An Empirical Model of the Adoption of Web-Enabled Governmental Services

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Abstract
The study examines the impact of bureaucratic corruption, economic freedom, and e-government readiness on the probability of having in place transactional e-government or Web-enabled transactions for public services. The study uses a logistic regression model and aggregate data on a cross-section of countries to investigate this relationship. The principal finding of the study is that a high level of a country’s corruption reduces the probability of having transactional e-government, whereas the presence of economic freedom and high levels of e-government readiness enhance such probability.

Keywords: Corruption, Transactional E-Government, E-Government Readiness, Economic Freedom

1. Introduction
Observers continue to debate the impact of e-government not only on organizational or administrative values (e.g., efficiency, economy, effectiveness, service quality) and on political values (public accountability, democratic responsiveness, equity, transparency), but also on the public bureaucracy itself. The potential for e-government to transform the public bureaucracy has prompted some to claim that information technology has engendered a paradigm shift in the practice of public administration, particularly at the municipal level of government. It is thus asserted that a shift has occurred from the traditional bureaucratic paradigm to the e-government paradigm (Ho, 2005).

The impact of e-government goes beyond the public bureaucracy; it also extends to the way governments provide services to their citizens. Transactional e-government or web-enabled provision of public services has been set up in some countries around the world. However, while most countries continue to have some form of website presence, only a few have transactional e-government. Thus, all United Nations member states (a total of 193 countries) except three have some website presence that provides information to citizens. However, less than half of these countries have a transactional government in place (United Nations E-Government Survey 2012).

The fact that a large number of countries do not have transactional e-government in place begs the question as to why this is so. The obvious answer that comes to mind is that most of these countries do not have the technical and other infrastructures that are necessary for instituting transactional e-government. Arguably, however, the adoption of web-enabled provision of public services cannot be accounted for by a single factor. At any rate, what accounts for the adoption of transactional e-government is an empirical question. It is important to ferret out the factors that impede/facilitate the adoption of e-government for the provision of public services. Prior knowledge of those factors could potentially provide aid to policy makers when planning for transactional e-government initiatives.

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This paper offers an empirical model for the adoption of web-enabled provision of public services. More specifically, it proposes a number of factors that account for the adoption/non-adoption of online public services. Those factors are incorporated as explanatory variables into a logistic regression model that explains such adoption/non-adoption. The outline of the paper is in order. Section 2 provides a review of the relevant literature on e-government. Section 3 presents the empirical model and the methods used to estimate it. Section 4 presents the results of the estimated empirical model, discussion of those results, and conclusions.

2. Literature Review

The literature on e-government is quite varied. Several strands are discernable in this literature. One strand deals with the values to be achieved through e-government initiatives. Those values encompass, inter alia, efficiency, public accountability, effectiveness, transparency, service quality, and democratic responsiveness, rule of law, and citizen participation and empowerment (Holliday and Kwok, 2004; Wong and Welch, 2004; West, 2004; Hazlett and Hill, 2003).

Another strand addresses issues and challenges facing e-government initiatives. (Jaeger, 2003; Edmiston, 2003). Notable issues identified include privacy, security, the digital divide, accessibility, citizen awareness and confidence, in addition to other barriers to the use of computers and the Internet. Some of these issues (e.g., digital divide) have become recurrent themes in the literature on e-government (Jaeger, 2003).

A third strand focuses on the technical and infrastructural aspects of e-government. This strand encompasses such technical and infrastructural aspects as technological infrastructural alternatives, security techniques for e-government services, development and evaluation strategies of e-government websites, etc. (Sepic and Kase, 2002; Strejcek and Theil, 2002; Scherlis and Eisenberg, 2003; McGregor and Holman, 2004; and Bakry, 2004).

The strand that is particularly relevant for the purpose of this study is the e-government adoption literature. (Ho and Ni, 2004; Kumar et al., 2007; Coursey, and Norris, 2008; AlShehri, 2012).

