The development of public eServices in Europe: New perspectives on public sector innovation

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Eiburs meeting
Luxembourg, January 24, 2013

Outline

- **Three research lines to exploit data on public eServices**

- **The use of macro-level data on eService development to assess public sector performances in European countries**
  - Qualifying input based measures of public sector output
  - Capturing the interaction of ICT, human capital and organizational determinants of public sector performances

- **The use of micro-level data to examine the drivers of eGovernment diffusion in Italy**
  - Disentangling insourcing and outsourcing strategies in new service development
  - Evaluating how contextual factors influence eGovernment development

- **The use of micro-level data to explore patterns of eService diffusion in European cities**
  - How cities differ in terms of e-service coverage
  - How cities differ in terms of e-service portfolio

References

This presentation will draw from the following papers:

- *Seri P. and Zanfei A.* "The coevolution of ICT, skills and organizations in public administrations: Evidence from new European country-level data" *Structural change and economic dynamics*, forthcoming 2013

- *Denni M., Arduini D., Lucchese M., Nurra A.and Zanfei A.*"Exploring the determinants of eGovernment services: An empirical analysis on Italian Local Public Administrations" *Structural change and economic dynamics*, forthcoming 2013

- Reggi L., D. Arduini, M. Biagetti, and A. Zanfei "How advanced are Italian regions in terms of public e-services? The construction of a composite indicator to analyze patterns of innovation in the public sector", *Telecommunications Policy*, forthcoming 2013

The use of *macro-level data* on eService development to assess public sector performances in European countries

Conceptual and methodological problems at measuring public sector performance (Griliches 1984, Djellal and Gallouj 2008)

- Public output can hardly be priced
- Task heterogeneity impedes measuring output in terms of quantities
- Evaluating quality is even harder

National accounts offer largely unsatisfactory solutions to these problems (World Bank 2011)

- Measuring output in terms of inputs is misleading especially in cross-country comparisons
- Adjusting public sector input cost by means of private sector productivity measures disregards intra-national differences in performance

Our approach:

- **Adjusting input costs in terms of public sector output quality**
- **Capturing output quality in terms of e-service adoption**

PA_ADJ_OUTPUT= PA_SPENDING * eSERV_ADOPTION

Where:

PA_SPENDING is obtained from EUKLEMS measure of per capita production costs (labor costs, intermediate consumption and capital amortization) of Public Administrations at constant prices, subtracting per capita Defense expenditures supplied by SIPRI

eSERV_ADOPTION is a weighted average of Eurostat indexes of eService adoption by citizens and firms

Public e-service adoption can be considered a quality indicator because:

– it denotes the ability of PAs to introduce new services that are per se innovative(Serrano Cinca et al. 2003, Arduini et al. 2010).

– users will only adopt "high quality" e-services, i.e. services that are really worth bearing the extra cost of getting acquainted to new procedures and tools

PA quality adjusted output indicator (PA_ADJ_OUTPUT) - trend
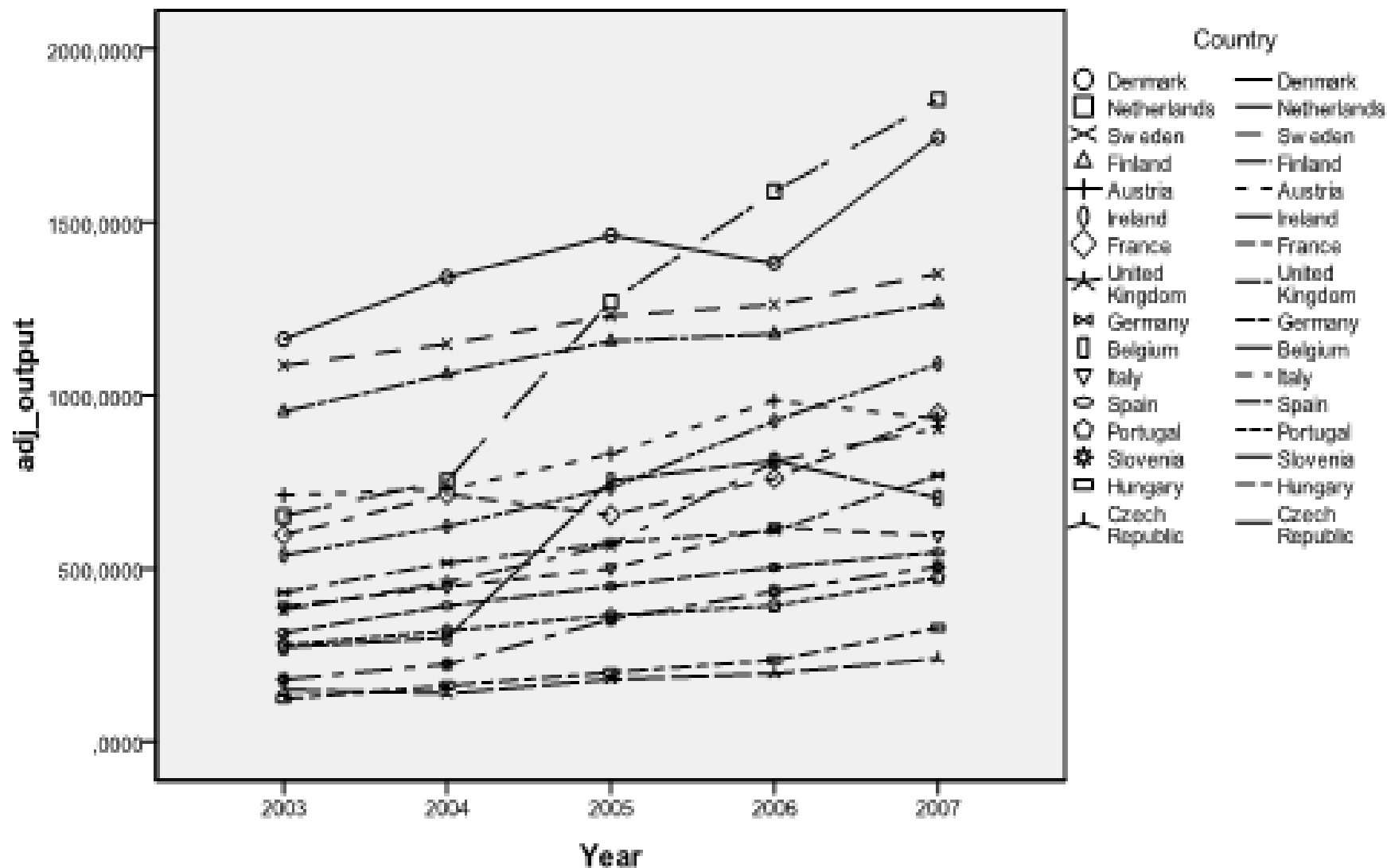
ICT, human capital and organizational change as co-determinants of PS performance in European countries

