Diffusion and usage of public e-services in Europe: An assessment of country level indicators and drivers

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Diffusion and Usage of Public eServices in Europe:

An Assessment of Country Level Indicators and Drivers

Abstract: *We analyze the state of the art of indicators on eGovernment, eHealth, eProcurement and ePartecipation. We survey the main methodological properties of these indicators, and uncover the principal stylized facts and trends; at the same time, we highlight their heuristic limits and potential inconsistencies. Finally, we address empirically the issue of the explanation of the indexes scores – i.e. how the supply of the various eServices in each country is affected by political, institutional and socio-economic differences, and is followed by actual usage. The econometric analysis uncovers the importance of broadband penetration and higher education as drivers for most of the types of eServices and users (citizens and businesses). Moreover, a corruption-free and agile public sector shows up to be an important pre-condition for more effective supply and usage. Despite severe data limits and the complexity of the underlying diffusion phenomena, our study of eServices availability and usage across European countries is a first empirical contribution aimed at disentangling broad empirical trends – with their correlates - from unresolved methodological issues. As such, this work appears useful to inform the policy debate and practice, in a phase characterized by a prospective reorientation of public eServices provision.*

Keywords: eGovernment; eHealth; eProcurement; eParticipation; Europe; diffusion; drivers; comparative analysis.

1. Introduction

As public eServices initiatives continue to gain global momentum, diffusion indexes, measures and benchmark studies are rapidly expanding. Academic researchers, NGOs, private and public sector organizations have produced numerous methodologies for measuring and evaluating eGovernment development locally, nationally, and internationally. Despite the wide interest in public sector innovation in general and in eGovernment indicators in particular, the evidence about their availability, usage and broad consequences is still quite scattered and often contrasting (Hardy et al., 2011; Carbo and Williams, 2004, Melitski et al., 2005). Moreover, while the first studies referred to US, at different aggregation levels, the following ones dealt with large and heterogeneous sets of countries, while a specific focus on Europe is still in urgent need, face to the extensive efforts paid by EU institutions to promote eServices development and their benchmarking. Moreover, most of the existing comparative studies concentrate on generic eGovernment, while a systematic and more articulated analysis of specific public eServices lack.

In this paper we analyze the state of the art of available indicators on eGovernment, eHealth, eProcurement and eParticipation, addressing empirically the issues of the underlying construction methodologies and informative potential. Then, we present an empirical analysis of the eServices experience of European countries. In detail, after having critically discussed the most common ranking-based methodologies and benchmarks, we pass to uncover how the supply (or availability) of the various public eServices in a cross country and macro perspective can be associated to noticeable socio-economic, institutional and political differences. Then, as a last step, we also investigate the degree of their actual utilization (demand side), discussing the extent and the possible reasons at the basis of the gap – in some countries very large – between availability and usage. Going through the different sections, we introduce specific examples and develop a focus on Italy which, over time, has followed very peculiar and partly contentious innovation and eServices policies. The ensuing policy reflection discusses the macro reasons that should move a society based on the use of traditional services (at the shelter) towards one based on eServices.

The paper develops as follows. In the next section, a systematic analysis of the main public eService indicators produced so far at the worldwide level is undertaken. Section 3 discusses their underlying assumptions and methodologies, highlighting some unsolved shortcomings; then the Italian case is discussed. Section 4 presents the empirical analysis on the candidate determinants and correlates of country-level eServices diffusion in Europe, with respect to the supply and demand sides, and their gap. The final Section concludes, pointing to some open questions and making a connection with the current "European Digital Agenda" debate and policy-making.

2. Indicators of public eServices

To carry out this survey, a preliminary comprehensive research has been carried out in order to review all public eService indicators produced from 2001 to 2011, and their related benchmarking initiatives. This detailed research included many specialized sources – *in primis*, websites of official international bodies (European Commission (EC) and United Nations (UN)), statistical institutes, private consultancy firms and national governments and agencies' portals. Due to the statistical heterogeneity of this wide array of sources, and their underlying diverging methodologies, we complemented the phase of data collection and analysis with frequent discussions and experts meetings[1]. The indicators finally selected are those: a) which have reached a high development stage, being internationally harmonized and regularly published at the country level[2], and b) focus specifically and strictly on the provision of eGovernment, eHealth, eProcurement and eParticipation services. In particular, the latter criterion means that we chose not to include other benchmarking initiatives dealing with ICT (for example, indexes of eReadiness[3]) and/or with Information Society or broader targets connected to it (for example, level of trust in online environments, quality of the country ICT legislation - for an early but still useful classification, see Janssen et al. 2004). Furthermore, the analysis presented here refers to the most recent editions of such benchmarking reports and accompanying manuals[4]. Table 1 lists the eService indicators preliminary chosen for discussion.

The ten indicators summarize the state of the art of public eServices benchmarking in Europe. They cover four broad typologies of services: eGovernment[5], eParticipation, eHealth and eProcurement. Five indicators measure the provision of services by public administrations (henceforth, PA), while other four indicate the level of usage by individuals and businesses; last, the indicator of eParticipation, due to its truly interactive essence, can be considered a mix of the two market sides/phenomena. A synthetic methodological description of these indexes follows.

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[1] In particular, we are indebted to the other members of the EIBURS-TAIPS research group (http://www.econ.uniurb.it/eib_project) and its Workshops participants for fruitful discussions and interactions.

[2] For this reason, reports focusing on benchmarking cities or specific regional eGovernment projects were not included in this analysis.

[3] The World Economic Forum (WEF) and the Economist Intelligence Unit (EIU) publish two examples of such reports: respectively, the WEF Networked Readiness Index and the EIU eReadiness Ranking. eReadiness indexes measure the presence of adequate ICT infrastructures, skills and of an ICT-conducive environment, but do not arrive to include the measurement of actual public eServices provision.

[4] We need to add that these benchmarking exercises and their underlying datasets undergone across time several revisions. Our analysis focuses on the latest methodologies, relative to the exercises carried out during the most recent data waves.

[5] As described *infra*, this label covers different services, so that, in some cases, it overlaps with the other categories of eServices.

Table 1. Selected eService indicators

eService	Source	Type of indicator	Time span	Availability / usage	Our name
1) eGovernment	European Commission DG Inf. Soc. - Capgemini	Composite index based on scores for 12 services (citizens)	2001 – 2010 (no 2008, 2005)	Availability	GovAI
2) eGovernment	European Commission DG Inf. Soc. - Capgemini	Composite index based on scores for 8 services (businesses)	2001 – 2010 (no 2008, 2005)	Availability	GovAE
3) eGovernment	UN – Dep. of Economic and Social Affairs	Synthetic index, country level	2003, 2005, 2008, 2010	Availability	-
4) eGovernment	European Commission DG Inf. Soc.- Eurostat	Percent of individuals interacting online with PA	2002 – 2011 (no 2008, 2005)	Usage (Individuals)	GovUI
5) eGovernment	European Commission DG Inf. Soc.-Eurostat	Percent of businesses interacting online with PA	2003 – 2011 (no 2008, 2005)	Usage (Enterprises)	GovUE
6) eParticipation	UN – Dep. of Economic and Social Affairs	Synthetic index, country level	2003, 2005, 2008, 2010	Both	Partic
7) eHealth	European Commission DG Inf. Soc. - Capgemini	Online sophistication score (NUTS2 level)	2010	Availability	HealthA
8) eHealth	European Commission DG Inf. Soc.-Eurostat	Percent of individuals using Internet for health issues	2003 – 2010	Usage	HealthU
9) eProcurement	European Commission DG Inf. Soc. - Capgemini	Unweighted average of “pre” and “post award” process availability scores	2010	Availability	ProcurA
10) eProcurement	European Commission DG Inf. Soc.-Eurostat	Percentage of businesses using eProcurement tools	2001 – 2010 (no 2008, 2005)	Usage	ProcurU

Source: our elaboration

eGovernment

The European Commission's annual e-Government benchmark study, carried out by Capgemini (see indicators n. 1-2 in Table 1) is one of the flagship initiatives in measuring public eServices[6]. The benchmark is designed and carried out with the participation of the EU Member States' representatives[7], and uses a comprehensive and harmonized ranking system to identify those European countries which implemented the most mature eGovernment services; in other words, the focus is on efforts aimed at "making services available online"[8]. The benchmarking exercise builds on a two-step method (see EC-Capgemini, 2010). In the first step an "online sophistication" ranking of all the available eServices is calculated; this assesses the online service delivery against a 5-stage maturity model[9]: (i) information, (ii) one-way interaction, (iii) two-way interaction, (iv) transaction, and (v) targetisation/automation, where the higher the stage, the higher is considered the informative and operative potential of the service electronically delivered. Basically, the analysis and evaluation is conducted on the relevant web-sites (from the involved service providers), and the final country' score (a percentage) is the average of the scores (percentages) of the relevant eServices considered, separately for citizens and businesses. The second step involves the construction of a "full online availability" indicator (FOA, henceforth), which is formulated introducing a threshold to the 5-stage maturity model. Basically, for those online services featuring levels of sophistication between "none" and "two-way interaction", the corresponding FOA will register "not full availability online"; for those eServices attaining the fourth or fifth sophistication level, the online availability will be "full". Both the "online sophistication" and the "full online availability" indicators are expressed at the country level with the 0-100% range.

Table 2 details the 20 basic services for citizens and enterprises on which the EC-Capgemini (2010) method and benchmark are based. In particular, we chose to extract and analyze separately the service mentioned at point 12 using it as the corresponding indicator for health-related services (see indicator 7 in Table 1); moreover for eProcurement we built an original index describing the whole process of procurement digitalization (pre- and post-award). This is feasible only for 2010 so that, for these

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[6] Annual reports and current updates are available from a variety of sources, including https://ec.europa.eu/digital-agenda. The concerned edition (short version) is downloadable at: https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/egov_report.pdf

[7] This step involves some forms of negotiations with the country' expert delegates, due to the need of adapting the general survey framework to the countries specific situations. Inevitably, these negotiations accommodate some discretionary power from both sides and may engender improper dynamics of strategic manoeuvring of benchmarking at the State level. These phenomena will be further discussed in Section 3.

[8] In detail, measurement encompasses a set of URLs (around 8,000, in total) agreed with Member States as relevant for each service. Native speakers in each language then carry out a web survey to measure the degree of sophistication of eServices (interactivity potential, degree of online availability) using a common evaluation methodology (see *infra*).

[9] At the maximum. In fact, some services involve an inferior number of stages of maximal complexity (eg: declarations to the police). Previous versions of the benchmarking included only four stages of sophistication. See http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/tsiir120_esms.htm.

indexes, the following econometric analysis will be limited to a cross-section estimation.

Table 2. Basic eServices covered by the EC-Capgemini benchmark

Citizens	1	Income taxes
	2	Job search services
	3	Social security benefits
	3,1	*Unemployment benefits*
	3,2	*Child allowances*
	3,3	*Medical costs*
	3,4	*Student grants*
	4	Personal documents
	4,1	*Passports*
	4,2	*Drivers licence*
	5	Car registration
	6	Application for building permit
	7	Declaration to the police
	8	Public libraries
	9	Birth and marriage certificates
	10	Enrolment in higher education
	11	Announcement of moving
	12	***Health-related services***
Businesses	13	Social contribution for employees
	14	Corporate tax
	15	VAT
	16	Registration of a new company
	17	Submission of data to statistical offices
	18	Customs declarations
	19	Environment-related permits
	20	***Public procurement***

Source: EC-Capgemini (2010).