Models, incorporating internal/organizational and external/environmental factors, have been developed to explain the adoption/non-adoptions of e-government or specific e-government features, particularly at the municipal or county level of government. In this strand, concerns about staff resistance have been identified as a principal barrier to the adoption of IT (Ho 2004).

As previously noted, the principal thrust of the e-government adoption literature applies at the micro level (i.e., local or municipal level). At a macro (i.e., cross-national) level, the question as to what accounts for the adoption of e-government across nations remains largely unexplored, as very little is known about what explains the adoption of e-government across nations. A country’s e-government readiness level, measured by the recent United Nations E-Government Readiness Index, is probably the only macro factor that could be taken to account for this adoption.

Could a country’s level of corruption explain why some countries have transactional e-government while others are without it? More specifically, does a country’s level of corruption influence the probability that it has transactional e-government in place? The provision of online public services does not, it seems, bode well for bureaucrats in at least three respects. First, it tends to remove or at least reduce administrative discretion. Michael Lipsky’s (1980) street-level bureaucrats, armed with consequential administrative discretion, have no place in today’s IT-based public management, as street-level bureaucracy is being replaced by screen-level bureaucracy. According to Bovens and Zouridis (2002), screen-level bureaucracy is a decision-making process where public officials, when they are in direct contact with members of the public at all, communicate with them through computer screen. However, they argue, screen-level bureaucracy itself is withering away in favor of system-level bureaucracies that transfer administrative discretion to system designers and other officials engaged in data processing. This transformation removes face-to-face interactions between members of the public and administrators (other than those bureaucrats who merely interface between the public and system such as help-desk workers) and, concomitantly, raises the possibility of the withering away of public bureaucrats exercising administrative discretion.
The second way in which online services may adversely affect public bureaucrats is that it may also lead to bureaucratic or managerial layoffs. The new term for this effect is organizational disintermediation, where Internet-based systems enhance the efficiency by decreasing layers of middle management (Swiss, 2003).

Finally, online provision of public services may also lead to loss of incomes from bureaucratic corruption associated with the interface between the public and public officials. More specifically, by eliminating the physical interface between the public and public administrators, online transactions for public services remove the opportunity for bureaucratic corruption. There is some evidence that transactional e-government reduces bureaucratic corruption (Mistry and Abu Jalal, 2012). It is worth noting that there were dramatic decreases in bureaucratic corruption in some countries following e-government initiatives. These initiatives introduced online transactions for government services and enhanced governmental transparency and citizen empowerment. Notable cases include the OPEN system introduced by Seoul’s Municipal Government, the VOICE system in the Indian State of Andhra Pradesh, and the Cristal Website in Argentina. It is also worth noting that as an indication of bureaucratic resistance, it is only with strong support from political functionaries that e-government initiatives were adopted and implemented in those cases.

The assertion that IT (in particular, transactional e-government) does not bode well for some public bureaucrats and that, therefore, they are likely to resist its introduction implies that bureaucratic corruption may be an impediment to the adoption of transactional e-government. It also implies that the probability of a country having a transactional e-government may be a function of, among other things, its level of corruption. In other words, countries with high levels of bureaucratic corruption are less likely to have transactional e-government in place than those with low levels of corruption. The principal aim of this study is to investigate whether there is empirical support for this relationship. The level of a country’s corruption is a major explanatory variable in the study’s empirical model.

3. Methodology

3.1 The Empirical Model

This study uses a logistic regression model to see if bureaucratic corruption has any impact on whether or not a country has a transactional e-government in place. The dependent variable is thus a binary variable that takes the value 1 if a country has a transactional e-government in place and 0 otherwise.