• The ***complementarity issue*** has long be confined to business sectors (Brynjolfsson et al.1997;Caroli,2001;Vivarelli, Piga, Piva 2004)

• It has been raised mainly in relation to Solow's productivity paradox as observed in the overall economy

• ***The complementarity between ICT investment, organizational change and human capital should be observed also in the case of PAs.***

• However, ***human capital investment and organizational change play an even stronger role*** as drivers of performance in public sector, over and above ICT, due to the complexities of knowledge and information flows *within* individual PAs*, across* different PAs and *between* PAs and external actors (citizens, communities, firms and other institutions).

ICT, human capital and organizational change as co-determinants of PS performance

Testing the complementarity issue in the case of Public administrations implies tackling two major analytical challenges:
• Measuring PS output (which we already addressed)
• Measuring organizational change

We suggest that while e-service adoption may be a proxy of output quality, e-service provision can be a rough proxy of organizational change.

The idea is that, much more than the provision of standard services, the introduction of web-based services entail an overall change in the organizational structure of PAs; and organizational change required will be even deeper the higher the level of "sophistication" (i.e. the degree of interactivity) of such e-services.

As suggested in the recent UN "E-Government Ranking 2012" :

"Small-scale ICT activity – development of a website as an additional information channel – may not require complex supporting changes.
***Far reaching organizational change will be required when**:*
1) The website begins to offer deeper, more complex services.
2) Agencies are asked to work together to deliver services according to the needs of citizens and not their structure.
3) New work styles - tele-working, virtual teams - emerge.
4) With increased data-sharing and communication:
_ particular data holdings become redundant
_ more decisions are made at the lower organization levels
_ special units are established for government-wide projects"

The introduction of e-services is generally associated to all four circumstances listed by the UN.

The use of macro-level data on eService development to assess public sector performances in European countries

ICT, human capital and organizational change as co-determinants of PS performance

Variable name	Description	Source	Obs	Mean	Std. Dev.	Min	Max
PA_SPENDING	*Total PA spending net of Defense on total population*	EU KLEMS, SIPRI, Eurostat	80	1804.8	651.3	501.9	3270.8
eSERV_ADOPTION	*Actual utilization of public e-services by citizens and enterprises*	Eurostat	80	36.4	11.6	13.3	62.2
PA_ADJ_OUTPUT	PA_SPENDING *eSERV_ADOPTION	EU KLEMS, SIPRI, Eurostat	80	696.9	408.8	123.9	1854.5
PA_LAB_QAL	*Labour quality, measured as the difference in growth of labour services and hours worked.*	EU KLEMS	80	16.0	6.9	2.0	25.7
PA_ICT	*PA investment in ICT on total population*	EU KLEMS	80	35.9	18.2	11.9	86.1
PA_ORG	*Proxy of organizational change in the PA, expressed as weighetd average availability of e-services with weights measuring "sophistication"*	Capgemini	80	53.3	19.3	10.5	100
GDP_PC	*GDP per capita*	Eurostat	80	25791.2	9336.0	7300	43500
BROADBAND	*Broadband penetration*	Eurostat	80	12.6	8.3	0	37.2

The use of macro-level data on eService development to assess public sector performances in European countries

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	Model 1	Model 2	Model 3	Model 4
GDP_PC	.034 (.284)	−.046 (.027)	.045 (.028)	.047* (.025)
BROADBAND	12.701 (7.985)	8.700 (7.901)	9.604 (7.936)	5.992 (7.116)
PA_LAB_QAL	281.318*** (103.084)	337.010*** (102.584)	250.228** (101.585)	219.150** (90.569)
PA_ICT	−3.397 (4.074)	−6.522 (4.186)	−4.136 (3.981)	−2.350 (3.568)
PA_LAB_QUAL*PA_ICT		1.191** (.560)		
PA_ORG			2.369* (1.258)	.529 (1.231)
PA_LAB_QUAL*PA_ICT*PA_ORG				.042*** (.012)
Fixed effects	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses; *** $p \le .01$; ** $p \le .05$; * $p \le .10$;

The use of *micro-level data* to examine the drivers of eGovernment diffusion in Italy

Analyzing the development of eServices at the micro-level allows to capture the role of organizational change more precisely

J.Fountain (2002, 2005) poses a key question : How do PAs organize the "enactment" of ICT, to improve the effectiveness of their government functions?

A central organizational issue is the co-existence of, and continuous tensions between, *in-sourcing and outsourcing* of ICT competencies

On the one hand, some services and systems will be outsourced:
- To comply with increasing financial constraints.
- To avoid difficult political negotiations that would be required to integrate new competencies, share information and coordinate communication within and across agencies.

On the other hand, internal competencies are necessary:
- to monitor technological opportunities,
- to enable public organization to protect sensitive data and processes,
- to deal with multiple communication channels, and to absorb external knowledge.

Data and indicators

- 2009 ICT-PA survey on "Information and Communication Technologies in Local Public Administrations", conducted by the Italian National Bureau of Statistics (Istat).

- This survey provides information on different aspects of the use of ICT in local administrations collected through a census of all municipalities with more than 20,000 inhabitants and a sample survey for the others.

- A total of 5,592 municipalities are covered, corresponding to about 70% of the Italian local administrations

- A synthetic indicator has been computed to measure the number and quality of online services offered. We use this as our dependent variable, capturing the level of technology "enactment" by PAs

Table 1 - Descriptive statistics for the Front-Office Index

Population size	(mean)	st. d.
up to 5000	1.45	1.43
from 5000 to 10000	2.56	1.52
from 10000 to 20000	3	1.74
from 20000 to 60000	3.26	1.72
over 60000	4.96	2.36
over 200000	6.25	1.80
Degree of urbanization[1]	**(mean)**	
Low	1.43	1.49
Intermediate	2.26	1.71
High	3.1	1.72
Macro-regions[2]	**(mean)**	
North-West regions	1.96	1.66
North-East regions	2.47	1.74
Centre regions	2.32	1.90
South regions	1.48	1.52
Total	**2.00**	**1.72**

Notes:

[1] The degree of urbanization is based on the population density and on the contiguity among areas.

