"Economies of Scale in eGovernment: Time for Evidence"

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Abstract. The presence of economies of scale has been often taken for granted in the discussion of many eGovernment implementation issues. This paper discusses this assumption by showing that empirical evidence in favor of economies of scale may be considered context dependent. Although the analysis carried out does not lead to discard the presence of economies of scale in the provision of eGovernment services, it casts a new light on the concept of one-stop-shopping portals as well as providing some insights for future research.

1 Introduction

In March 2000, the European Council met in Lisbon and set the following goal: "Europe will have to become the most competitive and dynamic knowledge economy by 2010". A bold statement that has been followed by the creation of a series of action plans labeled eEurope laying out the intermediate steps necessary to the meet the 2010 deadline.

The eEurope action plans heretofore published have placed a considerable amount of attention on eGovernment related objectives. This suggests that the implementation of eGovernment plays a strategic role in the achievement of the Lisbon target and thus in the future of Europe.

The two main factors that contribute to eGoverment's strategic importance are the following: firstly, the indirect positive impacts that the implementation of eGovernment has on both citizens and firms in terms of technology adoption and usage. In this respect, eGovernment may be considered as a complementary innovation to eCommerce. In Europe, Government consumption amounts to about 20% of the gross domestic product. This makes it the single biggest consumer whose behavioural patterns may exert a significant impact on the economic system. The switch to an online model of government procurement, for instance, may act as a

catalyst by encouraging a large number of enterprises to adapt in order not to loose what may be a significant part of their business.

Secondly, the implementation of eGovernment is expected to lead to an increase in efficiency which should both alleviate the pressure caused by a decrease in the number of taxpayers due to aging populations, as well as increased expectations in terms of service quality.

Part of the expected efficiency gains mentioned above was assumed to be associated with the alleged presence of economies of scale. As a matter of fact, the literature points out that municipality size is an important factor in the implementation of electronic service delivery [9]. This has led the research community to accept the concept of one-stop-shopping portals since they may function as demand aggregators among municipalities, thus creating bigger virtual front offices. As sensible and intuitive as it may be, the assumption of economies of scale still requires some empirical evidence to be provided. This paper will question the economies of scale assumption and will seek evidence of its presence.

2   Objectives

The objective of this paper is to investigate the possible efficiency gains that may be enjoyed in the provision of eGovernment services to a large number of customers. In particular, empirical evidence of the presence of economies of scale in the implementation of e-Government at the municipal level will be researched.

Given the high geographical localization of the sample used for this analysis (Piedmont, Italy), the ultimate goal of the paper is not to provide a final answer on the existence of economies of scale in e-Government, but rather to stimulate some discussion on its context dependency.

The results obtained will also be used to cast a new light on the concept of one-stop-shopping portals, suggesting that both its advantages as well as a possible hybrid solutions should be further investigated.

3   Methodology

The data used for the purposes of this paper was generated by a survey conducted in the context of a project sponsored by the European Commission and named Regional-IST (www.regional-ist.org).

The project was carried out by an international network of regional official observatories whose mission is to support Regional Governments in the policy design process by periodically monitoring the diffusion of technology among public administrations, citizens and enterprises.

The analysis was carried out on the data collected by the observatory in Piedmont (Italy). The unit of analysis of the survey was the municipality.

The sample frame was extracted from a population made up of the 1206 Piedmont Region's municipalities

The population distribution was known and looked as follows:

Table 1. Population and Sample Distribution

Stratum number	Municipality size (Inhabitants)	Population Distribution	Sample Distribution
1	<10.000	1144	238
2	10-500.000	61	36
3	>500.000	1	1
Total		1206	275

The sample was built by adopting a differentiated probability approach in order to over represent the last two strata. The stratification variable is municipality size in terms of number of inhabitants. Stratification thresholds were chosen in order to: isolate the main city and allow a proportional distribution among strata in most of the regions that took part to the Regional IST project (i.e. Piedmont, Catalonia, Baden-Württemberg).