According to its proponents (see EC-Capgemini, 2010;p.8), this methodology and ranking enable statistically robust comparisons cross country and over time, starting from 2001 (2005 and 2008 are missing); we will investigate this issue in a more systematic way *infra*, together with the realism surrounding some of its implicit assumptions.

An alternative is the United Nations eGovernment development index (EGDI, n.3 in Table 1). It is a comprehensive measure of the capacity of national administrations to employ online and mobile technologies in the execution of government functions[10]. The index ranges from 0 to 1 and is composed as the average of three different sub-indexes:

[10] The methodological manual can be accessed at: http://unpan1.un.org/intradoc/groups/public/documents/un-dpadm/unpan038858.pdf. The annual datasets are available at: http://unpan3.un.org/egovkb/.

first, the "Online service index", which is the result of an in-depth online research balanced by a consideration of usability that, unfortunately, make it inconsistent across time[11]; second, the "Telecommunication index", indicating the state of development within the country of the Information and Communications Technologies (ICT) infrastructures; third, the "Human capital index" which relies on the UNDP "education index", a combination of the adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio[12]. This benchmark, at the time of writing this article, is available for four waves: 2003, 2005, 2008, 2010; meanwhile, the underlying evaluation criteria have evolved, as long as the potential for eGovernment and the associated technologies have been unfolding and transforming. Hence, the UN eGovernment development index is not designed to make cross-country consistent comparisons along the longitudinal (temporal) dimension. Moreover, we believe that the UN indicator, being a composite index including information on its likely explanatory factors (such as telecom infrastructure and human capital), is not an appropriate dependent variable in a regression setting. For all these reasons[13], we will build our econometric analysis on the EC-Capgemini alternative.

Turning to demand-side indicators of eGovernment (meant as usage, or "realized demand"), the EU-Capgemini benchmarking exercise does not provide time series of indicators measuring usage or user satisfaction aspects - although some pilot initiatives started in 2009 (see EC-Capgemini, 2010;p. 24-8). Hence, we chose to employ some useful indicators provided by Eurostat, belonging to the annual "Community Survey on ICT Usage in Households and by Individuals" and "Community Survey on ICT usage and e-commerce in enterprises"; both are originally collected by the national statistics institutes, based on an EU-harmonized questionnaire and stratified samples of respondents. These two surveys provide, for the period of our interest[14], various indicators measuring public eServices usage with different degrees of service completeness and interactivity. In particular, for citizens, four different indexes are provided by Eurostat for our period of analysis: starting with the most general and encompassing indicator, the first measures the percentage of individuals aged 16 to 74 using Internet for whatever kind of online interaction with public authorities; other variants ask the same information with respect to the following specific purposes: for obtaining information from public authorities' websites, for downloading official forms,

[11] In fact, this further step involves a subjective and appreciative analysis, carried out over time by different teams of researchers.

[12] With two third weight given to adult literacy and one third to gross enrolment ratio. For a comprehensive treatment of the underlying methodology see Whitmore (2012), who also proposes data recombination (factor analysis) to fix some of the benchmarking shortcomings of the index.

[13] As a further check, we noticed that the linear correlation coefficient between the two indexes, for the set of countries featured in one common edition, is generally quite low. For example, in the 2010 edition of both indexes (with their intersection matching 25 countries) the Pearson's coefficient was equal to 0.508 (significant at the 5% level). Hence, the choice of the EC-Capgemini comes out unquestioned.

[14] This means that we refer to the series named "i2010 benchmarking indicators". In fact, for the most recent period, a slightly modified but shorter series is also available, termed "Benchmarking Digital Europe: 2011-2015 indicators" (see http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/database).

for sending back filled in forms. For our analytical purposes, we decided to use the most general type of indicator, able to include all the possible eGovernment usages[15]. Hence, in Table 1, the indicator n. 4 measures individuals using Internet for interaction with public authorities. Equally, indicator n. 5 measures the same phenomenon for businesses. Also in this case, other more specific indicators would be available, although with different degrees of data completeness; consequently, we continue to stick to the most general option[16].

From this brief presentation, we can draw some preliminary considerations. First, concerning supply-side variables (availability of eGovernment, both from EU and UN sources), it emerges that, although the underlying lists of indicators are fairly representative of the main government and administrative functions and public services offered in a developed nation (consider again Table 2), they are not complete, both in the extensive and intensive sense, for several reasons. First, concerning extensivity, we notice that several areas of Government activity are not included (for example, the many taxes on other non-income domains, other certificates and public authorizations, other social security provisions, etc.). More radically, other new eServices might be technologically feasible and extremely relevant, from a social point of view, but at present they have not been included in the statistical and benchmarking projects: main examples are ICT-enabled eServices and tools for natural catastroph prevention or public emergency management (including communication systems for public alert and coordination, as in the case of earthquakes or floods). Second, concerning intensivity, the included items refer to eServices that may involve, across countries, sizable differences in terms of degree, "intelligence" and complexity of electronic implementation of the underlying administrative procedures. Obviously, public administrations and normative systems diverge greatly across countries, for many historical reasons, legacies and evolutions. This is particularly valid for non-EU countries (hence, the bias is more likely to affect the comprehensive UN rankings), but in part holds also for EU members, despite in the latter case a superior degree of normative and procedural harmonization has been realized, as part of the European unification process. The resulting heterogeneity makes difficult to capture the specificities of one single administrative procedure with the simple headings of Table 2: for example, we may consider the lengthy passages and complex authorizations requested to complete a building permit request in some EU countries. A partial mitigation of the measurability bias comes – for the EU-Capgemini data - with the application of the "online sophistication" and the "full interactivity" scores, which

[15] On one side, our choice tend to overestimate the maturity of the demand side, but on the other it captures the "average" type of eGovernment usage, so that laggard countries are not penalized. This choice is more suitable for the "eGovernment 1.0" phase, like that featured in our long and initial period of analysis (2001-11), while should be changed because obsolescent when tackling the next generation of public eServices, called "eGovernment 2.0".

[16] In this case, in addition to the usual specific purposes (obtaining information from their websites, downloading forms, returning filled in forms), another more advanced possibility is considered for firms: full and complete interaction with public authorities – id est, the instance where the case handling is completely electronic (paperless); for firms, the index considers the percentage of those with at least 10 employees in the given NACE sectors.

corrects for the 5-level interactivity potential of the realized electronic procedure; however, several other dimensions and procedural details[17] cannot be accounted for by the employed methodology of index construction; in particular, a main aspect that will be detailed *infra* concerns their level of technical reliability and operational effectiveness for users' daily lives.

ePartipation

In the case of eParticipation, we face a complex phenomenon to monitor, as recent reviews of the literature have been pointing out (Susha and Grönlund, 2012, Medaglia, 2012). Susha and Grönlund (2012), in particular, clarify as the field appears still immature, especially from a theoretical point of view, with existing contributions picking out inconsistent or loose definitions of main concepts. Similarly, although many approaches tended to frame e-Participation as a sub-field of eDemocracy (with the latter term being the first historical manifestation and label given to the whole field), over time eParticipation has developed as a more extensive and general field, and now includes other streams of research and concepts not directly connected with the original meaning of eDemocracy – *id est*, the usage of ICT for participation in strictly defined "citizen-government" processes. In particular, to reflect these literature advancements, our choice of eParticipation has been that supplied by the United Nations (n. 6 in Table 1), since its breadth is enough general, being focused on measuring the usage of polls, surveys, blogs, newsgroups and even social networks, beside other interactive platforms of communication, to "facilitate engagement" (see UN-DESA, 2010;p.96). In other terms, this indicator offers insight into how different countries are using online tools to promote interaction between not only citizens and government, but also among citizens, "for the benefit of all". It considers the following three levels of analysis: provision of information by governments to citizens ("e-information sharing"), interaction with stakeholders ("e-consultation"), engagement in decision-making processes ("e-decision making"). It takes the values from 0 to 1 to indicate the degree of "openness" of a government, i.e. a government that does not fulfill its work as a "black box" but operates in a transparent way, involving relevant societal players whenever possible.

eHealth

As introduced before, the index of eHealth availability in Europe (n. 7 in Table 1) is one of the 20 basic services measured by Capgemini (Table 2)[18]. As a representative example, it registers structured eServices aimed at the provision of health care (the most basic example being online reservation of medical visits or exams). The index of usage

[17] Going back to the example of the building permit, the electronic application phase might be only one step of a multi-layered and more complex procedure requested by a country, involving also other paper documents and certificates with multiple administrations, as it is typically the case in Italy and other Mediterranean countries. All in all, a full treatment of the measurability issue goes beyond the scope of this paper. Moreover, it connects inevitably with the literatures of constitutional and administrative law, and political sciences.

[18] In this case, to enable its separate analysis, we used the "online sophistication" score of point n.12 (in Table 2), taken at the NUTS2 level.

(n. 8, *ibidem*), instead, comes from the Community survey on ICT usage in households and by individuals. It measures the share of individuals aged 16 to 74 having used Internet to seek health information, whether for themselves or for others, in the last three months from the survey (data cover 8 years, from 2003 to 2010). In the case of eHealth, most of the available official indicators suffer from shortcomings related to the inner many-sidedness of the ongoing process of digitalization of the relation between the patient and the doctor (whether general practitioner, hospital, or specialist). In particular, our demand-side indicator certainly captures the on-going "disintermediation" of the health care provision, which sees the Internet increasingly used as a partial substitute for traditional medical visits and advice seeking (for an early analysis of this phenomenon, see Cline and Haynes, 2001). However, this is just one aspect of eHealth, while there are many other recent developments and instrumental possibilities of ICT usage, which remain uncovered. First, on the stricter therapeutic domain, we can mention the possibility of performing remote monitoring, diagnosis and prescriptions thanks to portable medical equipment complemented with "always-on" digital connections and audiovisual devices; a main example are portable sensors detecting heart conditions of patients, remotely monitored. Second, in a larger sense, other important applications of eHealth include the dematerialization and the administrative simplification of the main medical procedures and documents (for example, the introduction of the personal digital file of the patient, the on-line dispatch of medical prescriptions and illness certificates, etc.). These further aspects of eHealth at present are not captured by our demand-side measures, and partly neither by the supply side ones. To summarise, the current technological frontier of eHealth remains largely unaddressed by the state-of-the-art benchmarking methodologies.

ePROCUREMENT

The provision of eProcurement services in Europe (n. 9 in Table 1) is both one of the 20 basic services measured by Capgemini (n. 20 in Table 2) and the object of a further focus carried out with other indicators, currently under revision. To analyse eProcurement in detail, we first surveyed the available outputs of the benchmark exercise, which monitors different aspects of this phenomenon. Then, as mentioned in Table 1, we built our best choice final indicator taking the un-weighted average of the "pre award" and "post award" scores of the process availability indicators, as calculated by EC-Capgemini (2010): in particular, while the pre-award phase is a 'traditional' indicator 0-100% aggregated by subphase[19], the "post award" score is still a "proof of concept" (experimental) index, constructed on qualitative grounds and referring to eInvoicing and ePayment practices. Basically, our aggregation choice reflects the need of having a comprehensive index logically comparable with the FOA indicators, used for measuring the other eServices; moreover, it is a measure of procedural effectiveness of the process, rather than of its mere on-line visibility (measured by another indicator provided by the benchmark). For the demand side, the index of eProcurement usage (n. 10 in Table 1) is taken from Eurostat (Community Survey on ICT usage and e-

[19] In particular, it is the differently weighted combination of three sub-phases: eNotification, eSubmission and eAwarding.

commerce in enterprises), and measures the percentage of businesses using eProcurement tools.