[2] North-West (Valle d'Aosta, Lombardia, Piemonte and Liguria); North East regions (Veneto, Friuli-Venezia Giulia, Trentino Alto-Adige and Emilia-Romagna); Centre regions (Toscana, Umbria, Lazio and Marche); South regions (Abruzzo, Molise, Campania, Basilicata, Puglia, Calabria, Sicilia and Sardegna).

				(Year)
Dependent variable				
Enacted technology	Front-Office Index (FOI)	Composite indicator measuring the availability and the interactivity of online services for each Administration.	Municipality	Istat (2009)
Independent variables				
Technological factors (objective technologies)	Smart cards players	Binary variable taking on the value 1 if Administration has Smart card players[1].	Municipality	Istat (2009)
	Broadband access	Binary variable taking on the value 1 if Administration has broadband access to the Internet[2].	Municipality	Istat (2009)
Organizational factors)	ICT training	Binary variable taking on the value 1 if Administration has sponsored at least one of the following training programs: office automation, operation systems, web, data management, and European Computer Driving License.	Municipality	Istat (2009)
Organizational factors	ICT In-House	Share of ICT-related activities operated with internal staff[3].	Municipality	Istat (2009)
	ICT Outsourcing	Share of ICT-related activities operated with external staff[4].	Municipality	Istat (2009)
Organizational factors	Municipal Size	Total number of employees of the local PA.	Municipality	Istat (2009)
Contextual Factors	Territorial dispersion	Binary variable taking on the value 1 if Administration is within sparsely-populated areas[5].	Municipality	Istat (2009)
	Demographic change	Over 64 years population growth rates (2001-2008).	Municipality	Istat (2001-2008)
	Employment growth	Employment growth rates in Local Labour Systems (2004-2008).	Local Labour Systems	Istat (2004-2008)
	Patents	Number of registered patents in 2009 per million inhabitants.	Provincial	Istat (2009)

Econometric model

We consider a Tobit model where a latent random variable y_i linearly depends on x_i, *i.e.*

$$y_i^* = x_i`\beta + \varepsilon_i$$

Due to the nature of our front-office index (with 871 zeroes), the observed value y_i is censored below 0 and has a censoring value below 13 (this being the maximum number of service areas considered by the survey).

The use of micro-level data to examine the drivers of eGovernment diffusion in Italy

Dependent variable: Front-Office Index Tobit model (heteroskedastic robust estimates)

Technological variables	Coefficients	
Smart card technology	0.512 (0.048)	***
Broadband access	0.394 (0.054)	

Organizational variables	Coefficients	
ICT training	0.529 (0.059)	***
ICT In-House	1.816 (0.085)	***
ICT Outsourcing	0.720 (0.087)	***
Municipal Size	0.000 (0.001)	***

Contextual variables	Coefficients	
Territorial dispersion	-0.609 (0.049)	***
Demographic change	-0.205 (0.050)	***
Employment growth	0.040 (0.011)	***
Patents	0.541 (0.063)	***
Constant	0.282 (0.085)	***
N. of observations	5592	

The use of *micro-level data* to explore patterns of eService diffusion in *European cities*

This is work in progress

Desk analysis conducted in 2012 through website-surfing to monitor e-service availability at the city level in EU15

Sample of 229 cities extracted from the 369 monitored in Eurostat's Urban Audit database (which refers to all Member States of the European Union, in candidate countries, in Switzerland and Norway).

Four service categories have been considered, and data have been collected adapting ITIC-Between methodology:
- Infomobility
- eHealth
- eProcurement
- eGovernment (desk analysis on eGov to be completed)

City sample

Code	Tot cities	50 000 – 250 000 ab.	> 250 000 ab.
AT	5	3	2
BE	7	4	3
DK	4	2	2
DE	40	18	22
IE	5	4	1
EL	6	4	2
ES	23	7	16
FR	32	12	20
IT	30	18	12
LU	1	1	
NL	15	11	4
PT	7	6	1
FI	4	3	1
SE	8	5	3
UK	29	11	18
TOT	**217**	**110**	**107**

Service categories

	No. observations	No. services	No. countries	Methodology
E-HEALTH	217+26*	8	15	Desk analysis
INFO MOBILITY	217	6	15	Desk analysis
E-PROCUREMENT	217	11	15	Desk analysis
E-GOVERNMENT	183	6	10	Desk analysis