The sample frame was set at 600 units and the redemption rate was 45.8%. Thus, the final sample size was 275 units.

As per data collection, the first contact with municipalities was made by CATI (Computer Aided Telephone Interviews), while data were collected through a written questionnaire.

3   Problem Layout

Three factors were considered while looking for evidence of economies of scale: eGovernment related costs, website complexity and municipality size.

E-Government activities are cross sectional in nature, and thus, their related costs are difficult to isolate and measure objectively. As a consequence, in order to proceed as rigorously as possible, for the purposes of this study a definition provided by the European Commission[1] was adopted:

"*E-Government is defined as the use of information and communication technologies in public administrations combined with organizational change and new skills in order to improve public services and democratic processes and strengthen support to public policies*"

This definition was used as a starting point for defining the variable utilized to measure the costs generated by the eGovernment related activities. Municipalities were asked to specify their annual expenditure on Information and Communication Technologies (ICT). This value was the aggregation of a number of cost items:

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[1] "The role of eGovernment for Europe's Future" European Commission 2003

1. Hardware
2. Software
3. Connectivity
4. ICT related consultancy and training.

As per the measurement of website complexity, the European Commission guidelines[2] were adopted. Five stages of online sophistication were in used to rate the services:

-   Stage 0: Service not available online
-   Stage 1: Information
-   Stage 2: One way interaction (downloadable forms)
-   Stage 3: Two way interaction (possibility to fill in forms online)
-   Stage 4: Transaction (full electronic case handling)

Municipalities were asked to assign a score from 0 to 4 to a set of services identified at EU level as having priority. Website complexity was then measured by computing the average level of sophistication.

Finally, regarding municipality size, two options were considered: number of inhabitants and number of civil servants. In order to avoid an arbitrary choice, two separate analyses were run using both variables. The results obtained did not differ. This paper presents only the results obtained using the number of civil servants employed, but a similar analysis could be carried out using the number of inhabitants.

4   Analysis

The following production function was used to describe the empirical relationship between input and output:

$$y = \alpha \, x^{\beta} \tag{1}$$

where:
"y" is the municipality annual ICT expenditure;
"α" is a multiplication factor;
"x" is the number of civil servants employed in the municipality;
"β" is the parameter of the function allowing the presence of economies of scale to be identified. If the parameter's value is less than one, this means that economies of scale are present.

In order to compute the value of the parameter β, logarithms were used to transform formula (1) into an additive linear function:

$$\log(y) = \log(\alpha) + \beta \log(x) \tag{2}$$

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[2] CAP Gemini "Online Availability of Public Services: How is Europe Progressing?" European Commission DG Info-Society 2003

In the graph below, the logarithm of the annual ICT expenditures of all the municipalities in the sample was plotted against the logarithm of the number of civil servants working in each municipality. The line in the middle represents the line of best fit while the outer lines are the 95% confidence intervals. As it may be noticed, the coefficient of the trend line is less then 1 ($\beta = 0.89$) and thus reveals the presence of economies of scale.
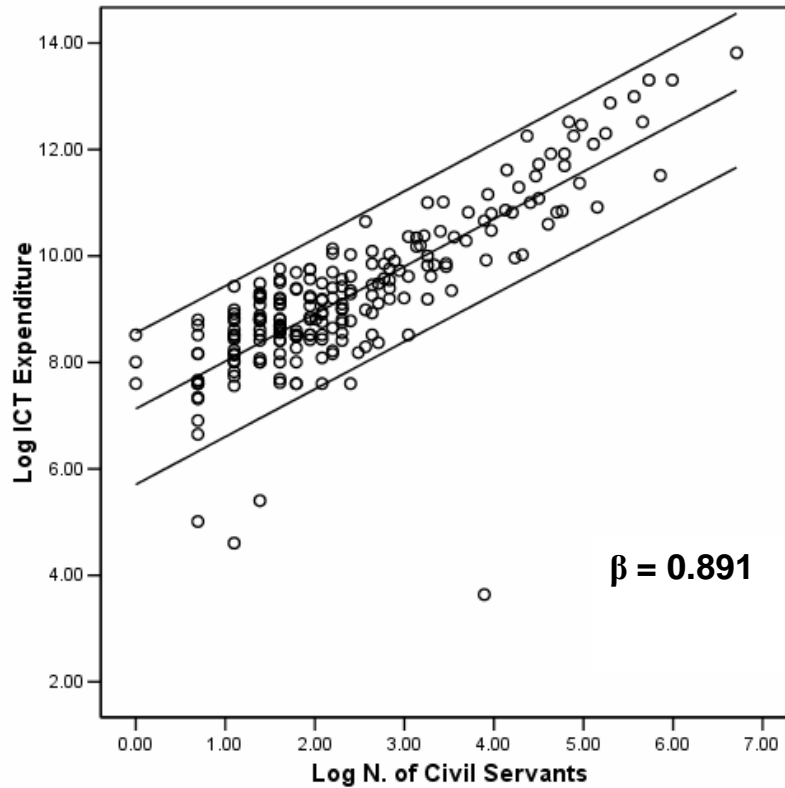

