internet accounting for nearly 100% of that category’s volume.

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\(^{10}\) I received this information from a phone conversation with a DPS director.
Data and Methods

This paper seeks to examine the relationship between the promotion of the Intent submission method and total SR volume. The data and methods section will first present summary statistics and tables of SR trends and composition, and then present three regression models aimed at better understanding relationships in the available data.

This will require two types of analysis. The first section will look at the general trend of SR submission volume and composition from January 2005 to July 2015. The second section uses three OLS models that examine the relationship between the promotion of the Internet as a submission method, and SR volume. The available data provides yearly SR volume as well as breakdowns by SR type, and submission methods. Data from the CAGIS database is limited for the years before the Internet became a submission option. This is because SR volume and composition prior to 2005 has not been fully transferred to the CAGIS database. CAGIS began rigorously tracking of SR volume and composition in its database starting in 2005. Therefore, the appropriate question centers on years before (2005-2010) and after (2011-2015) the City launched an initiative to make Internet submission the primary option. Summary statistics and analysis are provided for further insight.\(^\text{11}\)

\(^{11}\) All visualizations and analysis are original to this paper unless specified otherwise.
Summary Statistics and Graphs

Since 2005, residents have submitted approximately 858,000 SRs to the City. Of these, 632,000 have been submitted via phone. 150,000 have been input through the Internet. The only other submission type that has been utilized more than 20,000 times by Cincinnati residents is direct input through the city department in question. For example, some residents directly call the health department for service, which counts as an input for city department SR submission type.

Figure 7: Comparative Submission Type Use
Figure 7 illustrates comparative use of the top three submission methods, and figure 8 shows the same relationship over the years from 2005 to 2014, 2014 being the last year of complete data, though data is available for months through June 2015.

**Figure 8: Comparative Submission Type Use by Year**

While the phone submission method far outpaces the use of Internet submission method in aggregate volume, we see an increasing trend in the use of the Internet submission method.
Figure 9: SR Trend by Month

SR volume first peaked in 2008 before declining between 2009 and 2012, and then peaked again in 2013 before setting a record for SR volume in a single year in 2014. Though SR volume did plummet between 2010 and 2012, the general trend between 2005 and 2015 is increasing.

For this analysis, a month-by-month breakdown is used so that 2015 data can be incorporated. Figure 1.8 above shows the increasing pattern of SR volume. A slightly increasing trend is observed using a linear trend line.
Figure 10: SR Trend by Quarter

Looking at quarters, the positive trend becomes even more pronounced, as seen in figure 10 which uses a polynomial trend line with three degrees of freedom. Of the six quarters since 2005 in which the city has received 27,000 or more SRs, four have come since 2013 with a peak of over 35,000 in Q2 of 2015.
Regression Methodology, Limitations, and Results

This study will use three Ordinary Least Squares regressions. I am looking to isolate the effect of Internet promotion starting in 2011 (independent variable) on SR volume (dependent variable). However, it is not sufficient to simply regress SR volume on Internet promotion. It is extremely unlikely that the promotion of the Internet is the only relevant explanatory variable when considering SR volume. Therefore, if I fail to account for other variables that may have affected SR volume between the years 2005 to 2015, I will have introduced omitted variable bias into my study. That is to say, the effects of the explanatory variables I omit from this study will “show up” and be wrongly attributed to Internet Promotion in a bivariate regression.

The primary independent variables that I use are a percent Internet SR submission/month variable, and a binary variable which is coded 0 for years 2005 – 2010, before Internet promotion, and 1 for years 2011 – 2015, years after Internet promotion. The control variables I use are Cincinnati’s population, Cincinnati’s budget (both total city budget and DPS budget), and a month variable, coded as 1 – 127 for each month for which SR data is available. Let us now examine the dependent, Independent, and control variables in greater detail.

**SR Volume (Dependent Variable):** SR volume is the total number of service requests over a given time period. For this study, SR volume is considered at the month level.
Percent Internet SR Volume (Independent Variable): This variable tracks the percent of SRs that were submitted by the Internet/month, and is one of two primary Independent variables used for this study.

Internet Binary Variable (Independent Variable): As mentioned, this variable is coded as 0 for the months occurring in years 2005 – 2010, and as 1 for months occurring in years 2011 – 2015. It is coded this way so that the effect of the Internet promotion by the city in 2011 can be isolated.

Population (Control Variable): Higher population may lead to greater SR volume. However, Cincinnati’s population declined sharply between 2009 and 2010, losing about 37,000 residents, going from about 333,000 in 2009 to about 296,000 in 2010. This drop in population corresponded to a decline in SRs in 2010, 2011, and 2012, when compared to 2007 – 2009. SRs then dramatically increased again between 2012 and 2013.12 Even though Cincinnati city proper has suffered population decrease, the effect this has on SR volume is not entirely clear, as the overall trend is an increasing pattern from 2005 to 2014. Wetterich (2015) suggests that residents leaving the city may be settling in nearby neighborhoods that have seen their populations grow. Further, one does not have to be a Cincinnati resident to submit an SR to the city. So, technically, residents of greater Cincinnati could still be submitting SRs for issues affecting Cincinnati proper. For example, one could live outside the city limits, beyond which the city is not responsible for addressing SRs, and still submit an SR for a pothole within the city limits, which is the responsibility of DPS. As of the present, no mechanism exists to differentiate between resident SRs and SRs submitted by non-residents. This may obfuscate the relationship between population and SR volume.