* For each capital city 3 hospitals have been considered

SERVICE LIST BY CATEGORY

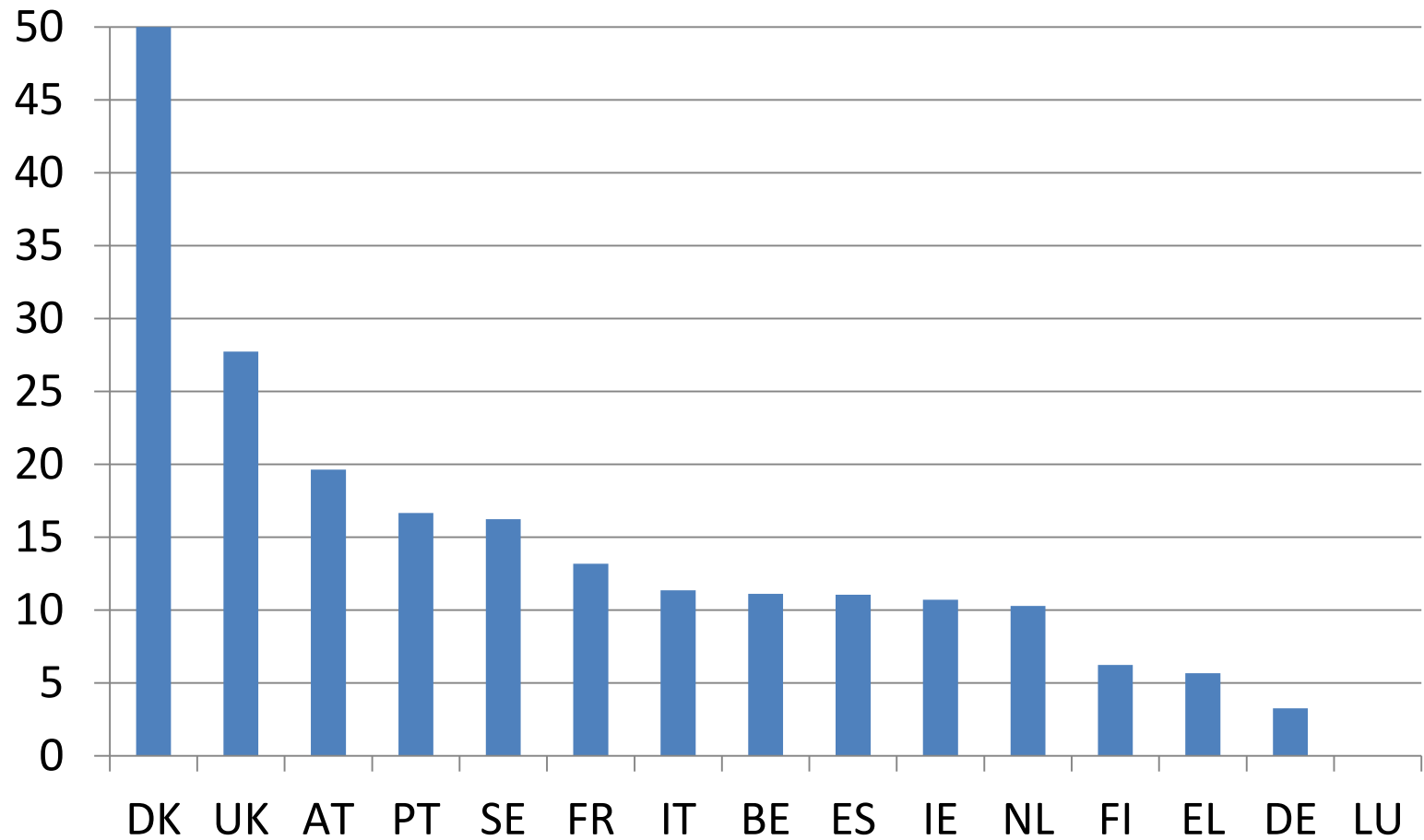| E-health	Infomobility	E-procurement	E-government
videoconferencing-video consultations between patients and doctors	*Online info to users while travelling*	On line registration of suppliers	OnLine local taxes
electronic patient records (EPR)	*Online time table consultation*	Supplier registration to receive email alterts	OnLine registration of residence
e-booking	*Ticket purchase*	Suppliers submission of bids/tenders electronically in a secure way	OnLine identity card
online clinical tests	Season ticket purchase	Remote communication channels enabling Q&A sessions with the bidders (e.g. eMail, chat. Audio, videoconferencing)	OnLine public library
e-referrals	*Info to car drivers while travelling*	Online assistance and user help services?	OnLine birth/marriage certificates
telemedicine service (tele-homecare/tele-monitoring)	*Electronic parking toll*	Information about awarded contracts is published online	OnLine registration of a new company
on line chronic disease management		eAuctions services provision enabling competition on price between potential suppliers	
on line ticket payment		Online order from eCatalogues	
		Web Market services for the interaction of buyers and sellers	
		e-invoicing services	
		E-payment services	

