Prepared for the eGovernment Unit

DG Information Society and Media

European Commission

eGovernment Economics Project (eGEP)

eGovernment Economics Project (eGEP)

Economic Model Final Version

31 May 2006

eGovernment

eGovernment Unit
DG Information Society and Media
European Commission

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Deliverable	Economic Model Final Version
Due date	April 1st, 2005
Date and place	Rome, May 31st 2006
Report version	Final version
Revision notes	validated by: Marcella Corsi approved by: Cristiano Codagnone
Addressee officers	Alejandro Moya Trond Arne Undheim European Commission Directorate-General Information Society Directorate C - Unit C6- eGovernment, BU 31 7/87 Rue de la Loi 200 - B-1049 Brussels - Belgium
Contract ref.	Contract Nr. 29173. start: 21 Dec. 2004 end: 20 Feb. 2006 (postponed to 1 April 2006)

EXECUTIVE SUMMARY

This Economic Study aims at assessing the impact of the introduction of ICT in the Public Sector (PS) on the Public Sector itself and on society. In particular, it provides the theoretical underpinnings of the tangible elements presented in the Measurement Framework.

The basic tenet of our model is that eGovernment programmes lead to improved labour productivity in PS and, as a consequence, contribute to a number of intermediate results (better services, cost savings, etc), and to GDP growth. Indeed, the contribution of PS to GDP can be adequately estimated as equal to the labour productivity of the public sector multiplied by the total number of public sector employees. As eGovernment represents the focus of our investigation, we make a *ceteris paribus* assumption and we consider only productivity increases linked to the introduction of wider forms of eGovernment. Then we estimate PS productivity as a ratio between public sector output and the number of public sector employees.

The model considers 5 main channels through which eGovernment generates increased PS productivity: Market Enlargement or Smith's Effect, the Substitution or Ricardo's Effect, the Back-Office Reorganization Effect, the Investments-Led or Schumpeter's Effect, and Other Take-Up Driven Effects. Given the large share of PS in European countries' GDP, efficiency in PAs is an objective per se and a major driver of international competitiveness and economic welfare: the growth of PS productivity is the first channel through which eGovernment enhances GDP growth.

There are also two other effects that depart from the growth of PS's productivity: on the one hand, publicly provided goods and services contribute to welfare and are part of a country's Gross Domestic Product, hence their growth should be entered in national accounts (the second channel: growth of PS total output). Also, a more efficient public administration contributes directly to the efficiency of the economy as a whole and to the productivity of the Private Sector in particular, by stimulating innovation and the growth of the most competitive and innovative industries (the first, an "indirect" part of the third channel). Finally, eGovernment contributes to GDP growth since it is part of Aggregate Demand, and its potential impact could further extend to multiplier and accelerator phenomena.

Although the model's foundations lie on a microeconomic analysis of single eGovernment projects and PAs, because of insufficient data and following a macro approach, we fitted our model with aggregate data so as to produce tentative forecasts for productivity and GDP behaviour in the next years, while providing a first validation of the proposed economic model. From this point of view, we can affirm that our results are encouraging, though it must be said that estimates are only partial, in that many relevant theoretical effects could not be taken into account, and they are based on a rather short observation period, which reduces statistical significance.

Our estimates imply rather strong effects of eGovernment expenditure on PS productivity and GDP growth, even if we only consider the direct effect, i.e. we ignore the potential effect of increased PS efficiency on the productivity of the private sector, and without even considering multiplier and/or accelerator effects. Our estimations imply that the projections on eGovernment expenditure provided by eGEP would lead to a 1.5% cumulative GDP growth at EU-level by 2010. Furthermore, in a second scenario we also developed a simulation exercise to take into account the aggregate

impact on GDP growth of cost savings related to both eProcurement and eGovernment expenditure for the period 2005-2010: if we assume that cost savings related to eProcurement would turn into additional investments by PAs during the period 2005-2007, the overall GDP growth attributable to eGovernment in the period 2005-2010 can be estimated at 2%.