The general form of a logistic regression function, for two independent variables \(X_1\) and \(X_2\) and a binary dependent variable \((Y)\), takes the following form:

$$\text{Prob } (Y=1) = P = \frac{e^{(\alpha + B_1 X_1 + B_2 X_2)}}{1 + e^{(\alpha + B_1 X_1 + B_2 X_2)}}$$

Where \(e\) stands for the exponentiation function, \(\alpha\) for the constant term, and \(B_1\) and \(B_2\) as logistic regression coefficients for the independent variables \(X_1\) and \(X_2\), respectively. When estimated, this equation provides estimated coefficients that can be used to calculate the probability that \(Y\) equals 1 for any given values of the independent variables. In other words, logistic regression coefficients can be used to predict dependent variable probabilities for given values of the independent variables.

The use of a logistic or exponentiation function makes a great deal of sense. The probability that a country has a transactional e-government in place is a nonlinear function of that country’s level of corruption and other factors which are discussed below. Thus, at a high level of corruption, the probability that a country has a transactional e-government is low. As the level of corruption decreases and reaches some threshold, the probability increases a great deal. When that threshold is reached, further decreases in corruption lead to smaller and smaller (or no) increases in the probability.

3.2 Other Independent Variables

As has already been indicated, the level of a country’s corruption is the principal predictor of whether or not that country has a transactional e-government. A country’s corruption level is expected to impact negatively on the probability of a country adopting Web-enabled transactions for
Another key predictor variable is a country’s level of e-government readiness. Specifically, e-government readiness is a principal control predictor in the logistic regression model. Obviously, a country cannot be expected to introduce online public services if it is not e-government ready. This independent variable is expected to have a positive effect on the probability of having transactional e-government in place. In other words, the higher the level of e-government readiness there is, the more probable that the transactional e-government will be in place.

Another control variable is a country’s wealth. This variable is related to the digital divide so often discussed in the literature on e-government. No, a priori argument is made here as to why one should expect a country’s wealth to affect its probability of adopting transactional e-government. This is an empirical question that has to be investigated. Nonetheless, wealthy countries are more likely to have the infrastructural requirements for transactional e-government. The country’s wealth is expected positively to affect the likelihood of adopting Web-enabled transactions for public services. In other words, the wealthier a country is, the more likely it will have transactional e-government. In addition, members of the public in countries with high per capita incomes should have greater access to computers and the Internet than those in countries with low per capita incomes. This predictor is likely to correlate with e-government readiness inasmuch as both indicate the extent of computer and Internet penetration in the society.

A third control variable is the extent of economic freedom a country has. Economic freedom can be seen as minimal state intervention in the activities of economic agents. This is indicated by the extent of state regulations and authorizations (Hanke, 1996; Tanzi, 1998; Gwartney and Lawson, 2003; Graeff and Mehlkop, 2003). Economic agents need to overcome state regulations, and authorizations before they can engage in economic activities. Hence, those agents engage in rent-seeking behavior, including bribing public officials, to overcome the obstacle posed by state regulations. For economic agents, economic freedom removes the impediment, to economic activities, posed by the need to go to public bureaucrats for bureaucratic approvals/clearances. Obtaining those approvals may detract from the speed, efficiency, and effectiveness that economic agents aspire to have when conducting transactions with public officials. It can be argued that the environment of economic freedom encourages the adoption of Web-enabled transactions between government and businesses (the so-called G2B interactions) inasmuch online government-business interactions translate into reality the very notion of economic freedom.

Economic freedom is expected to impact positively on the probability of adopting Web-enabled transactions for public services. In other words, the higher the level of economic freedom there is, the greater the probability of having a transactional e-government in place. Conversely, the greater the level of economic repression there is, the less likely that transactional e-government will be in place.

Excluded from the empirical model is a potentially important control variable; namely, literacy. This variable is likely to influence the extent of computer and Internet penetration in the society. Thus, people in countries with high literacy should be expected to have much greater access to computers and the Internet than those in countries with low literacy. Consequently, it can be argued that countries with high literacy have greater e-government readiness and thus more likely to introduce transactional e-government. The rationale for the exclusion of literacy from the empirical model is simply that it is a principal component of e-government readiness (see the discussion on the measurement).