Finally, Tables 3 and 4 present the descriptive statistics of the chosen state-of-the-art dependent variables, appearing in the following econometric analysis. Table 3 shows that, in 2010 (end-period of observation for most of our dependent variables), the supply of eGovernment has reached on average a high level of development, both for individuals and businesses: respectively, FOA indexes score at 80,6% and 90% levels of the maximum potential (of full online availability) of eServices. Moreover, across the EU and the other European countries included in our sample, there has been a certain convergence path, especially for eGovernment services aimed at businesses (see their lowest coefficient of variation). Further, a similar remark applies to eProcurement services (FOA= 73,3%, coefficient of variation=33,5%), while lower and more dispersed diffusion scores are registered by eHealth and eParticipation services. Concerning the latter fact, it is interesting to notice that it holds despite the fact that the underlying variables, as commented *supra*, possess a low discriminant capacity (flattening out the relative performances of diverging countries). To summarise, the supply side specifically aimed at citizens globally appears as relatively less developed than that for enterprises.

Table 3. Descriptive statistics for dependent variables – year 2010.

Variable	Obs	Mean	Std. Dev.	Var. Coeff.	Min	Max
			Supply side			
GovAI	30	0,806	0,189	0,235	0,417	1
GovAE	30	0,900	0,133	0,148	0,500	1
HealthA	24	0,536	0,278	0,520	0,0	1
ProcurA	24	0,733	0,246	0,335	0,170	1
			Mixed side			
Partic	24	0,460	0,192	0,417	0,129	0,829

Legend: statistics in integer (obs.) and decimal values (all the rest).
Source: our elaboration from cited sources.

Moving to Table 4, we notice that the demand side of eServices diffusion presents a main difference and a few similarities, compared to Table 3. First, in general the average level of usage is lower than the corresponding one for availability, with the larger gaps[20] characterising eGovernment for citizens and eHealth. Then, differently from Table 3, in Table 4 the eGovernment usage for citizens is the most dispersed across countries (see the highest coefficient of variation), while the usage of eHealth is less than in Table 3. Finally, among the commonalities, we notice that also in Table 4

[20] Supply and demand indexes cannot be directly and perfectly compared, due to differences in their composition. However, in an impressionistic way, we can indirectly compare them considering each one with respect to its range and hypothetical maximum (the latter being =1 for all, *id est* the attainment of 100% of the maximum potential).

eGovernment for businesses results to be the most evenly-distributed public eService (this time, for usage).

Table 4. Descriptive statistics for dependent variables – year 2010.

Variable	Obs	Mean	Std. Dev.	Var. Coeff.	Min	Max
			Demand side			
GovUI	30	0,434	0,203	0,468	0,083	0,823
GovUE	30	0,792	0,117	0,147	0,498	0,959
HealthU	24	0,343	0,116	0,339	0,140	0,570
ProcurU	24	0,761	0,254	0,334	0	1

Legend: statistics in integer (obs.) and decimal values (all the rest)
Source: our elaboration from cited sources

3. Benchmarking eServices: methodological aspects

3.1 Literature review and unsolved issues

The eServices research field has expanded considerably, amassing in more than a decade of empirical literature tens of scientific papers, beside many consultancy and practitioners' reports (for a systematic review of the field, see Heeks and Bailur, 2007). In parallel with the expansion of research and benchmarking outputs, data flaws and inconsistent rankings of countries have started to show up. In various cases, disappointing performances or ranking shortcomings pushed the concerned national Governments to officially complain to the reports' authors. More generally, the field core topics turned up very sensitive - especially for politicians – and have been stimulating a surge of papers focusing on the detailed methodological aspects of eServices benchmarking (for eg., Bannister 2007, Salem, 2007). In this Section, we want to contribute to the recent debate. In what follows, we first review some objective flaws of the data design and collection methodologies, to later tackle more subjective and discretionary issues associated with benchmarking and its usage by bureaucrats and politicians.

A main point of departure is that, despite this sizable study activity, so far empirical research has shed little light on the robustness of several country-level indicators of eServices, and on what may explain the low correlation between different benchmarking exercises. A few exceptions exist (for eg., see Rorissa et al. 2011 for African countries), but many more systematization works are needed, face to the burgeoning amount of conflicting evidence. Indeed, the data consistency problem for eServices appears a

relevant one, and needs to be addressed also by the relevant stakeholders[21] and data producers, beside the research community.

Basically, the studies constructed on the basis of internationally-harmonised indexes can hardly be considered exhaustive in explaining the cross country variability in the choice, implementation and usage of eGovernment initiatives. While empirical studies at the local level often manage to assess the robustness of their results by checking out several complementary and articulated sources of information (see e.g., Arduini et al., 2013; 2010; Norris and Moon, 2005; Moon, 2002), global comparisons at the national level (for a comprehensive review, see Section 4) result to be more problematic, since they just rely on fewer synthetic indexes which, because of the harmonization and the comparability needs, are often narrowed down to generic items of the public sector presence and intervention (Melitski et al., 2005).

Now, the answer to the question of what makes one country rank high in some of these benchmarking exercises and significantly lower in others is a complex and multi-faced one. Here, we chose to address it with a gradual inductive approach, since there is no generally applicable answer, due to the fact that different methodological shortcomings affect a variety of stages of the statistical process of data collection and usage: differences in the theoretical hypotheses, in the level of detail of variables contained in the questionnaire, in the statistical samples of respondents, in the data collection methods, and in the statistical tools of analysis used for rankings and benchmarking.

Several factors can be associated to the benchmarking inconsistencies. First of all, since there are several ways and strategies to measure eServices (Janssen et al., 2004 provide an early but still useful taxonomy[22]), data strengths and weaknesses depend on the category and indicators chosen. In general, while input indicators (for eg., financial resources spent on ICT/eGovernment) are the most affected by data comparability problems (due to cross-country definition and accounting differences), output indicators (like the ones produced by EC-Capgemini) reflect a narrow and minimalistic definition of eGovernment (that of "online service delivery"), which leaves completely unaddressed the crucial point of the redefinition of the rationale of public service delivery and its back-office reengineering, in addition to neglecting the final user's experience (usage rate, level of satisfaction, etc); the latter can be taken into account by demand side indicators, which we decide to include as a cross check of the supply side ones.

Second, beyond the chosen type of indicator (whether input, output, usage, etc.), the whole subject of eServices is inevitably affected by the fast technical change rapidly transforming the underlying ICT technologies, so that questionnaires and surveys cannot keep up with the market reality, and may frequently mis-represent the "real"

[21] For a survey on e-Government stakeholders, their agendas and incentives and their potential conflicts, see Rowley (2011).

[22] They distinguish between input, output, usage, impact and environmental (readiness) indicators.

technological endowment of countries[23]. A similar phenomenon, for example, has been detected by Matteucci (2013) in the case of the official statistics on broadband (OECD, ITU, Eurostat), which are based on (now) obsolete definitions of the relevant variables and tend to systematically underestimate the gap of the laggard countries, flattening out diverging national situations. Coherently, the "obsolescence" bias is even more perverse in the case of eServices, due to the higher intensity of the service component (with respect to the infrastructural one) and the larger multidimensionality of the indicators: in Section 2.1 we dealt with the case of eHealth, which is a good example of a domain featuring an increasing measurement gap attributable to the fast-expanding potential of application of ICT to the provision of public services.

For similar reasons, the "obsolescence" bias equally affects e-Government indicators; again, in Section 2.1 (see comments to Table 2) we mentioned the "extensivity" and "intensivity" bias, due to the fact that the relevant aggregates monitored and included in the definition of each eService are in part country- and time-variant, and the initial 'historical' choice of which administrative function or service to include – and how – might now account for a sizable part of the final indexes inconsistencies[24]. Further, another important but often neglected point is that the bureaucratic overload contained in each procedure or public service delivery differs across countries, so that even attaining the maximum level of digitalization (for eg. FOA=100%) in one of the 20 basic services monitored by the EC-Capgemini benchmark does not guarantee that the supply of the whole procedure has been completely digitalized, in reality[25].

Finally, output indicators naturally tend to emphasize the technological dimension of eServices and the front-office efforts of countries, while usage and impact indicators better capture the back-office effective redesign and user-level benefits. Hence, using output indicators might paradoxically lead to cases where countries having highly complex and unchanged bureaucratic procedures (but ICT-intensive and available online) score better than countries where eGovernment tools radically redesigned operations, streamlined procedures and centralized databases, avoiding, for example, tedious and useless duplications of data and documents storages in multiple branches of the PA.

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[23] Bannister (2007; p.173-4) considers similar problems when calls for a "time-invariant metric" and "time-invariant technology context".

[24] For example, while at the beginning of last decade a two-way interactive on-line form for the initial request of a building permit should have been probably very innovative and anticipatory for most public administrations, today this eService is rather trivial, and a high eGovernment standard would rather require the complete virtualization of the whole administrative procedure, from the initial request of the permit to the end of the building works, linking all the public offices involved and including the final deposit of the new cadastral map of the construction to the land registry.

[25] As an example, concerning service n.10 in Table 1 (enrolment in higher education), many registrar' offices of Italian universities did not enable online enrolment from remote private terminals, but only from those placed in the university premises/buildings, alleging security and identification concerns. Other online services (for eg., those delivered by social security portals, such as that of the Italian Institute INPS) require very complex online authorization procedures, which often demand further paper steps or visits to the INPS offices to be finalized.

We want to stress that, so far, these apparently 'minor' points have not been seriously acknowledged in the literature, even in the few cases where someone[26] spelled the need of moving towards new benchmarking indicators, able to capture new emerging priorities for eGovernment, such as transparency and reusability of public data.

Then, beside the issue of "what" has to be considered as "eService", there is the usual dimension of "how" statistical institutes and bodies perform the data collection. In this respect, our comprehensive analysis of the methodologies adopted in the construction of the selected indicators of Table 1 revealed the combinations of different data collection techniques, such as paper questionnaires, experts' interviews or evaluations, web surveys and users interviews, which can explain another share of the encountered indexes inconsistencies. For example, we mentioned in Section 2.1 that the UN eGovernment composite index includes a sub-index ("Online service index") where a subjective judgment of usability is formulated by time-varying teams of research, thereby dampening its temporal consistency and comparability.

More radically, the very notion of benchmarking incorporates strong logical assumptions, such as the hypothesis that the performance of complex aggregate entities (like countries) can be measured using a set of common quantitative indicators and a given methodology, and that this measuring results in a clear and objective evaluation of their comparative situation. In the case of eServices benchmarking, a further assumption is made, with respect to simpler cases (such as benchmarking countries with respect to productivity or unemployment dynamics): that the investigated phenomenon, despite its multidimensionality, can be fairly synthesized with the data and indicators we have. Basically, none of the above assumptions can be taken for granted, and this view suggests that eServices benchmarking tends to fall into a sort of positivist research paradigm, which is notoriously too reductionist for studying interdisciplinary issues arising from social sciences domains. Without going into further methodological details and questioning the very foundations of the economic discipline (up to the long-debated reductionism implicit in the "homo oeconomicus" metaphor and the utilitarian tradition informing prevailing economic approaches), here it is sufficient to remind a few points, which help us to use more critically the benchmarking scores, acknowledging their "true" heuristic potential.