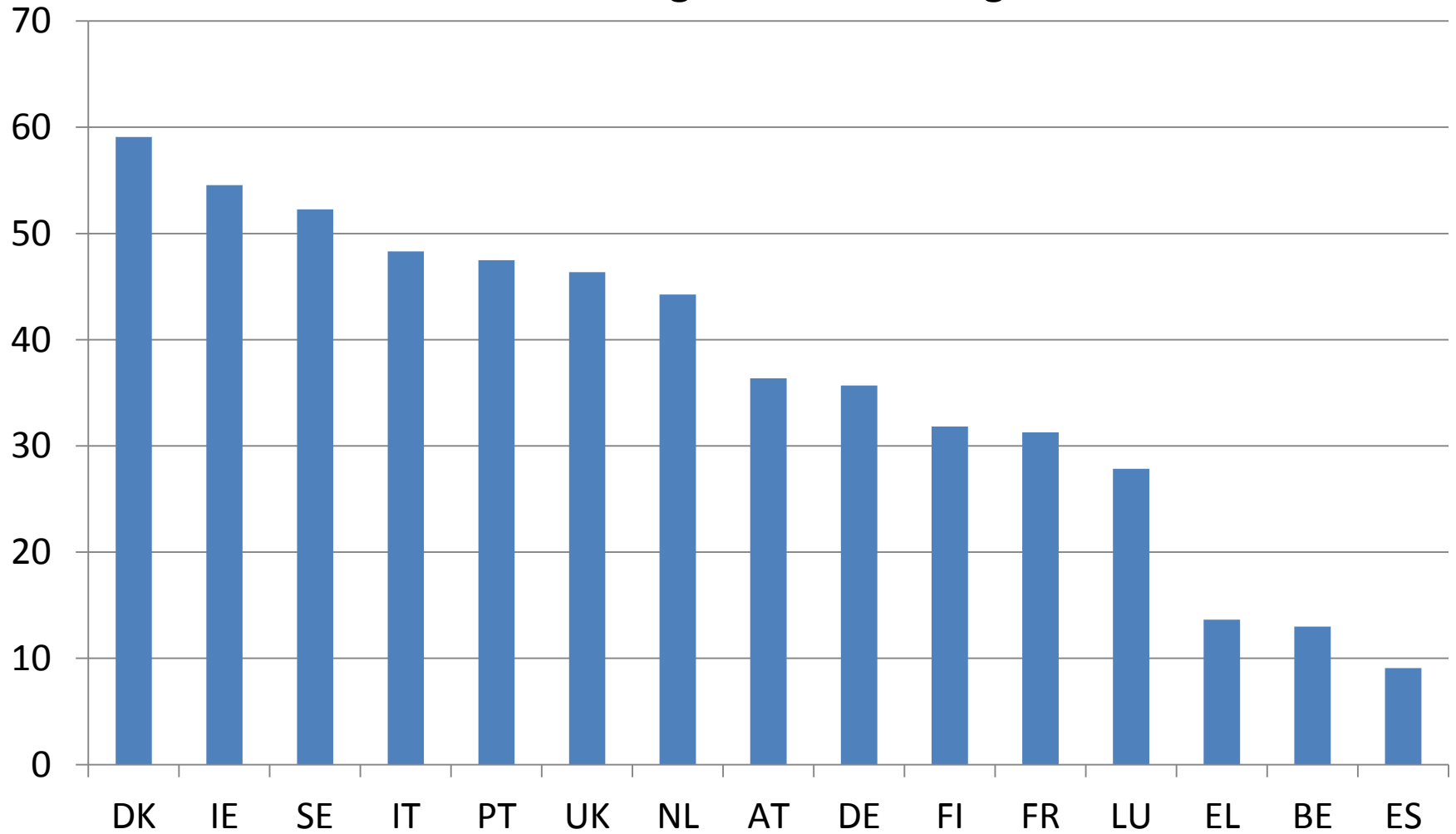# Infomobility

%average service coverage
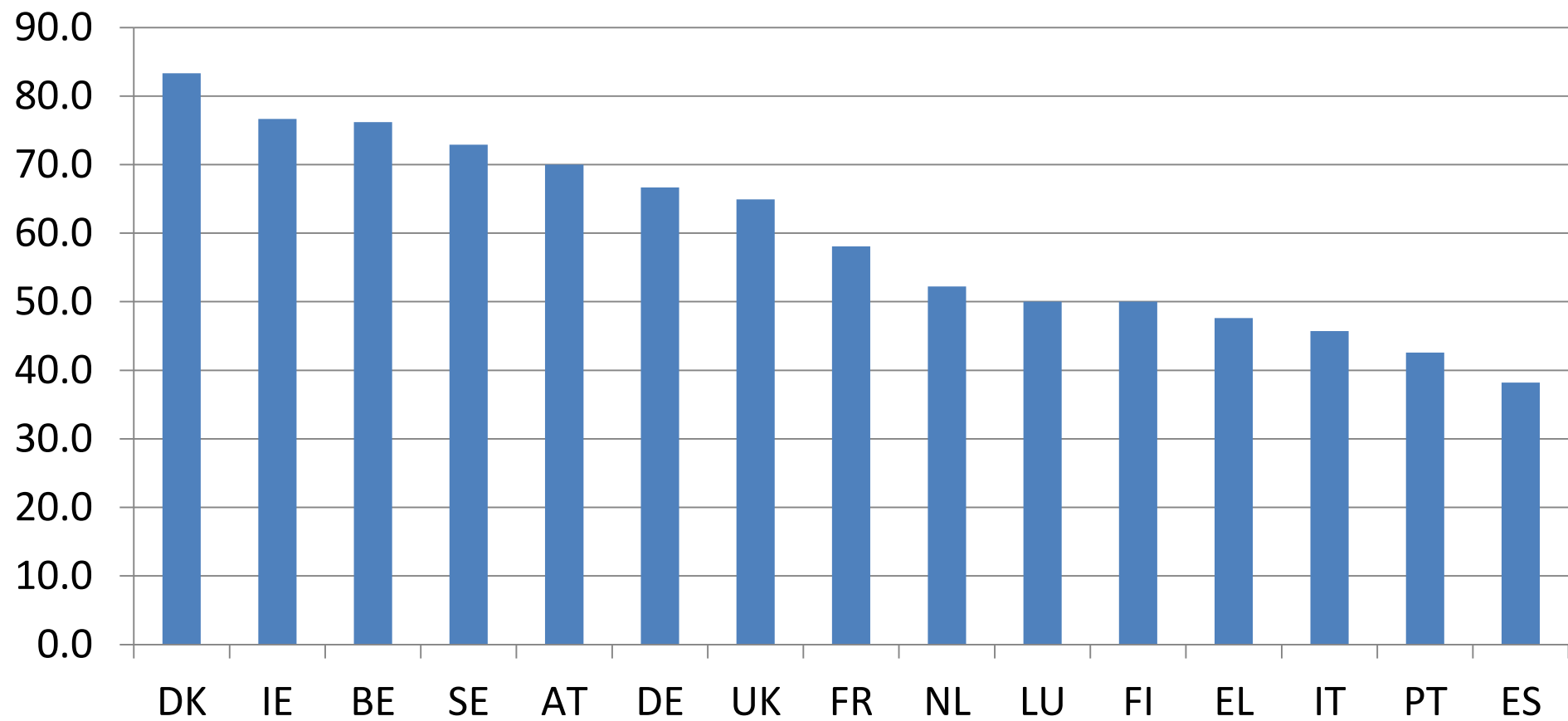
E-HEALTH

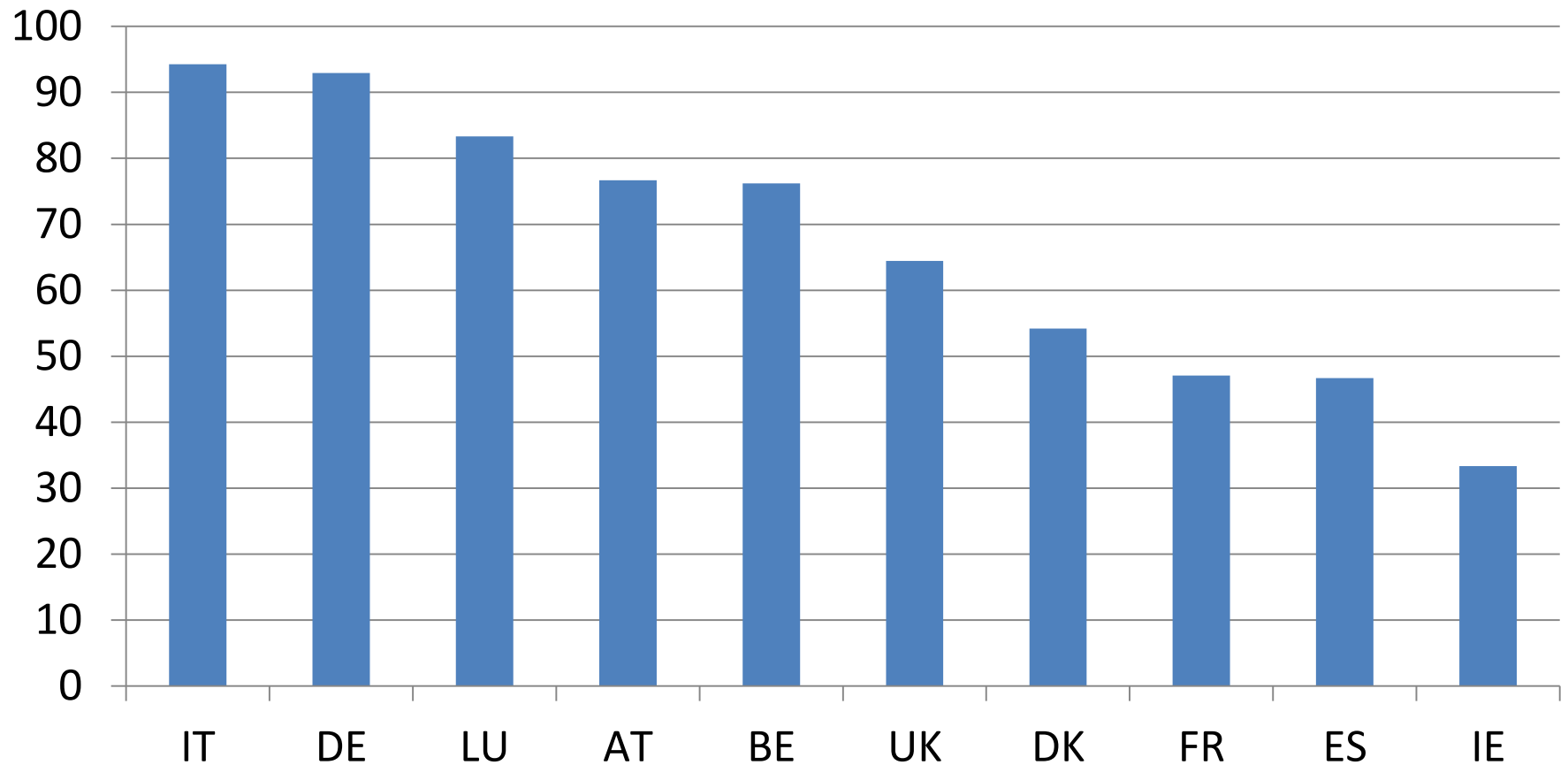**% average