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12 See figure 7
Budget (Control Variable): Two budget variables have been included in the data set. The first is the total City of Cincinnati budget per month. The second is the DPS budget per month.

Month (Control Variable): The month variable is a time fixed effects variable, which is coded 1 – 127, for each month that this study considers.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Obs</th>
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<th>Std. Dev.</th>
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<th>Max</th>
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<td>City Population (Thousands)</td>
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<td>313.685</td>
<td>17.79856</td>
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<td>PercentInternet</td>
<td>Percent of SRs Submitted by Internet/Month</td>
<td>127</td>
<td>16.82071</td>
<td>13.47235</td>
<td>0.19</td>
<td>42.13</td>
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Figure 11: Variable Statistics Table

Figure 11 is a summary statistics table for all variables used in this study.

Limitations

A key limitation to this model is that there is no direct measure for community engagement, which I suspect would have a statistically significant effect on SR volume. Community engagement is relevant in several ways. Take, for example, the SR types ‘litter pick up,” and “graffiti removal.” These two SR types were collectively responsible for 5.8% of all SRs from 2005 to 2015. Engaged communities may obviate the need for SRs to be sent to the city through private citizens removing graffiti and collecting litter in their own communities. Similarly, engaged communities may have fewer issues that require SR submissions than non-engaged communities to begin. Since we do not have anything better than anecdotal evidence of community engagement, or even more generally Cincinnati resident engagement, it cannot be included in the regressions of this
study. Since it is not being included, it may bias the results of the included variables. The extent to which the effects of the variables included in this model are altered by omitted variable bias from the exclusion of community engagement, and other non-quantified variables, is unknown.
OLS Regression Models

This study will present three OLS regression models that analyze the effect of Internet promotion in 2011 on SR volume. The first two regression models use percent Internet SR volume as the primary independent variable. The third regression model uses the Internet promotion binary variable as the primary independent variable. The regression equations are followed by their respective results.

Regression 1

\[
SR\ Volume = B_0 + B_1 \text{PercentInternet} + B_2 \text{DPSbudgt} + B_3 \text{Month} + B_4 \text{Citypop} + e
\]

<table>
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<th>VARIABLES</th>
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<td>PercentInternet</td>
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<td>Month</td>
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<td>Citypop</td>
<td>86.84***</td>
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<td>DPSbudgt</td>
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<tr>
<td>Constant</td>
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<tr>
<td>Observations</td>
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<tr>
<td>R-squared</td>
<td>0.251</td>
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</table>

Coefficient values
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The control variables month and city population are statistically significant at the 1% level. However, the primary independent variable percent Internet SR volume and the control variable DPS budget fail to meet statistical significance at the 10% level.

To interpret the statistically significant variables, we expect an additional 67.05 SRs for each additional month that passed during the timeframe of this study (January
2005 – June 2015). For each additional thousand Cincinnati residents, we expect an additional 86.84 SRs/month on average.

Regression 2

\[ SR Volume = B_0 + B_1 \text{PercentInternet} + B_2 \text{Citybudget} + B_3 \text{Month} + B_4 \text{Citypop} + e \]

<table>
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<th>(2) SRVol</th>
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<td>Month</td>
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<td>Citypop</td>
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<td>(16.93)</td>
<td>(24.21)</td>
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<td>DPSbudgt</td>
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<td>Citybudgt</td>
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<tr>
<td>Constant</td>
<td>-23,640***</td>
<td>-27,731***</td>
</tr>
<tr>
<td></td>
<td>(5,549)</td>
<td>(5,100)</td>
</tr>
<tr>
<td>Observations</td>
<td>127</td>
<td>127</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.251</td>
<td>0.329</td>
</tr>
</tbody>
</table>

Coefficient values
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of regression 2 are shown in the second column. Regression 2 seems to be a better fit of the data than regression 1. To begin, the R-squared value, which is a measure of predictive power, increased from .251 to .329. Additionally, three out of four explanatory variables are statistically significant in regression 2, as opposed to two out of four in regression 1. This is attributable to the exclusion of the DPS budget variable and the inclusion of the city budget variable, the only change between the two equations. This may be due to the fact that, although DPS does address a majority of SRs in the city, it is not the only city agency that addresses SRs. Additionally, the DPS budget total is
included in the city budget total. Whereas the DPS budget variable does not yield any information about other city agencies, the city budget variable aggregates budgetary information on all city agencies that address SRs, and is therefore the better explanatory variable.

In regression 2 each additional month corresponds to an increase of 41.48 SRs on average. An additional million dollars to the city budget/month is associated with an increase of 849.3 SRs/month, and, perhaps surprisingly, each additional percentage point increase in percent Internet SR volume is associated with 48.63 less SRs/month on average.