A first limitation comes from the widespread usage of simple (univariate) indicators and ranking methodologies. For example, Ford (2011), while examining the benchmarking of cross-country broadband diffusion, correctly warns against the overwhelming focus placed on ranking performed on unbounded indicators[27]. In this situation, in fact, the

[26] Osimo (2008) for example, while advocating the need for a new set of indicators able to benchmark correctly the new eGovernment priorities in the "Web 2.0" era, says that the previous set of EU-Capgemini indicators has served their purposes well; as we will demonstrate across the whole paper, we tend to be less optimistic concerning the latter judgment.

[27] With unbounded indicators, diverse countries may exhibit different ranges for the same variable (indicator), so that even the absolute variable comparison is misleading; hence, also the derived ranking. Moreover, is notorious that the ordinal classification inevitably compresses the original indicator's variability, loosing precious information. Ford (2011)'s proposal is to build an external benchmarking reference indicator, to evaluate diffusion progresses. For an improved version of the Ford's proposal, see Matteucci (2013).

positional difference of the ranked countries results very sensitive to even negligible variations of the underlying original indicator (whatever the latter is), so that wide ranking differences between two countries may simply reflect only marginal absolute differences; and this risk typically augments during the life-cycle of the innovation diffusion, when saturation processes make 'naturally' countries to converge in absolute terms. In the case of benchmarking cross-country eServices diffusion, information complexity is much higher and multidimensional indicators are unavoidable, so that the usage of appropriate synthetic indexes taken in absolutes values– as the one we chose for the supply side – appears a viable alternative to the ranking shortcomings; consequently, this choice also influences the structure of the following econometric analysis.

Further, the aggregation and measurability assumptions underlying eServices are far more heroic than conventionally hypothesized in other benchmarking exercises or disciplines[28]: in fact, here they assume that we can synthesize the complexity of large and heterogeneous set of items (such as infrastructural elements - ICT products and services, administrative cultures and norms, social behaviours and organizational routines) in one single score. In this respect, the initial critic made to early benchmarking attempts focused on infrastructural elements (so called technology-centric views of eGovenment; for a review, see Yildiz, 2007), with the aim of enlarging their focus to human and organizational elements, is appropriate but does not solve the aggregation problem, whose complexity is even aggravated.

Finally, eServices indicators tend to result inconsistent with other similar Information Society scores and benchmarking exercises, and these differences show up in unpredictable ways; after all, this is implicit in the different information content of the benchmarking variables, as underscored by previous classification exercises (Janssen et al. 2004; Kunstelj and Vintar, 2004). This observation seems at first trite, but it is not. First, a frequent underlying explanation for the rankings' contradictions is that most of the supply-side indicators of eServices availability do not measure or check for the effectiveness and quality of the service, but just its provision and theoretical existence: our EC-Capgemini choice is a case in point. Now, it is only when moving to demand-side indicators that rankings can be controlled for the effective technical functioning and the users' fruition of the underlying services. This discrepancy, when we refer to publicly provided non-market eServices can be even sizable (depending on the country's quality of public administration, its social and political accountability and overall efficiency); moreover, any malfunctioning of the deployed eService could potentially last long, since the public provision and the collective system of financing naturally delays the market sanction of the resulting ineffectiveness.

[28] The debate on the measurability of constructs and phenomena in social sciences has a long tradition. For an early notorious contribution, see Boyle (2002).

3.2 Selected examples and the Italian case

The discussion presented in the previous Section has highlighted that the nature of the investigated phenomenon and the limits of the describing data requests us special care in checking for single cases deviations and associated idiosyncrasies. Hence, before the econometric analysis - which is typically aimed at detecting average trends and general stylized facts - we present a few descriptive statistics on our indexes and rankings, to better discuss their properties and inform the following inferential step.

Table 5 shows the cross correlations between the countries' index scores in 2010, for the supply side (four categories of eServices) and for eParticipation. It emerges clearly that the expectation that countries should have similar levels of development for most eServices is not verified in our European sample; on the contrary, most of the index pairs are loosely associated, with the only exception being a moderate and significant correlation existing between eGovernment for citizens and enterprises, and one between the first index and eHealth[29]. We believe that this evidence, that has been also detected by other studies based on larger cross-country datasets, in our case is particularly research-provoking, because it refers to a restricted sample of countries that in principle should share strong commonalities in multiple domains (socio-economic, institutional, policy, etc.), being in large part members of the EU.

Table 5. Linear correlation between dependent variables – supply/mixed side

	GovAI	GovAE	HealthA	ProcurA	Partic
GovAI	1				
(obs.)	30				
GovAE	0.584*	1			
(obs.)	30	30			
HealthA	0.645*	0.453*	1		
(obs.)	24	24	24		
ProcurA	0.040	0.094	0.187*	1	
(obs.)	24	24	19	24	
Partic	0.419*	0.242*	0.180*	-0.123	1
(obs.)	24	24	20	20	24

Legend: *= significant at 5%

Source: our elaboration from cited sources

A similar picture emerges from Table 6: the intensities of usage of eGovernment by citizens and enterprises display a moderate and significant correlation, and the usage of eHealth is strongly and significantly associated to eGovernment by citizens (more than

[29] Also the availability of eGovernment for enterprises is moderately and significantly correlated with eHealth, although in a weaker form.

in the case of availability). Instead, all the other cross-correlations display loose or not association whatsoever.

Table 6. Linear correlations between dependent variables – demand side

	GovUI	GovUE	HealthU	ProcurU
GovUI	1			
(obs.)	30			
GovUE	0.538*	1		
(obs.)	30	30		
HealthU	0.870*	0.477*	1	
(obs.)	24	24	24	
ProcurU	-0.186*	-0.191*	0.0053	1
(obs.)	24	24	20	24

Legend: *= significant at 5%

Source: our elaboration from cited sources

Another crucial point is the expected strength of the country-level linear correlation between indicators of eServices availability and usage, distinctively for citizens and enterprises. In this respect, sticking to the most relevant case (eGovernment), performing Pearson linear correlation shows that the association between GovAI and GovUI (citizens) is quite low, being only 0.275* (0.362* if calculated on the whole longitudinal sample); similarly, the coefficient of correlation between GovAE and GovUE (enterprises) in 2010 drops to 0.060 (insignificant; it raises to 0.425* on the whole sample).

This evidence is somehow puzzling, and can hardly be justified simply with the argument of the imperfect comparability of the supply and demand indicators we use[30]. To provide more hints, Graph A1 and A2 in the Appendix present the country diffusion curves of both supply and demand indicators of eGovernment. Comparing Graph A1 (citizens) with Graph A2 (businesses), it emerges that, on overall, the supply-demand gap tends to shrink for businesses, while the contrary happens for citizens[31]. Indeed, the fact that the gap for citizens widens towards the end of the long-term diffusion process is really counter-intuitive, since this is typically the period when the bandwagon of the larger shares of users (imitators) is expected to start, according to the stylized facts of the theory of the innovation diffusion (see Rogers, 1995). In our view, this clear evidence about growing unbalances between supply and demand in the provision of public eServices introduces a specific and complex issue - that of the reasons of a possible non-frictional gap between availability and usage of eServices - which so far has received in the literature only scanty attention.

[30] To alleviate the potential bias, one can simply concentrate on the exam of the patterns of the first and second derivatives (steepness and convexity/concavity) of the two curves, as we do.

[31] For example, for countries such Bulgaria, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Spain and United Kingdom the gap clearly widens approaching the end of the monitored diffusion process.

Basically, several streams of literature may be considered to frame the issue. First, the theme of the best matching between supply and demand of public service infrastructures received a steady coverage in macroeconomics, both from mainstream contributions (in particular, those emphasizing a classical rationale mirroring the so-called J.-B. Say's law, according to which supply would create its own demand) and from the new-Keynesian ones, by which the State's role in infrastructures building is considered irreplaceable and acts as a powerful driver for the downstream sectors (for eg., automotive industry, transport services, etc.). More recently, starting from the 1980's and 1990's, the burgeoning literature on the economics of networks has considered fundamental the centralized network management (hence, the State intervention) to support investments in roads, railways or broadband networks[32], because pure market mechanisms alone would not provide the right incentives to sustain risky and long-term repaid investments, thereby failing to activate supply-side increasing returns and, on the demand side, the related network externalities[33].

In our case, however, the analytical setting tends to be the opposite, because many European States have rapidly recovered in providing eServices by subsidizing their costs, while demand has not kept up with the pace of supply. Here, two main possible avenues for research seem to be likely. The first one is the possibility that our supply side indicators over-estimate the actual provision, due to the various methodological issues discusses in Section 3 (including – in particular- the Governments' incentives to strategically overestimate the measured level of eServices availability for the sake of "marketing" reasons). Another explanation, instead, would consider the widening distance between supply and demand as a real gap, due to demand side conditions: for example, because of the inadequate level of ICT literacy and general education, lack of broadband coverage and other technological problems. In this respect, the fact that the gap tends to shrink for enterprises but not for citizens could be a sign that the phenomenon has also a real nature, as indirectly showed by the different path of the gap for enterprises, which notoriously have superior technological resources, ICT skills and human capital endowments.

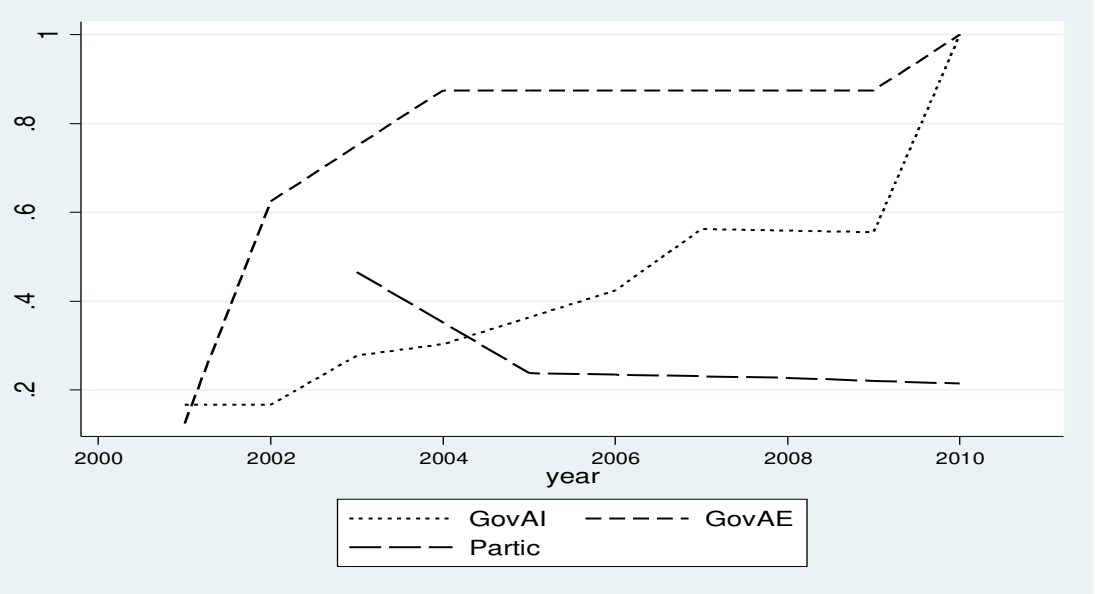
We close this Section with a focus on Italy, which we believe stands as a multi-faced and very illustrative case highlighting the possible pitfalls of empirical studies on eServices diffusion. According to the "Full online availability" indicator by EU-Capgemini (2010), the EU27+ average reaches 82% in 2010 (the last available), compared to 69% in 2009. Then, for the same year, the benchmark reveals that in Italy, Malta, Austria, Portugal and Sweden all 20 services included into the eGovernment index are 100% e-enabled, with some country (including Italy) showing remarkable improvements over one single period. The Italian fast supply-side progression, common to GovAI and GovAE but particularly intense for the former (citizens), is illustrated in Graph 1; here it is also shown that eParticipation (Partic, variable sourced from UN), on

[32] Particularly, this debate now concentrates on the on-going roll-out of NGN (next generation broadband networks).