service coverage**

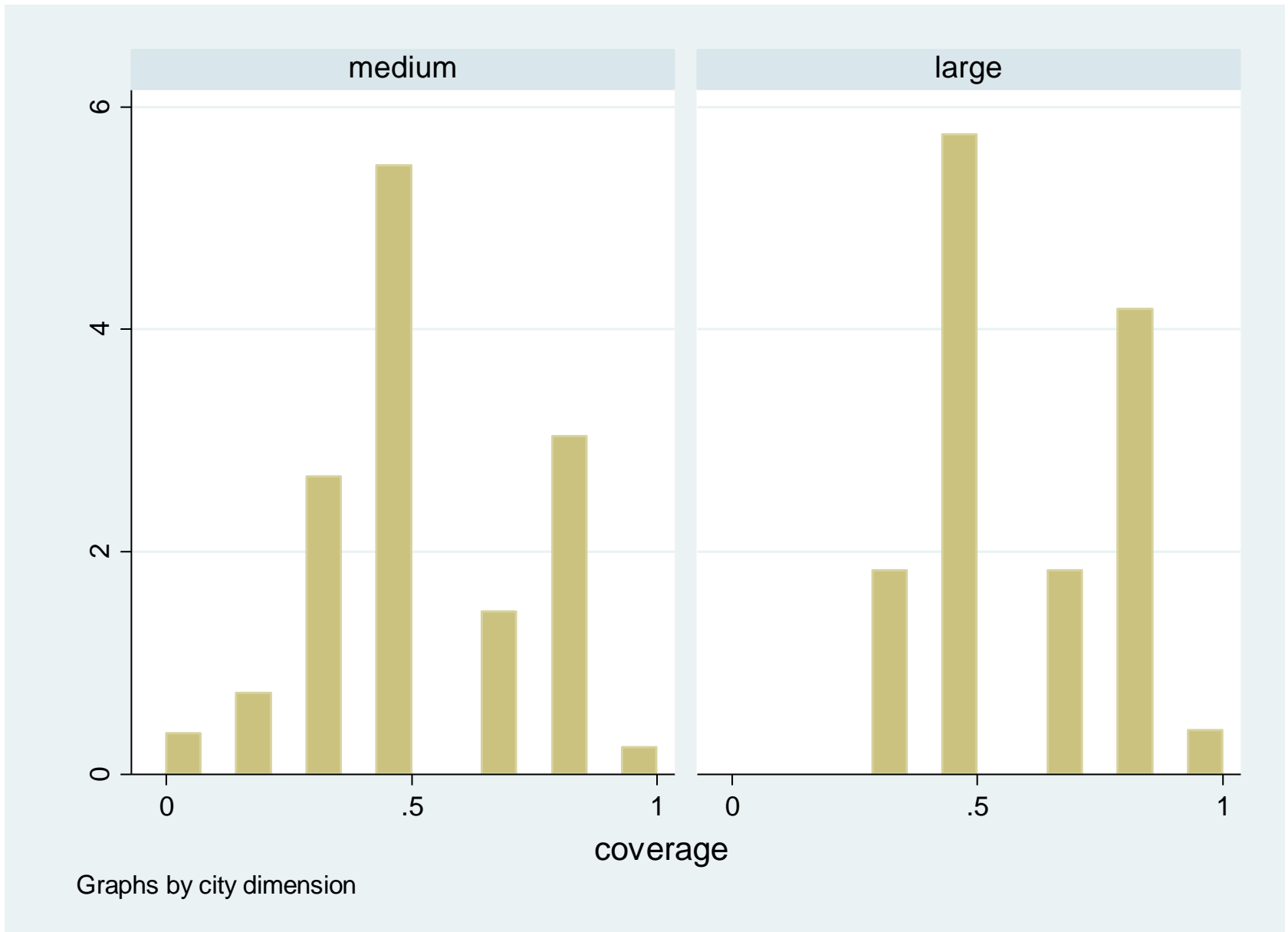# E-PROCUREMENT

% average service coverage

E-government

% average service coverage