In the light of the preceding discussion, the study’s logistic regression model can be represented by the following equation:
Prob (TEG = 1) = \frac{e^{(\alpha + B_1 \text{CORR} + B_2 \text{E-GREADY} + B_3 \text{ECONFREE} + B_4 \text{WEALTH})}}{1 + e^{(\alpha + B_1 \text{CORR} + B_2 \text{E-GREADY} + B_3 \text{ECONFREE} + B_4 \text{GDP})}}

Where:

- TEG = Transactional E-Government
- CORR = Corruption
- E-GREADY = E-Government Readiness
- ECONFREE = Economic Freedom
- WEALTH = A country’s wealth

In this model, the probability that TEG equals 1, which is the same as the probability that a country has a transactional e-government, is the function of that country’s level of corruption, e-government readiness, economic freedom, and gross domestic product. The estimated values of the logistic regression coefficients in this model will make it possible to calculate a country’s probability of having transactional e-government given values of its level of corruption, e-government readiness, economic freedom, and gross domestic product.

3.3 Variable Measurement and Data Sources

The paper uses country aggregate data, the unit of analysis being country. The sample of 134 countries, both developed and developing, is used in this study.

Dependent Variable:

As previously noted, the dependent variable (that is, whether or not a country has transactional e-government in place) is a binary variable that takes the value 1 if there is a transactional e-government in place and 0 otherwise. The United Nations Global E-Government Readiness 2004 Report lists 38 countries that have transactional e-government. Countries that have transactional e-government are assigned the value 1; countries that are not listed as having transactional e-government are assigned 0.

Four European countries (Spain, Luxembourg, Portugal, and Switzerland) are not listed by the United Nations Global E-government Report for 2004 as having transactional e-government. However, a 2004 report prepared for the European Commission DG Information Society, lists these four countries as providing Web-enabled public services (Ernst, C.G. and Young, 2005.). This study includes these four countries among those offering online public services.

Independent Variables:

Corruption

This study uses Transparency International’s 2004 Corruption Perceptions Index (CPI), which measures the level of corruption in 146 countries. The index does not provide a direct measure of corruption; it measures corruption according to the level of public perceptions of bureaucratic corruption. Values on the index range between 10 (highly clean) to 0 (highly corrupt).

For the purpose of consistency, this variable is transformed so that scores close to 0 indicate low corruption while those close to 10 indicate high corruption. This transformation is achieved by subtracting each country’s CPI score from 10 and dividing the remainder by 1. Thus, Bangladesh’s CPI score is 1.5 while Finland’s is 9.7. After transformation, Bangladesh’s score becomes 8.5 (indicating high corruption) whereas Finland’s becomes 0.3 which indicates a very low level of corruption.

E-Government Readiness


Values on the E-Government Readiness Index range between 1 and 0. Scores close to 1 indicate a high level of e-government readiness whereas those near 0 indicates low levels of e-government readiness. Thus, according to the 2004 Index, the United States has a score of .91 (the largest) which gives it the highest level of e-government readiness in the world. Niger has the lowest score (.06) and, concomitantly, the lowest level of e-government readiness. In this study, the score for each country (a ratio) is multiplied by 100 to the convert it into a percentage.
Economic Freedom

This study uses the 2004 Index of Economic Freedom, published by the Heritage Foundation, as a measure for economic freedom. The index measures how countries score on 50 independent variables which are grouped into 10 dimensions of economic freedom. These dimensions encompass trade policy, fiscal burden of government, government intervention in the economy, monetary policy, capital flows and foreign investment, banking and finance, wages and prices, property rights, and regulation.

For each country included, the Index of Economic Freedom provides both an overall score and a rank. The higher a country's overall score is, the greater the level of government intervention in the economy is and, concomitantly, the less economic freedom that the country has. Values on the index range between 1 (free) and 5 (repressed). Thus, the scores on the index can be taken to measure either economic freedom or economic repression.