[33] The rationale being that these infrastructures feature important "public good" characteristics, together with powerful scale and network externalities, and that their public provision enhances welfare by raising the users mass served in equilibrium (like in the case of the "universal service").

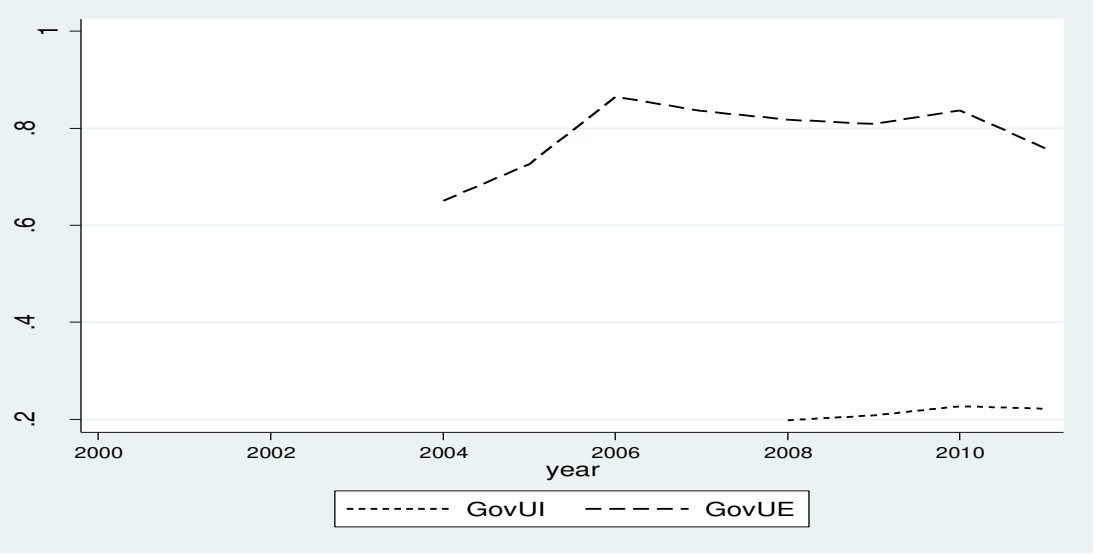
the opposite, exhibits a decreasing trend. Graph 2, instead, presents a different picture, with demand side indicators for both citizens (bottom line) and businesses (upper line) following a rather flat trend.

Graph 1. Trends of eServices diffusion for Italy –availability



Source: our elaboration from cited sources

Graph 2. Trends of eServices diffusion for Italy –usage



Source: our elaboration from cited sources

Now, one can legitimately question the credibility of the two very optimistic supply-side scores and the rapid eGovernment progress of Italy they depict, because the same

country ranks very low in other associated Information Society statistics and uncovers an above-average digital divide – both infrastructural and socio-cultural (for a comprehensive analysis, see Matteucci, 2013): for instance, Italy scores at the lowest ranking positions according to the OECD (2012) statistics of broadband penetration (both overall and fixed one)[34]. Now, the two phenomena of electronic government and digital divide - according to the most recent stream of literature on eServices - are not only connected, but recursively linked (Helbig et al. 2009) and mutually enforcing each other. Concerning the infrastructural digital divide, for example, Arduini et al. (2010) show that in 2005 there was a positive correlation between the range and quality of eGovernment services provided by their sample of Italian municipalities and the degree of broadband development available in the area where these municipalities were located. More fundamentally, we believe that the still-prevalent supply-side perspective of most studies addressing eGovernment diffusion has failed to consider the mediating role of demand-side (users') and other socio-institutional issues. These aspects are instead crucial to solve not only the digital divide (meant as reduced connectivity) but, according to our view, to nurture an appropriate culture in the Government and the overall PA conducive to fill the eServices usage gap. In this respect, various events and pieces of evidence seem to confirm that, in Italy, key elements of the socio-institutional and political spheres have dampened the actual implementation and usage of the eServices solutions rolled-out.

At the Government level, for example, Italy has been one of the latest EU Member States to adopt a national Digital Agenda[35] oriented to address the infrastructural targets of the European Digital Agenda. Moreover, according to various sources[36], influential members belonging to several Parliament groups have been characterized by a biased attitude towards Internet-based communications, which repeatedly produced draft bills and norms on Information Society issues privileging concerns of piracy, public security and sometimes control of the public opinion and censorship, while disregarding the socio-economic benefits and priorities connected to effective electronic government and administration[37]. We believe that it is not a case that Italy was the only Member State in EU to initially privilege and invest considerable public funds in shaky t-Government projects (basically, e-Government delivered via digital TV transmission and sets - see

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[34] Matteucci (2013), using the per capita broadband subscriptions indicator, updated at end 2011, calculates for Italy a ranking position of 24th for wired and 28th for wireless per capita connections, out of 34 OECD Members. See the most updated figures at http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm.

[35] It was finally adopted only in late 2012, to begin to be implemented during 2013, with many difficulties and delays, also because of the chronic political instability and the conflicting interests of the policy maker.

[36] Main references are several specialized websites and blogs managed by law and technology scholars or practitioners. Here, we just mention a few, such as: www.guidoscorza.it, www.punto-informatico.it, and www.corrierecomunicazioni.it.

[37] A remarkable –yet unsolved - story are the contentious restrictive norms dampening the diffusion of Wi-Fi (since the so-called "Pisanu" Decree), which in Italy remains underdeveloped due to the complexity of the regime of authorization. Other notable stories of public projects failure are those of the national electronic identity card and the services national cards, so far partially and problematically implemented after a decade of false starts.

Matteucci, 2009), promoted in a phase characterized by the patent technological immaturity of the concerned platform[38].

More generally, according to law scholars, Italian PA is historically characterized by a highly formalistic and legalistic tradition (stemming from the unchallenged hegemony of the administrative law paradigm). Among the many examples, Panozzo (2000) nicely reconstructs the movement to introduce managerial accounting systems in the Italian PA, aimed at stimulating performance-oriented operations and more efficient and effective organizational routines. According to him, the original innovation project was radically altered in its spirit and dampened in its effectiveness by incompatible institutional and cultural settings. In fact, the prevailing legalistic culture codified into norms the new accounting standard in such a way that it was soon transformed in a requirement of formal compliance, thereby sterilising its inner potential of performance-oriented accounting reform. Similarly, and more drastically, Gualmini (2008) contends that the prevailing legal and juridical culture across time hampered the implementation of several important reforms in the Italian PA, and that the lack of managerial spirit and performance-oriented action, in relation to other countries, should be chiefly explained by the dominance of red-tape philosophies, and by uncritical compliance to formal rules and ex-ante controls, instead of ex-post effectiveness analysis.

We tend to be very sympathetic to these interdisciplinary suggestions, and we believe that there is room to extend the implied logic to affirm that Italian PA's legalistic tradition does not appear conducive also to the effective implementation and usage of eServices, which require, as necessary pre-requisites, performance-oriented reorganization of the back-office, systemic thinking and inter-organizational collaborations among different PA departments[39], beside crucial ICT skills and intellectually flexible civil servants.

In this respect, it is interesting to notice that more recent analyses increasingly uncover the importance of these "soft" factors: for instance, Arduini et al. (2013), in a national study on the eGovernment services developed by 4471 Italian municipalities from 2007 to 2009, register that in-house ICT activities and internal competencies of PA have an overwhelming role on the number and quality of eServices offered. Further, at the cross-country level, in a panel of 16 European countries over the period 2003-7, Seri and Zanfei (2013) find that index-based measures of the PA output quality are significantly driven by investments in human capital and organisational change, over and above their investment in ICT.

[38] In fact, if TV is everywhere one of the most politically sensitive and controlled media, in Italy is even more so, due to the influence of a big Government party connected to the main private media group - Mediaset.

[39] This collaboration seems particularly necessary in the Italian legal framework governing the PA, which typically features in several domains (police, construction, environment, health care and accident prevention) multiple and overlapping competences distributed across many uncoordinated bodies.

4. A cross-country analysis of eServices diffusion

4.1 Data structure and econometric method

Our econometric analysis aims at investigating the determinants of the cross-country, State-level performance in public eServices (distinctively for availability and usage, and their gap). We focus on the State level because this is where most public eServices projects were launched and their relative indicators implemented. After all, central Governments usually spend or at least allocate a majority share of the budgets on ICT and digital government initiatives[40].

This exercise, despite its importance for informing policy discussions, has not been previously carried out in a systematic and comprehensive way: in fact, existing studies, in line with the early technology-push approach underlying most projects for digital Government, concentrated on the supply side (availability), and mostly dealt with general eGovernment indicators. At the national/local level, sticking to Western countries, we mention Arduini et al. (2013); (2010) (both on Italy); Norris and Moon (2005); Moon (2002). At the international level, there has been a recent surge of studies, such as Krishnan and Teo (2012); Lee et al. (2011); Azad et al. (2010); Siau and Long (2009); Kim (2007); West (2007); Moon et al., (2005). However, these cross-country studies typically disregarded the distinction between eServices for citizens and for businesses and, to our knowledge, none was specifically focused on eHealth and eProcurement. Moreover, despite the recent surge, all studies address the cross-country determinants of eGovernment diffusion relying on simple cross-sectional data, so that the proposed causation analysis remains extremely weak[41]. To summarize, to our knowledge this study is the first to propose a longitudinal exam of the drivers of eServices diffusion for Europe[42].

Inevitably, the breadth of our empirical exercise leads to bigger and more complex estimation issues, due to the difficulty of elaborating a model which is enough general to accommodate different data generation processes and correlation structures among the variables, and at the same time enough specific to capture the peculiarities of the single eService diffusion process. Another difficulty, as previously detailed, concerns the incomplete (missing) and changing nature of several variables of the employed time series, which requested us to perform preliminary operations of dataset construction (described in Table A1). The final dataset structure is a cross-country panel spanning 2001-2011, with 2005 and 2008 generally missing; supply-side variables end at 2010,

[40] Given the existing cross-country variation, this level of government is an ideal empirical laboratory.

[41] In fact, also the newer contributions are focused on large sets of countries (mainly, those covered by UN indicators or those elaborated by D.M. West' team of researchers, at Brown University), for which there is not longitudinal time series available.

[42] A partial recent exception is Fernández-i-Marín (2011), who focus on eGovernment adoption using 2007 and 2009 data.

while demand side ones are available also for 2011. eHealth and eProcurement supply variables are only available for the year 2010.