Fig. 1. Logarithm of ICT Annual Expenditure against the Logarithm of Number of Civil Servants

From the first analysis carried out, it may be concluded that the annual ICT expenditure per civil servant tends to diminish as the municipality size increases. However this result reveals to be a Pyrrhic victory if municipalities without a website are excluded from the calculation. In fact, the regression run only on municipalities with a website provides a β whose value is not below 1 with a 95% confidence level. This suggests that the presence of a website (regardless of its complexity level) seems to create inefficiencies and thus diseconomies of scale.

Another component was introduced in the analysis in order to further explore the impact that the presence of a website may have on municipal ICT expenditures. Websites were classified according to their level of complexity and divided into two groups (L and H). Websites with an average level of sophistication lower than 1 were put in the L group, while more complex websites (with an average sophistication level greater than 1) fell in the H group.

The analysis carried out on these two subsets of the population showed that municipalities with less complex websites (L group) enjoy the presence of economies of scale (β=0.762). However, the analysis revealed the presence of diseconomies of scale in municipalities that have a more complex website (β=1.029).

5   Conclusions:

The first conclusion that may be drawn from the analysis described above is that economies of scale in eGovernment at the municipal level should not be taken for granted, since their presence seems to be context dependent.

In the analysis carried out, for instance, although the presence of economies of scale may not be discarded, the supporting evidence is not extremely strong. The implementation of complex websites that allow a high degree of interaction with the citizenry, in fact, seems to foster the creation of inefficiencies.

A possible explanation to these findings may be that, at this early stage of eGovernment implementation, a municipality that has implemented a more sophisticated web interface covers a pioneering role. Thus, the presence of economies of experience should also be taken in due account. In this respect, the theme of reuse and experience sharing plays an important role in contributing to the reduction of the inefficiencies found.

This simple empirical exercise also suggests that it may be worth reconsidering the concept of one-stop-shopping portals in light of these findings, in order to better understand to what extent they may lead to the creation of more efficient and effective systems. In particular, it could be interesting to investigate the possible presence of minimum aggregation threshold (or a critical mass) that may be necessary to reach in order to enjoy the presence of economies of scale. Moreover, different levels of aggregation/collaborations should be explored as a solution that, in addition to allowing the attainment of efficiencies, also takes in due account the importance of local idiosyncrasies, identified by the literature as being a crucial factor in a successful implementation of public e-services [2].

As a caveat, it must be added that the study presented in this paper adopted a cost based approach. As such, it may not be considered exhaustive, since no provision was made for value creating aspects. Nevertheless, given the highly intangible nature of these aspects, a cost based approach seemed to be the only viable option.

In conclusion, the results found reveal that the process of scaling up the provision of eGovernment services may turn out to be a fruitful field of research. In particular, efforts should be directed towards understanding the managerial implications that may hinder an efficient implementation and management of eGovernment systems.

6   Bibliography

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