Finally, from both the theoretical implications of the Economic Model and the empirical analysis employed in its validation procedure, we established that, in order to exploit eGovernment potential to the hilt, it is necessary to work in three directions: increase both the efficiency and the effectiveness of eGovernment inside Public Administrations and with reference to their main stakeholders (policy recommendations 1 to 4); promote the dissemination of specific tools for performance measurement, together with a favourable cultural background (policy no. 5); set up a number of complementary policies, in order to foster the "take-up" effect, and finally promote productivity and growth.

We identified five policy objectives connected to these three strategies: to share eGovernment goals, to address eGovernment towards shared objectives, to favour a performance-friendly environment within the Public Sector, to promote accessible and useful eGovernment services, to create a friendly financial framework for eGovernment, to make the performance measurement mandatory.

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1. Introduction

The Economic Study aims to assess the impact of ICT within the Public Sector (PS) and to provide the theoretical underpinnings of the tangible elements presented in the Measurement Framework. In particular, it has been designed to take into account all factors influencing the paths the European Public Administrations (PA) will have to follow to improve their internal and external efficiency.

The first section of this report focuses on the proposed theoretical model.

The basic tenet of our model is that eGovernment activities (national programmes, specific projects, etc.) result in an improvement in labour productivity of the public sector and, as a consequence, contribute to a number of intermediate results (better services, cost savings, etc.), and to GDP growth. The contribution of the public sector to GDP can be commonly estimated as equal to the labour productivity of the public sector multiplied by the total number of public sector employees.

The proposed ***Productivity Function*** for the Public Sector takes into account four different effects of eGovernment on productivity (Smith's effect, Ricardo's effect, Schumpeter's effect and Back-office effect) plus an amplifier, the Take-up effect.

These five components enter into the estimation of public sector productivity, which in turn produces an impact on the public sector share of GDP.

The second section focuses on testing the effectiveness of the proposed theoretical model as a tool for describing the economic consequences of eGovernment in a European context. Despite the many obstacles due to a lack of data and intrinsic difficulty of measurement, we manage to deal with macro data relating to the variables analysed by the model and to show the soundness of our results.

Finally, the third section proceeds to make some relevant policy recommendations in order to exploit eGovernment potential to the hilt - along the lines of the present study.

2. Economic Model Pillar: eGovernment-Productivity-GDP

The basic tenet of our model is that eGovernment programs result in improved labour productivity in the public sector and, as a consequence, contribute to a number of intermediate results (better services, cost savings, etc), and to the growth of GDP. [1]

This is a complete about-face with respect to the orthodoxy of how economic theory considers the public sector contribution to overall economic development, i.e. mostly focusing on reducing its burden to unleash market forces. Our model does indeed take into account the objective of administrative burden reduction, but it goes one step further to estimate how the public sector through ICT driven innovations can proactively increase its ability to generate a positive non-neutral impact on general growth. Our assumption is simply that the goal of user-centred public administrations providing better services is achieved first of all through an increase in productivity enabled by reorganisation, training and ICT technologies, that is to say by eGovernment.

First, we can start from the general contribution in monetary terms of the public sector to GDP, henceforth indicated as GDP_{PS}.[2] Actually, by using the concept of public sector labour productivity, the contribution of the public sector to GDP can be estimated more accurately as being equal to the labour productivity of the public sector multiplied by the total number of public sector employees:[3]

Public Sector share of GDP	=	Public Sector Labour Productivity	*	No. of Public Sector employees

As eGovernment represents the focus of our investigation, with a *ceteris paribus* assumption and if we only consider productivity increases linked to the introduction of wider forms of eGovernment, we must estimate the productivity of the public sector as a ratio between public sector output and the number of public sector employees involved in eGovernment projects:[4]

$$\text{Public Sector Labour Productivity} = \frac{\text{Public Sector Output monetary measure}}{\text{No. of Public Sector employees involved in eGovernment projects}}$$

As already stated, the economic model starts by considering the value-drivers presented in Measurement Framework model and the presence of "take-up" effects tied to the context, connecting both value drivers and take-up to a productivity estimation model.