Our starting point was to select the most appropriate estimation tool, taking into account the dataset characteristics. Notwithstanding the previous operations of dataset building, several data gaps remain, and they emerge unevenly distributed across countries and years; so, our sample features a short and unbalanced panel structure (with N –countries - bigger than T-years). Moreover, to keep as much information as possible, we decided to employ as depended variables the original availability and usage indexes, rather than their ranking transformations[43]. All this naturally suggests the consideration of linear panel data models with individual effects, where the scalar dependent variable y_{it} is generally specified as:

$$y_{it} = \alpha_i + x_{it}'\beta + \varepsilon_{it} \qquad (1)$$

where α_i is the random individual-specific effect, x_{it} the vector of the regressors, and ε_{it} the usual idiosyncratic error term. The consideration of the random individual effect, in turn, opens two main alternatives, the fixed-effect (FE) and the random-effect (RE) model (see Wooldridge, 2002; chp.10). In our case, the fixed effect model appears the best choice, for a variety of theoretical and applied reasons. The main one is that we naturally expect that our vector of covariates is affected by endogeneity, since several country-level explanatory and control variables we use qualify as persistent "characters" or "abilities", which are likely to be idiosyncratic to each single country and correlated to its unmeasurable characteristics (or individual effects). A main example is the *cpi* variable[44], which registers the (perceived) level of the public sector's corruption for a particular country[45]. In this sense, the error term's complete structure of equation 1 is the following:

$$u_{it} = \alpha_i + \varepsilon_{it} \qquad (2)$$

where the time-invariant, country-variant error component (α_i) is permitted to be correlated with $x_{it,}$ (while ε_{it} is not). Hence, under the standard assumption on errors[46], the FE model estimates consistently the parameters of the time-varying regressors (β) - even in the presence of the previous form of endogeneity. In other words, with FE we obtain the marginal effects of the regressors - but not the estimate of the variable of interest ($E(y_{it}|x_{it}) = E(\alpha_{it}|x_{it}) + x_{it}'\beta$), whose prediction remains out of reach, due to

[43] Moreover, this alternative choice would have required the usage of other specific estimation methods, such as rank-ordered logistic regressions.

[44] See http://www.transparency.org/research/cpi/.

[45] In fact, in turn corruption depends on country-specific socio-economic, cultural and institutional features, mostly immeasurable or even too complex to be identify.

[46] Formally, the condition $E(\varepsilon_{it}|\alpha_i, x_{it}) = 0$ is requested.

the shortness of the panel[47]. Instead, with the random-effect (RE) model (estimated through FGLS), we could get an estimate of all the coefficients (including α_i) and the prediction of the dependent variable; however, the underlying necessary condition is that the fixed effect α_i is purely random, otherwise the resulting estimates would be inconsistent. Hence, in our estimating sample, due to the high probability that some regressors are endogenous, the RE method does not appear the right choice[48].

Concerning the selection of the candidate control and explanatory factors, based on the available literature, we summarize in Table A2 the options finally made. First, *gdppc* (GDP per capita, in thousand euros) is the usual control variable employed to tap the impact of the economic development stage and wealth of a country, which is expected to have a role also on the State's welfare system (hence, on the eServices policy agenda). Despite the use of GDP in regressions can be quite controversial (for a critique from the Austrian School, see Lawson, 1997), for comparability with the bulk of existing analyses we decided to use it. Second, we employed *cofog99,* a harmonized measure of the Government's expenditures for general public services[49], expressed as a percentage of GDP: this is a proxy of the State's organizational structure and related functioning costs, face to eServices innovations and their potential cost reductions and efficiencies[50]; *ceteris paribus*, the lower is the ratio, the more efficient is considered the State's organization. Third, fixed broadband penetration (*brofix*) per 100 inhabitants is probably the most important variable in determining effective eServices availability and usage, and consequently the gap between the two. Obviously, despite the shortcomings of the official statistics on broadband (see again Matteucci 2013), this indicator is the best possible harmonized choice, since it does not reflect merely broadband coverage (availability), but actual usage (paid subscriptions). We decide to use this technological variable, contrary to other solutions previously employed in the literature (for eg., PC ownership rate in the population, Internet access rate, frequency of Internet usage, or composite indexes of telecom infrastructure, like that of UN eGovernment survey), for two main reasons: first, for our sample made of developed countries fixed broadband is the current technological standard of online presence, while other alternatives are less discriminant; second, our measure is a truly supply-side census measure (n. of subscriptions as billed by telecom/cable operators), while alternatives are demand-side sample survey indicators, likely to register spurious socio-economic dynamics and sampling biases; since we need a genuine indicator of the technological country infrastructure, the first type of variable is the most appropriate and unbiased choice.

[47] In fact, short panels do not enable a consistent estimate of $E(\alpha_i | x_{it})$.

[48] This choice has been later checked by performing the Hausman test. In all but one cases, the H_0 (stating that the difference between the coefficients estimated with FE and with RE are not systematic) was rejected at the conventional level (5%). Thereby, on overall the FE model appears as the best. Test diagnostics are available upon request from the authors.

[49] It includes expenditures for executive and legislative organs, financial and fiscal affairs, external affairs, foreign economic aid, general services, basic research and expenses related to debt – excluding interest payment.

[50] A more specific proxy for the latter aspect would be some measure of the Government's expenditure for ICT. However, such an alternative is currently unavailable, despite there are on-going projects of collection.

Then, the variable *educ* is a high-end measure of the level of human capital available in the concerned country. On purpose, we neglected other variables specifically referring to basic ICT skills (PC and general Internet usage) used in previous studies, because less demanding; so, our variable closely matches those individual or family-level human capital indicators employed in micro-level studies of eGovernment usage, where a strong association with general education has been found (for a recent example, see Taipale, 2013). Further, the notorious and widely-used *cpi* index (from Transparency.org) measures the perceived level of public sector corruption, which we believe is a fundamental indicator to ascertain the social climate present in public administrations, and the quality of human interactions available for a fruitful implementation of systemic-projects, such as eServices: this index is obviously correlated to other driving intangible phenomena, such as the level of trust in society and its cooperation potential (Snijkers, 2004). Finally, the set of indicators Government effectiveness (*gov_eff*), Political stability (*pol_stab*) and Regulatory quality (*reg_qual*) - part of the Worldwide Governance Indicators project, World Bank (see Kauffman et al. 2010) – was considered, to capture other more specific characteristics of the State's organization; again, a positive relation between them and the availability and/or usage of most eServices should be expected: in fact, electronic administration should be chiefly and readily implemented by effective, politically stable, and regulation-capable countries.

Last, we may expect some overlapping in the informative potential of some variables and multicollinearity; the latter is frequent when using composite indicators. Hence, we chose to exclude from each selected model highly correlated variables; to this aim, we followed the rule of thumb – often used in political science (see e.g. OECD, 2008) – that two indicators are considered so if their Pearson's correlation coefficient is at least equal to 0.8. Then, the usual controls for the estimated coefficients' stability across different model specifications have been performed. Consequently, due to high correlations between themselves and with *cpi*, the last triad from World Bank has been dropped[51]. Tables A3 and A4 in Appendix present, respectively, the descriptive statistics of the candidate independent variables and the cross-correlations between those finally used.

4.2 Regression results

We conduct our analysis on the four blocks of indicators (eGovernment, eHealth, eProcurement and eParticipation) separately for availability (variable' suffix A), usage (U) and gap (Gap), and for individuals (variable' suffix I) and enterprises (E). At the end, we consider jointly all the results, making an attempt to generalize common findings and to point out specificities. Hence, a complete set of regressions for each dependent variable with all the possible combinations of independent ones is run: here,

[51] Further, *pol_stab*, beside being highly missing, did not appear really useful for our sample of politically stable European states, while g*ov_eff* is partly contained *in cofog99*; *reg_qual* is highly correlated with *cpi* (0.84).

for space reasons, we only present the initial model specification, and the final one, after iteratively eliminating insignificant regressors. We need to notice that, due to missing data and the unbalanced nature of the panel, the number of observations varies across dependent variables and model specifications.

Table 7. Determinants of eGovernment adoption, usage and gap – individuals

VARIABLES	(1) GovAI	(2) GovAI	(3) GovUI	(4) GovUI	(5) GapI	(6) GapI
gdppc	-0.005**	-0.005**	-0.000		-0.004	
	(0.002)	(0.002)	(0.002)		(0.015)	
cofog99	0.021		0.020		-0.024	
	(0.020)		(0.014)		(0.089)	
brofix	0.020***	0.018***	0.011**	0.011**	0.063	0.087***
	(0.003)	(0.002)	(0.005)	(0.005)	(0.038)	(0.019)
cpi	0.039		-0.036		-0.171	
	(0.033)		(0.026)		(0.213)	
educ	0.019**	0.023***	0.017***	0.017***	0.043	
	(0.008)	(0.007)	(0.006)	(0.006)	(0.074)	
Constant	-0.501*	-0.129	-0.082	-0.199	-0.867	-1.900***
	(0.300)	(0.145)	(0.247)	(0.126)	(1.631)	(0.491)
Observations	155	160	74	79	38	45
R-squared	0.663	0.656	0.458	0.345	0.526	0.487
Number of countries	20	21	19	21	19	23

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Figures rounded to the 3rd decimal.

Table 7 presents the estimates of the correlates of eGovernment for citizens - first for availability (specifications 1 and 2) and then for usage (3 and 4) and the gap (5 and 6). First, it emerges that the level of education and the penetration of fixed broadband are related (in a highly significant way) both to availability and usage, with the expected positive signs (with coefficient sizes of the similar magnitude); hence, our results confirm the previous cross sectional evidences found for the eGovernment supply (see, for example, similar positive coefficients in Krishnan and Teo, 2012 and Lee et al. 2011), adding a stronger causality interpretation; at the same time, it extends this effect also for the demand side (usage). There is also a negative effect (however, very small) of per capita GDP, significant for availability (GovAI) but not for GovUI (usage); we anticipate here that this negative effect, although with varying significance, will persist across specifications and eServices indicators. Hence, we should conclude that, across time, the deployment and usage of eServices seems to be flourishing particularly in the newer EU Members and other developing European countries, rather than the wealthiest and oldest Members. This may seem counterintuitive, at first, but it is not. Several considerations can be made. First, those studies finding a significant positive effect of GDP are mostly early and inherently different from ours, and often include many heterogeneous countries where GDP and development differentials loom large. For example, West (2007) refers to a cross-sectional sample of 198 countries where

eGovernment is evaluated in terms of n. of online services available in 2003: he find that GDP is the only significant regressor, and this result should be ascribed to the early period of observation of the diffusion process (where country differentials were still sizable), the nature of cross-section (correlations in levels tend to be stronger that in differences), and the high economic heterogeneity of the countries surveyed (when compared to our small and homogeneous European sample). Similar considerations regard Kim (2007)' cross-section of 163 countries for 2003, using another of West's indexes (that of e-government score). A sort of counter-proof comes from the consideration of more recent works carried out on large samples (this time, the UN eGovernment dataset), such as Azad et al. (2010) (examining a cross-section of 60 countries in 2005) or Lee et al. (2011) (a cross-section of 131 countries in 2007), who uncover, instead, insignificant coefficients for GDP per capita (respectively, positive and negative), like in our case. Hence, our conclusion is that at the country level and over long periods of time, the role of economic wealth looses relevance for the successful implementation of eGovernment projects[52], while its role could persist at the lower jurisdictions of the PA; for example, Norris and Moon (2005) found that eServices projects and their costs might be financially-constrained at the local level.