Infomobility service coverage by city size

Graphs by city dimension
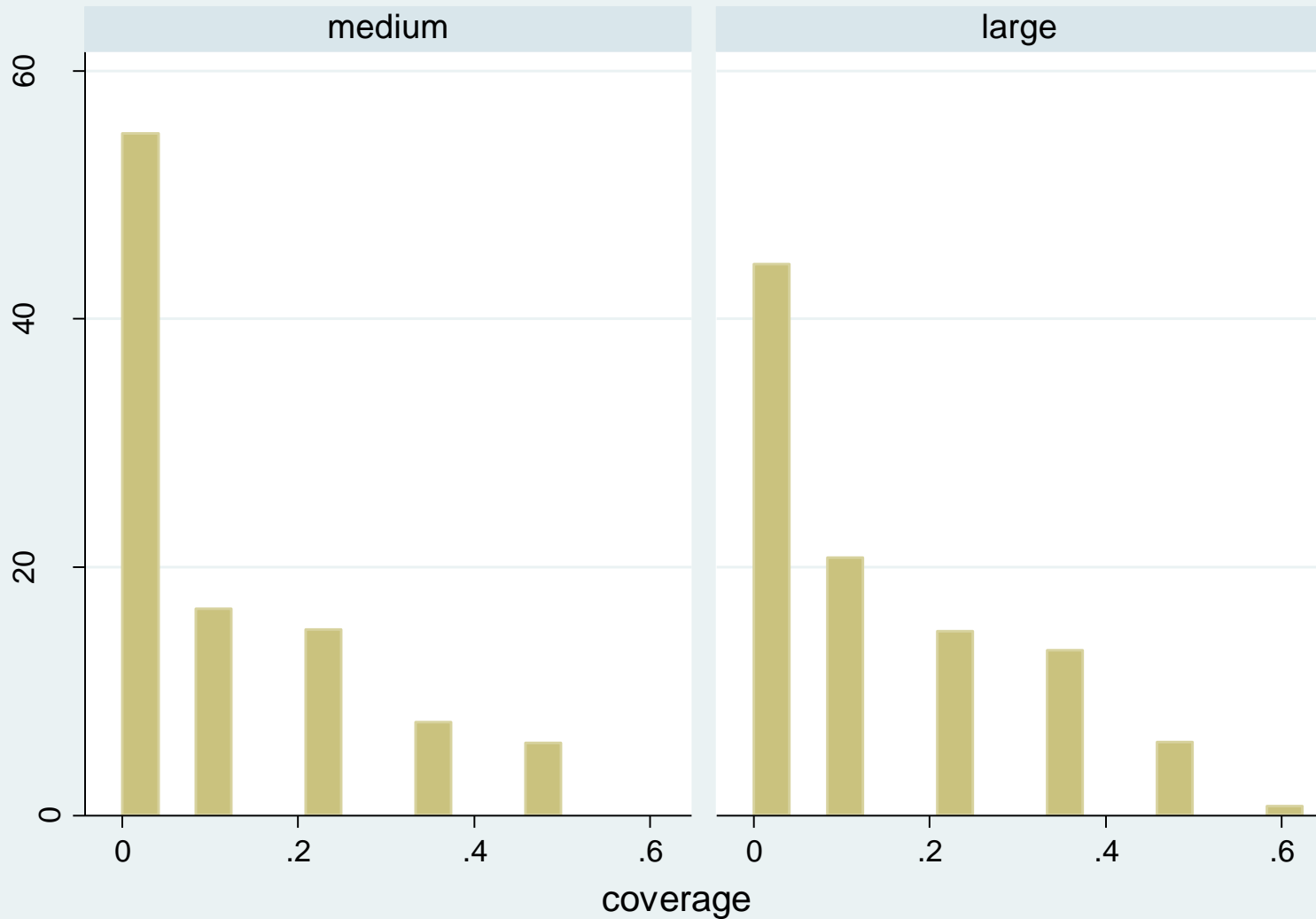
eProcurement service coverage by city size