The Heritage Foundation also provides an ordinal measure of economic freedom based on the countries’ overall scores. Thus, countries with scores between 1 and 1.99, 2.00 and 2.99, 3.00 and 3.99, and 4 and 5 are classified, respectively, as free, mostly free, mostly unfree, and repressed. In this study, in order to explore the extent to which economic freedom influences the probability of adopting transactional e-government, these ordinal categories are transformed here to reflect either the existence of economic freedom or the lack thereof. This is done by coding the categories free and mostly free 1. By the same token, the categories, mostly unfree and repressed are coded 0. In other words, economic freedom is treated here as a categorical or dichotomous variable with 1s indicating the presence of economic freedom and 0s indicating its absence.

Wealth

As a measure of this variable, this study uses the 2004 GDP per capita (calculated at current prices with the American dollar as the unit of monetary valuation) published by the International Monetary Fund. In view of the fact that countries differ widely in their GDP figures, this variable is logged to guard against the heteroskedasticity problem which inflates the variance of the coefficient on this predictor.

4. Logistic Regression Results

The results of the logistic regression model are presented in the Tables 1 and 2. The overall model is statistically significant at .01 according to the model chi-square statistic (p < .01, Chi-square= 93.05, df=4). The model also fits the data fairly well. As can be gleaned from Table 2, the model made 88 correct predictions out of the 91 (i.e., 96.7 percent) cases of the value 0 and 32 correct predictions out of the 43 (i.e., 74.4 percent) cases of the value 1 on the dependent variable. Overall, the model made 120 correct predictions out of the 134 (i.e., 89.6 percent) values on the dependent variable.

Table 1

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-GREASY</td>
<td>0.1</td>
<td>0.03</td>
<td>9.6</td>
<td>0.000</td>
</tr>
<tr>
<td>CORR</td>
<td>-0.88</td>
<td>0.33</td>
<td>7.1</td>
<td>0.008</td>
</tr>
<tr>
<td>ECONFREE</td>
<td>1.7</td>
<td>0.9</td>
<td>3.7</td>
<td>0.05</td>
</tr>
<tr>
<td>GDP</td>
<td>-0.03</td>
<td>0.43</td>
<td>0.01</td>
<td>0.94</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.2</td>
<td>4.4</td>
<td>0.08</td>
<td>0.78</td>
</tr>
</tbody>
</table>

Model Chi-Square=93.05 at .000 significance, McFadden’s R2= .55

Table 2

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>88</td>
<td>96.7</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>74.4</td>
</tr>
<tr>
<td>Overall</td>
<td>99</td>
<td>89.6</td>
</tr>
</tbody>
</table>
hypothesized; that corruption reduces the probability of having transactional e-government whereas e-government readiness and economic freedom increase such probability.

The coefficient on GDP is positive, as expected. However, it is not statistically significant at the conventional levels of statistical significance (i.e., .01 or .05). Thus, a country’s average income does not appear to influence the probability of having a transactional e-government in place. However, the impact of GDP on the dependent variable appears to be confounded by the fact that this predictor correlates as expected, with e-government readiness. Although the correlation is moderate (i.e., -.48), it is to some extent indicative of some collinearity problem.

One way to deal with this problem is to remove one of the collinear predictor variables from the model. Since GDP appears to be less important, it is removed. The results of the logistic regression model rerun are presented in Table 3. As the Table shows, there is virtually no difference between the results of the original model and the reduced one. In other words, the inclusion of GDP in the original model does not add anything. Hence, the reduced model is better, inasmuch as it is parsimonious.

In summary, the probability of a country having a Web-enabled transactions for public services can be predicted by its level of corruption, whether or not it has economic freedom, and by its level of e-government readiness. Countries with high levels of corruption, economic repression, and low levels of e-government readiness are not likely to introduce online transactions for public services.