Then, when we move to the supply gap for citizens (columns 5 and 6), only the broadband penetration remains significantly associated to it, and with a stronger than before positive coefficient. This result, despite being apparently counterintuitive (the most ICT-endowed countries signal eGovernment excess supply/paucity of demand for their citizens), is interesting since it may account[53] for at least two different phenomena: first, that ICT investment alone cannot not solve the usage gap; second, that there could be a possible race for eGovernment leadership (or simply, for better benchmarking - recall the considerations spelled out in Section 3) going on among those EU countries possessing a better communication infrastructure.

[52] Further, another explaining factor could be that the advent of standardized and cheaper ICT solutions – including *open source* platforms – has lowered the average infrastructural costs of eGovernment deployment, especially in our sample of developed countries.

[53] In the case of the Gap variables, however, caution is requested by the smaller sample size, due to missing variables, which also originates less stable estimated coefficients across different model specifications.

Table 8. Determinants of eGovernment adoption, usage and gap – enterprises

VARIABLES	(1) GovAE	(2) GovAE	(3) GovUE	(4) GovUE	(6) GapE	(7) GapE
gdppc	-0.001		-0.003**	-0.003**	0.000	
	(0.002)		(0.001)	(0.001)	(0.002)	
cofog99	-0.012		-0.033**	-0.036***	0.011	
	(0.017)		(0.013)	(0.012)	(0.021)	
brofix	0.007***	0.007***	0.010***	0.009***	-0.000	
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	
cpi	0.082***	0.084***	0.025		0.119***	0.054*
	(0.028)	(0.028)	(0.020)		(0.035)	(0.029)
educ	0.032***	0.031***	0.012***	0.014***	0.023***	0.025***
	(0.007)	(0.006)	(0.005)	(0.004)	(0.008)	(0.005)
constant	-0.611**	-0.691***	0.431**	0.602***	-1.447***	-0.893***
	(0.256)	(0.217)	(0.177)	(0.107)	(0.325)	(0.216)
Observations	155	156	150	153	132	177
R-squared	0.573	0.572	0.504	0.518	0.235	0.164
Number of countries	20	21	20	20	20	28

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Figures rounded to the 3rd decimal.

The previous results are substantially confirmed and new ones arise when we move to the correlates of eGovernment for enterprises (Table 8): here the overall picture become even more convincing. Starting with availability (columns 1 and 2), we have the confirmation of broadband and education (fully significant, with the expected signs), with the first having a lower effect than in the case of GovAI: this can be motivated by the stronger priority that broadband assumes for solving the digital divide of individuals. Here, the corruption index turns fully significant and with the expected sign: hence, a corruption-clean PA is a main driver for eServices roll-out, with respect to other possible determinants. These results hold when we move to usage (columns 3 and 4) where, beside broadband penetration and education - confirmed with the expected signs - a small negative effect of GDP per capita is also detected. Then, the GDP intensity of general public services Government expenditures, for the first time, turns out to be negatively and significantly associated with usage of eGovernment: here, it seems that countries having a more agile and efficient organizational structure do enable an effective usage of the deployed electronic Government tools by businesses. Again, this evidence makes much sense, face to the current debate and quest for slimmer bureaucracies pervading most European societies. Further, corruption, as expectable, is not significantly related to eGovernment usage, contrary to its provision. Finally, the supply-demand gap at first seems to show counterintuitive features, as in the case of citizens (GapI). In particular, here (with GapE) it seems that the level of public sector's transparency and that of general education are associated to an oversupply of eServices for firms: however, this apparent excess-investment (or, seen interchangeably, lack of demand) can be also justified by the good prospects and socio-demographic

fundamentals (including a highly educated work-force) of the concerned economies, which push their Governments to act proactively on behalf of their enterprises.

Table 9. Determinants of eHealth adoption and usage

VARIABLES	(1ols) HealthA	(2ols) HealthA	(3fe) HealthU	(4fe) HealthU
gdppc	-0.010	-0.011**	-0.002	
	(0.006)	(0.005)	(0.002)	
cofog99	-0.017		0.030*	
	(0.048)		(0.016)	
brofix	0.003		0.009***	0.007***
	(0.023)		(0.002)	(0.001)
cpi	0.122	0.163***	0.006	
	(0.079)	(0.055)	(0.019)	
educ	-0.012	-0.023**	0.009	0.014***
	(0.020)	(0.010)	(0.006)	(0.005)
constant	0.400	0.360	-0.292	-0.190*
	(0.416)	(0.219)	(0.183)	(0.101)
Observations	15	22	112	117
R-squared	0.348	0.374	0.617	0.582
Number of countries	15	22	18	19

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Figures rounded to the 3rd decimal.

Moving to the explanation of eHealth, the first model (that for availability) is unfortunately testable only as a simple and small cross-section, of dubious estimation properties. Hence, we prefer to concentrate on the analysis of the demand side, because of the higher asymptotic properties of the estimates. Here, we find confirmed a positive, small but highly significant role for both broadband penetration and for education; all the other regressors, being insignificant, have been removed from the specification (including GDP per capita, that does not seem to exert any significant role). These results are particularly meaningful when we recall the measurement potential of the used indicators, as explained in Section 2: in fact, the kind of eHealth activities they monitor is mainly that related to information search.

Table 10. Determinants of eProcurement adoption, usage and gap

VARIABLES	(1) ProcurA	(2) ProcurA	(3) ProcurU	(4) ProcurU	(5) GapP	(6) GapP
gdppc	-0.003		-0.005	-0.004*	0.176	
	(0.003)		(0.004)	(0.002)	(0.355)	
cofog99	-0.066	-0.082***	0.001		-6.655	-8.105***
	(0.037)	(0.022)	(0.055)		(4.372)	(2.336)
brofix	-0.008		0.007		-1.517	
	(0.012)		(0.018)		(1.445)	
cpi	-0.013		-0.031		1.823	
	(0.058)		(0.086)		(6.823)	
educ	0.006		0.006		-0.010	
	(0.012)		(0.018)		(1.416)	
constant	1.412***	1.236***	0.781	0.906***	63.09	46.82***
	(0.361)	(0.138)	(0.532)	(0.090)	(42.33)	(14.93)
Observations	17	24	17	23	17	24
R-squared	0.484	0.396	0.171	0.162	0.357	0.354

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Figures rounded to the 3rd decimal.

Table 10 shows the model specifications for eProcurement, distinctively for supply and demand. Again, a few interesting facts emerge, despite the cross-sectional nature of the estimates and the small sample size impose interpretative caution. First, the GDP intensity of general public services Government expenditures turns out to be negatively and significantly associated with the provision of eProcurement: in other words, it is those countries having a more agile and efficient organizational structure that seem to be readier to deploy electronic forms of tendering and purchases for their Public Administration. At first, this may seem to contradict the alternative hypothesis of a cost-saving rationale, assuming that the most bureaucratic and structured States should embark first in eProcurement. However, this alternative hypothesis seems to be very heroic in practice, due to the difficulty of implementing and using eProcurement in heavy and cumbersome public organizations. Finally, on the demand side, a negative and small coefficient for per capita GDP emerges, confirming also for eProcurement what was observed *supra* concerning eGovernment. Moving to the supply-demand gap, a highly significant coefficient of Government expenditure is uncovered: again, our interpretation is that the most agile States tend to over-supply eServices impacting on the organization of the State, with respect to the demand take-off, due to the comparative advantage they have in setting up these public innovations quicker than other more structured and heavier public bureaucracies, where back-office reorganization takes longer time.

Table 11. Determinants of eParticipation

VARIABLES	(1) Partic	(2) Partic
gdppc	-0.003	
	(0.003)	
cofog99	0.008	

	(0.030)	
brofix	0.009**	0.005**
	(0.004)	(0.002)
cpi	-0.015	
	(0.037)	
educ	-0.027**	-0.024**
	(0.012)	(0.012)
constant	1.060***	0.894***
	(0.375)	(0.225)
Observations	124	128
R-squared	0.073	0.042
Number of countries	18	19

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Figures rounded to the 3rd decimal.

Finally, eParticipation shows a partly surprising, albeit very interesting framework, also due to the higher robustness of the estimates: first broadband is confirmed as a positive and significant correlate of widespread societal interactions, while education comes with a negative sign. However, having in mind the nature of the phenomena captured by the employed UN indicator, spanning both the vertical (Government-citizens) and horizontal level (citizens-citizens), we should not be surprised that, at the end, less educated (and presumably less developed) countries develop and interact more on public Internet-related platforms on common governance themes and public policy issues. In fact, differently from the previous eServices platforms, where we should expect more structured and costly ICT solutions, the dependent variable of Table 10 captures a wide and heterogeneous aggregate of interaction means, that are not exclusively available to richer and more educated countries. Taken at the extreme consequences, the case of the political turmoils, social protests and new media activation underpinning the so-called "Arab Spring" demonstrates that eParticipation is still a fluid and mutable phenomenon, available and used by developed but mostly developing countries: in our European sample, a similar pattern seems to apply to newer UE Member States.

5. Conclusions and research agenda

The EServices literature has now accumulated a sufficient critical mass of data and papers to enable the first comprehensive comparative analyses of the progresses made at the international level, both in terms of the diffusion *per se*, and of their likely determinants. However, differently from other simpler technological and stand-alone innovations, public eServices present several challenges to the researcher, due to their multi-dimensionality, measurement problems and intangible correlates. In our paper, we first provided a review of the state of the art on eServices at the international level, focusing on State-wide measures. Then, we carefully explored the methodological status of these indicators, pointing to several unsolved shortcomings and highlighting

specific and counter-intuitive country cases. In the focus made on Italy, in particular, we argued that existing official "output" indicators of eServices tend to overlook various facts and details that, if correctly included in the measurement, would bring different and less benign estimates of the same phenomenon. Then after having spelled out the main caveats and methodological precautions, we introduced our econometric analysis featuring an unbalanced panel of countries spanning the last decade. Hence, various stages of the diffusion processes have been included, so that this original empirical exercise can yield rather general and robust long-term regularities. This exercise, to our knowledge, is the first attempt to analyse eServices' drivers across the longitudinal dimension.

First, we decided to couple indicators of eServices availability and usage (respectively, output and demand side measures), in order to have a more comprehensive picture of the diffusion processes, trying to uncover cross-country differences. To this end, we looked for both "hard" (GDP, Government expenditures, broadband penetration) and "soft" (human capital and corruption) explanatory variables, with the expectation that different diffusion stages and types of eServices may respond differently to these sets of regressors.