Graphs by city dimension

eGov service coverage by city size
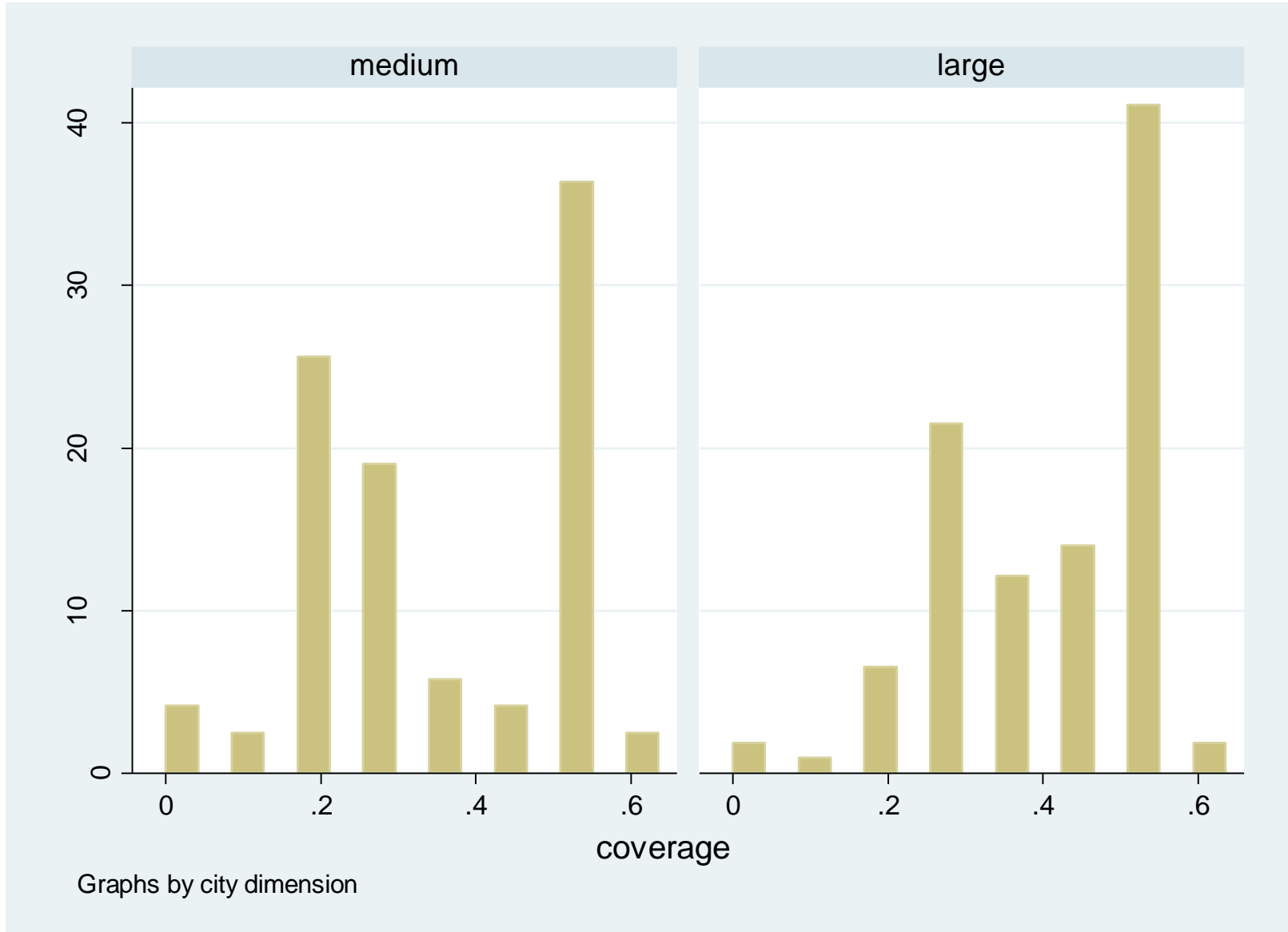
Graphs by city dimension
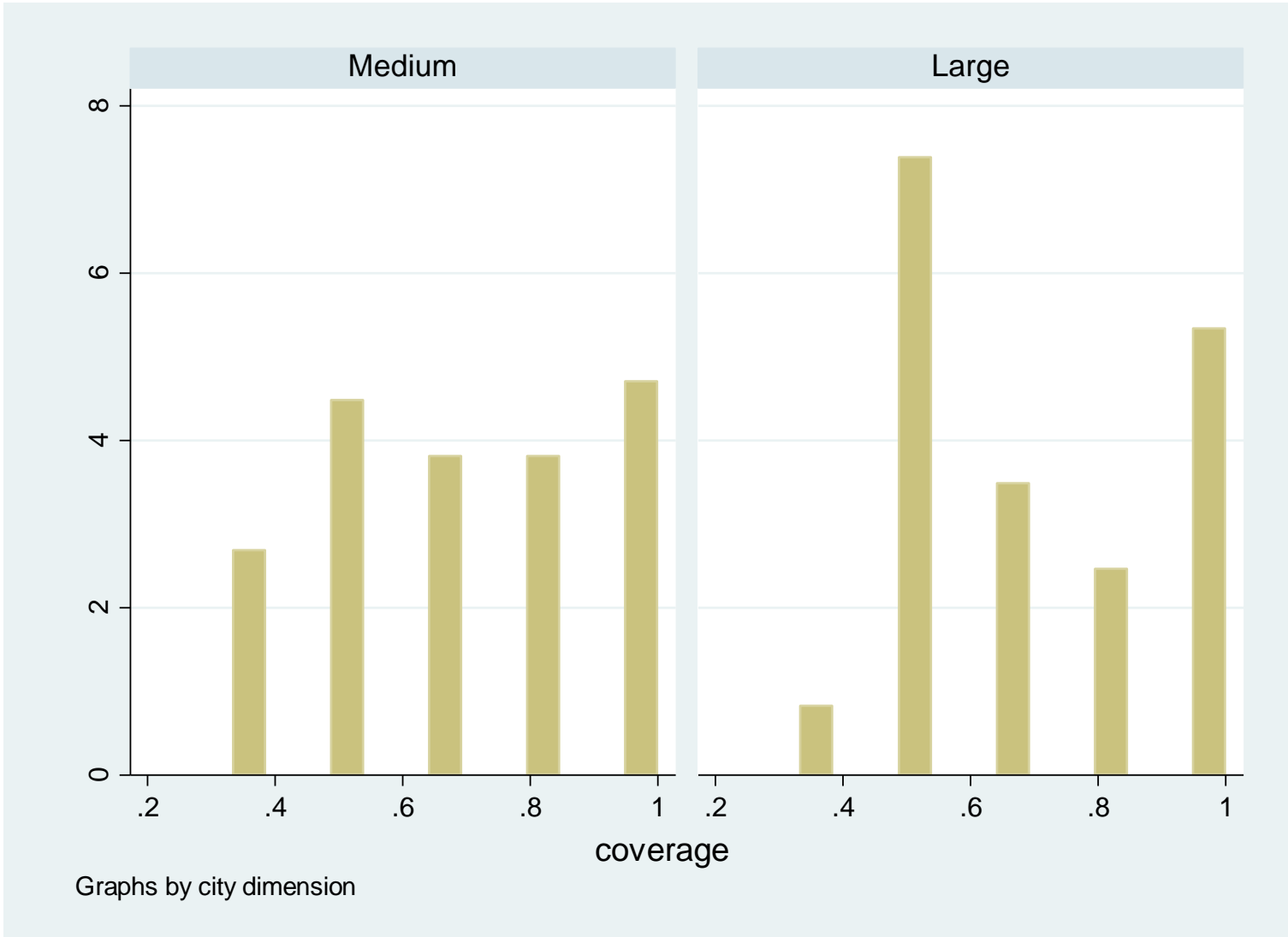
Ehealth service coverage by city size

Graphs by city dimension

Service coverage and city size

Service category	Infomobility	E-health	E-procurem ent	E-government
ρ	0,19*	0.1	0.19*	0.01

Spearman correlation
* significance level 5%

A few insights from work in progress

Cities with the highest coverage of e-services are not the same across service categories

Countries wherein cities have the highest service coverage tend to be largely the same across service categories (DK, SE and UK always in the top 5), eccept the case of eGov, where more variety exists

City size is positively associated with eService provision. The significance level is highest in the case of infomobility and eProcurement

Next steps

•Assessing specialization patterns of cities in terms of e-Services

•Analysing links between patterns of e-service development and socio-economic performance of cities