### Table 3
Logistic Regression Results

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-GREADY</td>
<td>0.1</td>
<td>0.03</td>
<td>12.2</td>
<td>0.000</td>
</tr>
<tr>
<td>CORR</td>
<td>-0.87</td>
<td>0.3</td>
<td>8.4</td>
<td>0.004</td>
</tr>
<tr>
<td>ECONFREE</td>
<td>1.8</td>
<td>0.88</td>
<td>4</td>
<td>0.047</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.5</td>
<td>2.3</td>
<td>0.4</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Model Chi-Square=93.04 at .000 significance, McFadden’s $R^2=.55$

4. Discussion

This study has attempted to link the probability that a country has transactional e-government with the level of the country’s corruption as measured by the Corruption Perceptions Index. No claim is made here that whether or not a country has transactional e-government is determined by its level of corruption. What is claimed and empirically demonstrated here is that the country’s level of corruption is simply one factor that influences that country’s likelihood of having a system of Web-enabled transactions for public services.

This finding is predicated on the assumption that this kind of e-government is detrimental to the interests of bureaucrats and, concomitantly, leads them to resist its introduction. In a sense, transactional e-government does not bode well for public bureaucrats. It has a tendency to displace or at least lay some of them off. It also has a propensity to remove the opportunity for bureaucratic corruption that takes place in the context of face-to-face interactions between bureaucrats and members of the public who go to the public bureaucracy for public services. Further, e-government tends to eat into the bureaucratic turf and discretion. Thus, public bureaucrats, who are often portrayed as empire-builders, have a vested interest in resisting the introduction of transactional e-government.

In this study, bureaucratic resistance is the crucial intervening variable between a country’s level of corruption and whether or not that country has transactional e-government in place. In this study, bureaucratic resistance is simply assumed rather than empirically demonstrated. In a study based on country aggregate data, it is not possible to empirically demonstrate such resistance or its effect in terms of preventing the adoption of transactional e-government.

Such empirical investigation would require micro or case studies. Such studies would be useful in terms of identifying the contextual conditions and managerial strategies that need to exist or be used to overcome bureaucratic resistance to the introduction of online transactions for public services. One crucial contextual factor is, in all probability, the commitment of top public managers or government leaders to use information technology to achieve public policy goals.
including combating corruption. The successful anti-corruption project undertaken by Seoul’s Municipal Government vividly illustrates the importance of leadership and commitment to introducing and using transactional e-government to fight bureaucratic corruption.

In view of its macro focus, this study has not incorporated into its empirical model micro factors such as government leadership and commitment as potentially critical factors influencing the adoption of Web-enabled transactions for government services. This is definitely an area for future research.

5. Conclusion

The basic conclusion of this study is that the level of corruption in a country, in addition to its level of economic freedom and e-government readiness, influences whether or not that country has Web-enabled transactions for public services. This relationship is predicated on the assumption that bureaucrats resist and successfully impede the adoption or introduction of transactional e-government inasmuch as it erodes their discretion and removes the opportunity for corrupt incomes.

It would be profitable to empirically investigate this assumption. Such an investigation is not feasible in a cross-sectional study employing country aggregate data. Case studies on the success or failure of e-government initiatives are likely to be much more informative as to the association between corruption and the adoption of transactional e-government and as to the role of bureaucratic resistance as a crucial intervening variable in this relationship.

In view of the fact that most e-government projects/initiatives fail either totally or partially (Heeks, 2003), finding the root causes of such failure becomes paramount. Bureaucratic resistance may be one such cause. Government planners for transactional e-government initiatives may need to incorporate into their risk management planning proactive measures to forestall such resistance. In this regard, the support of top management may be critical for the success of such initiatives. Furthermore, the adoption of transactional e-government does not need to be a zero-sum situation with public bureaucrats at the losing end and members of the public at the other end. Government planners for transactional e-government initiatives are called upon to incorporate into those initiatives a system that makes the adoption and use of online provision of public services simultaneously beneficial for both members of the public and public servants.

References


UN E-Government Readiness Index, United Nations, New York, 2004