Regression 3

\[
SR \text{ Volume} = B_0 + B_1 \text{Internetpromotion} + B_2 \text{DPSbudgt} + B_3 \text{Month} + B_4 \text{Citypop} + e
\]

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
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<tbody>
<tr>
<td>PercentInternet</td>
<td>-48.53*</td>
<td>-48.63*</td>
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</tr>
<tr>
<td>(30.49)</td>
<td>(28.48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month</td>
<td>67.05***</td>
<td>41.48***</td>
<td>46.05***</td>
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<td>(14.80)</td>
<td>(15.60)</td>
<td>(13.31)</td>
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<tr>
<td>Citypop</td>
<td>86.84***</td>
<td>26.47</td>
<td>20.63</td>
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<td>(16.93)</td>
<td>(24.21)</td>
<td>(23.63)</td>
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<tr>
<td>DPSbudgt</td>
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<tr>
<td>(536.9)</td>
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<td></td>
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<tr>
<td>Citybudgt</td>
<td></td>
<td>849.3***</td>
<td>764.0***</td>
</tr>
<tr>
<td>(243.8)</td>
<td>(249.7)</td>
<td>(489.9)</td>
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</tr>
<tr>
<td>InternetPromotion</td>
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<td></td>
<td>-1,981***</td>
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<tr>
<td>(489.9)</td>
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<td>(489.9)</td>
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<tr>
<td>(5,549)</td>
<td>(5,100)</td>
<td>(5,026)</td>
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<tr>
<td>Observations</td>
<td>127</td>
<td>127</td>
<td>127</td>
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<tr>
<td>R-squared</td>
<td>0.251</td>
<td>0.329</td>
<td>0.361</td>
</tr>
</tbody>
</table>

Coefficient values
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Regression 3 uses the Internet promotion binary (dummy) variable as the primary independent variable, and includes city budget, which is the better explanatory variable when compared with DPS budget. Regression 3 has the highest R-squared value, .361, which suggests that it has the most explanatory power in terms of understanding SR volume of the three regression models. As in regression 2, month, city budget, and the primary independent variable, Internet promotion, are all statistically significant at the 10% level or lower.

To interpret, each additional month is associated with an additional 46.05 SRs/month on average, an increase of USD 1 million to the monthly city budget is associated with an increase of 764 SRs/month on average, and months for which the Internet was promoted by the city had an average of 1,981 less SRs than did months before the Internet was promoted.
Conclusion

The results from the three regression models presented in this paper do not support the hypothesis that the City of Cincinnati’s promotion of the Internet SR submission method in 2011 led to an increase in SR volume between 2011 and 2015 when compared to SR volume between 2005 and 2010. In fact, Internet promotion is associated with a decrease in SR volume/month on average. This is in spite of the fact that SR volume followed an increasing trend from at least January 2005 to June 2015. Thought perhaps surprising, the argument being easier submission methods (Internet) would lead to higher SR volume, the regression results do in fact point to a secondary trend in in SR volume.

Figure 12: SR Volume by Year

Figure 12 provides a review of SR volume/year. As we see, there were over 41,000 more SRs in 2014 than there were in 2005, a 73% increase. However, the average SR volume/year between 2005 and 2010 was 80,724, but was only 77,219 for years between 2011 and 2014, the last full year of data. This is due to low SR volume in 2011 and 2012. Therefore, the increase in SR volume was more pronounced between 2005 and 2010, before Internet promotion, than it was between 2011 and 2014, after Internet promotion.

At the same time, although the data may suggest it, it does not seem likely that the promotion of the Internet SR method will lead to an extended decrease in SR volume. If
we look only at SR volume between the months of January and June, 2015 had more SRs in that 6-month period than any other year.

Figure 13: SRs by Year Excluding July-December

Therefore, while the regression results used in this study suggest that Internet promotion led to the relative decrease in SR volume from 2011 to June 2015, when compared to SR volume between 2005 and 2010, this trend seems unlikely to continue.

Figure 13 shows SR volume/year counting only SRs received between January and June. In conclusion, we cannot conclude that Internet promotion in 2011 led to greater SR volume/month between January 2011 and June 2015 than was seen between January 2005 and December 2010, or before Internet promotion. Instead the regressions used in this study suggest Internet promotion was in fact negatively correlated with SR
volume. However, this trend appears to be dissipating, with record SR volume in 2014, and record SR volume through June 2015. It is probable that some unobserved factors not included in this study also influence SR volume/month. For a more complete understanding of the effect of the promotion of the Internet on SR volume, this study should be reproduced in 2020, after sufficient time has passed between the promotion of the Internet as an SR submission method, and SR volume.

Though the Internet submission method is being increasingly used, it still utilized in less than half of all SR submissions. When the percent of SRs submitted with the Internet submission method crosses the 50 percent threshold, which is probable in the next 2 to 4 years if current trends continue, I expect a more complete picture to emerge regarding the effect of the promotion of the Internet on SR volume in the City of Cincinnati.
Bibliography