On overall, despite evident data limits which also constrained the models selection, results are encouraging and most of the expected signs of the coefficients are confirmed. In general, results show that the maturity of a country's ICT infrastructure (as measured, *in primis*, by broadband penetration) is a main "hard" driver of the national diffusion of public eServices, both for availability, usage and their gap; equally, its importance holds for both services aimed at citizens and enterprises. Such a robust result, arising from a longitudinal cross-country sample spanning a decade, also gives indirect support to those (for example, Fernández-i-Marín, 2011) claiming that policies for usage of eGovernment may exhibit a differential impact, according to the level of maturity of the underlying ICT infrastructure. Second, also higher education appears correlated to eGovernment availability and usage (and their gap), and even to eHealth demand, due to the content complexity of eServices requiring appropriate information and search skills in the user population. Then, the organizational agility of the Public Administration seems to exert a general positive role: the slimmer it is, the higher seems the usage rate of eGovernment for enterprises and the provision of eProcurement. Finally, as indirectly expectable from the literature stressing the role of trust and political accountability in eServices diffusion (see, for eg. Snijkers, 2004), we found that the level of corruption of the public sector is inversely related to the supply of eGovernment for enterprises, and to their supply gap, as a sign of proactive behaviour of cleaner public sectors. Finally, the broader level of socio-economic development in a country (as expressed by per capita GDP) is mostly negatively associated with the supply and demand of eServices- although with a very negligible marginal effect. This result should not come as a surprise, taking into account the longitudinal nature of our sample and the convergence undergone by the underlying technologies, that now qualify eServices as a rather mature paradigm – largely independent from the country's absolute level of wealth. Finally, eParticipation seems to be a spreading paradigm, whose applicability is no more limited to richer and better educated countries, as also recent socio-political events and revolutions tend to show at large.

Consequently, this work yields clear policy implications, concerning the interest variables. As eServices-laggard European States want to progress in their long run journey towards a fuller realization of the Information Society, more emphasis and financial efforts should be put on the contextual and broad infrastructural sides (*in primis*, broadband and higher education) of their economies and societies, whose role is fully confirmed by our analysis. In particular, the current targets of the European Digital Agenda, for both ultra-broadband and continuous life-long education, should be seen as joint crucial objectives also with respect to the eServices agenda. Concerning corruption, our estimates confirm that cleaner public sectors are conducive not only to higher economic wealth (as demonstrated by a long literature in development economics), but also to faster technological diffusion and usage of business-oriented public service innovations.

Looking at the future research agenda, our analysis confirms the urgent need of constructing longer series of appropriate longitudinal data, useful to strengthen towards other directions the proposed tests (for example, introducing time lags in the regressors to better test causation links). More generally, despite the fact that the eGovernment frontier is now moving towards new themes (for eg. data transparency and reusability, so called eGovernment 2.0), the need to understand the many drivers pushing different aspects of "traditional" eServices diffusion remains a topical necessity and asks for better and more objective harmonised data.

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Links to datasets used in the paper

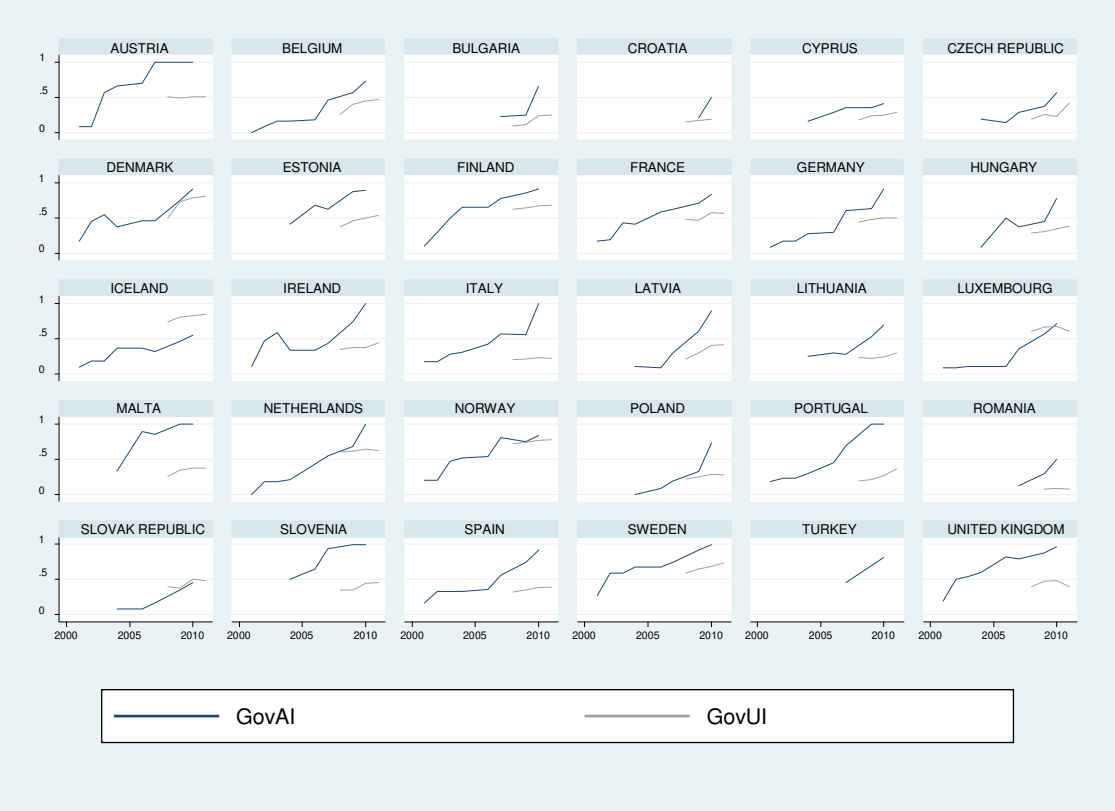
EUROSTAT**:**
http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database

OECD (2012) "Historical time series, Fixed and Wirless broadband penetration" (updated at Dec. 2012), available at http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm

UN e-Government Development Database (UNeGovDD): http://unpan3.un.org/egovkb

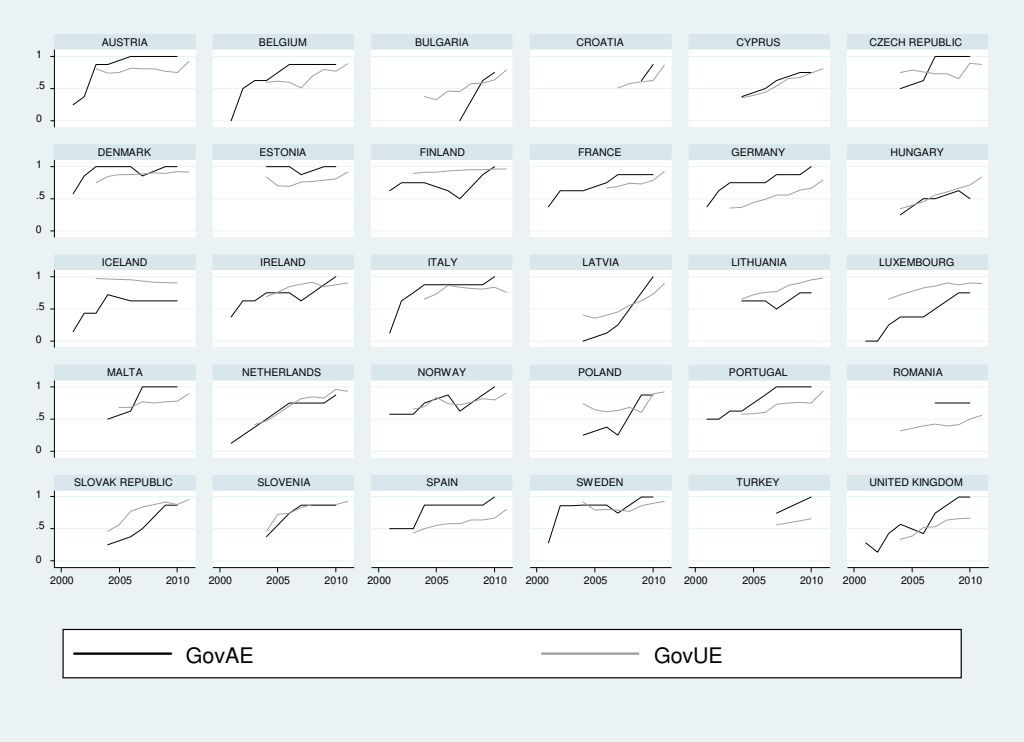
APPENDIX

Graph A1. Temporal diffusion of eGovernment for citizens - EU27+



Source: our elaboration from cited sources.

Graph A2. Temporal diffusion of eGovernment for businesses - EU27+



Source: our elaboration from cited sources.

Table A1. Main steps of dataset construction

Problem	*Used principle*	*Examples*
Length and stability of the series	We chose the longest, most stable and coherent time-series (especially for the demand side).	Eurostat's demand-side data (usage) were subject to frequent changes and updates. Consequently, our dataset was finalized in various steps, with repeated data downloadings made during 2012.
Data gaps filling. Case of highly missing variables	Data gaps were solved employing comparable variables extracted from different data sources.	Data on fixed broadband diffusion (referring to subscriptions by households and small and medium firms). Despite the largely harmonized nature of the available sources (OECD, Eurostat, ITU), each single series presented different lengths for different countries and years. Paradoxically, the Eurostat series presents more gaps. So, we chose to use the OECD equivalent, minimizing the number of missing values (see OECD, 2012).
Data gaps filling. Case of rarely missing variables	In a few cases/variables, having a persistent nature, single-year 'internal' missing values were filled by interpolation, attributing the contiguous two-years average.	

Table A2. Independent variables used in the regressions

Indicator (our name) (source)	***Description/rationale***
GDP per capita (1000€) (*gdppc*) Eurostat	*Usual proxy for the country's level of development, wealth and form of State organization.*
Government expenditure for General Public Services over GDP *(cofog99)* Eurostat	*Expenses related to general Government functions (GF01). State's financial size/incentive for undertaking general government policy innovations*
Broadband penetration (*brofix*) OECD	*Fixed broadband lines penetration per 100 inhabitants (enabling downloading at minimum 256 Kbs)*
Level of higher education (*educ)* Eurostat	*Share of individuals older than 21 with tertiary or superior education.*
Corruption Perception Index (*cpi*) Transparency.org	*Perceived level of public sector corruption. Index on a scale 0 – 10 (from highly corrupt to very clean). http://www.transparency.org/research/cpi/*
Regulatory quality *(reg_qual)* Worldwide Governance Indicators	*From enterprise, citizen and expert surveys. Details on data sources and methodology are found in Kauffman et alii (2010).*
Government effectiveness (*gov_eff*), Worldwide Governance Indicators project	*From enterprise, citizen and expert surveys. Details on data sources and methodology are found in Kauffman et alii (2010).*
Political stability (pol_stab) Worldwide Governance Indicators project	*From enterprise, citizen and expert surveys. Details on data sources and methodology are found in Kauffman et alii (2010).*

Sources: our collection, with sources as indicated. Eurostat indicators are downloadable at: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database

Table A3. Descriptive statistics of candidate explanatory variables

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
gdppc	276	32.1	20.8	1.7	118.2
cofog99	260	6.1	1.9	2.7	12.0
brofix	201	18.6	10.5	0.1	38.9
educ	247	21.8	7.0	8.2	33.6
cpi	275	6.7	1.9	2.9	9.7
gov_eff	202	1.4	0.7	-0.3	2.3
pol_stab	59	0.8	0.4	-1.0	1.4
reg_qual	267	1.3	0.4	0.2	1.9

Source: our elaboration from cited sources.

Table A4. Cross-correlations (Pearson' coefficient) between final explanatory variables

	gdppc	*cofog99*	*brofix*	*educ*	*cpi*
gdppc	1				
cofog99	-0.076	1			
brofix	0.571*	0.058*	1		
educ	0.499*	-0.043	0.576*	1	
cpi	0.694*	0.125*	0.446*	0.639*	1

Legend: *=significant at 5% level
Source: our elaboration from cited sources.