This model is derived by adjusting the Productivity Function developed by Sylos Labini (1984) for the private sector[5] to the Public Sector. The proposed productivity function for the Public Sector can be summarised graphically as follows:

PS Labour Productivity	=	PS adapted Smith's Effect	+	PS adapted Ricardo's Effect	+	Back-office Effect	+	Investments Led Effect	+	Other Take-up driven Effects

Market Enlargement or Smith's Effect. In the private context, Smith's effect takes into account how the market/specific sector growth influences labour productivity. The resulting ratio is positive; i.e. growth in market dimension increases productivity in two ways: a) enterprises try to increase productivity to gain market share; b) once they gain a large market share, productivity must improve to match increased output volume.

The adaptation of such an approach to the public sector presents several difficulties. The first problem is that public administrations do not have a market where they sell their products and services. The second one is that this kind of products and services must be measured in monetary terms. The third consideration is that it is improper also to talk about a "demand" for public sector: instead, the reference should be to the supply of the public sector, namely public services, assuming that every service supplied is in demand. ***Therefore 'Smith's effect' applied here, corresponds to***

what happens in the private sector when market size increases, with the difference that in the public sector there is no real market.

In the next section, estimation of this effect for the public sector will be made in monetary terms starting from the supply-side and not from the demand-side. ***In other words the basic hypothesis is that the introduction of eGovernment increases the supply capacity of the Public Sector, which is considered equal to the market enlargement effect, based on the strong assumption that all services produced are also demanded by users.***

The Substitution or Ricardo's Effect. In the private context, "Ricardo's effect" shows how an increase in the spread between wages and the price of technology (machines) boosts businesses to improve their productivity, often through a substitution process between technology and employees. This effect is due, alternatively or complementarily, to an increase in wages or a decrease in the price of technology, generally because of innovation. In the formalised model, the equation points out the existence of a time lag between when the event is recorded (number of employees replaced by technology) and when its effect becomes tangible, this is because investment in machines to replace employees, does not lead to an immediate increase in productivity. The assumption is that when the cost of innovation drops against that of manpower, it may be profitable to substitute the latter.

Technically, in estimation model terms, the adaptation of this effect to the Public Sector is less problematic than Smith's effect. On the other hand, however, it is a bit more problematic politically given the peculiarity of the Public Sector, where employees cannot be dismissed easily. Therefore adaptation to the public sector implies a reformulation of the above assumption as follows: ***when the cost of innovation drops compared to that of manpower, it may be efficient to partially replace the latter and partially complement it with a wide implementation of eGovernment services***.

Back-office Re-organisation Effect. For the private sector, the model shows that firms will undertake a re-organisation when the cost of making a product or delivering a service is disproportionately higher than its perceived value. If, for whatever reason, the product or the service cannot be discontinued, firms will be forced to reorganise production or service delivery and thus influence general productivity.

Apart from the possible lack of an adequate incentive structure, from the organisational rationality point of view, this effect should be observed easily in the Public Sector too. From the point of view of the technical estimation of this effect, for the Public Sector, an approximate calculation will be required for the computation of the costs re-organisation.

Investments in Innovation or Schumpeter's Effect. The estimation of this effect does not present particular problems for the adaptation of the model to the Public Sector context. The characteristic element of this component is consideration of ICT investments, but also of related aspects: consulting, training, hardware, software, etc. The impact of such innovations (as new innovations replace older ones) generates an increases in productivity, after a time lag.

Take-up effect. Take-up can be considered an amplifier and an enabling condition for eGovernment. In particular, some aspects have to be considered:

- *The technological scenario*. Where there is an upward trend in delivery of ICT-based products and services, users should demand more ICT-based public

services. This does not impact only the delivery channel, but also the time of delivery.

- *The existence of private competitor services.* An increase in the delivery of some kinds of public services through e-GSP (eGovernment Service Providers) could induce an increase in the direct or indirect efforts of the public sector to provide better and quicker services*;*
- *The general education level*. With reference both to public sector staff and to the entire population, some links should appear between the general level of education and the push to provide more knowledge-based services via eGovernment programmes.

Thus, the more "receptive" the social environment is (because of a wide ICT diffusion, for instance, or because of a broad, deep-rooted use of e-services) the more public sector productivity will increase. In particular, this happens for two reasons:

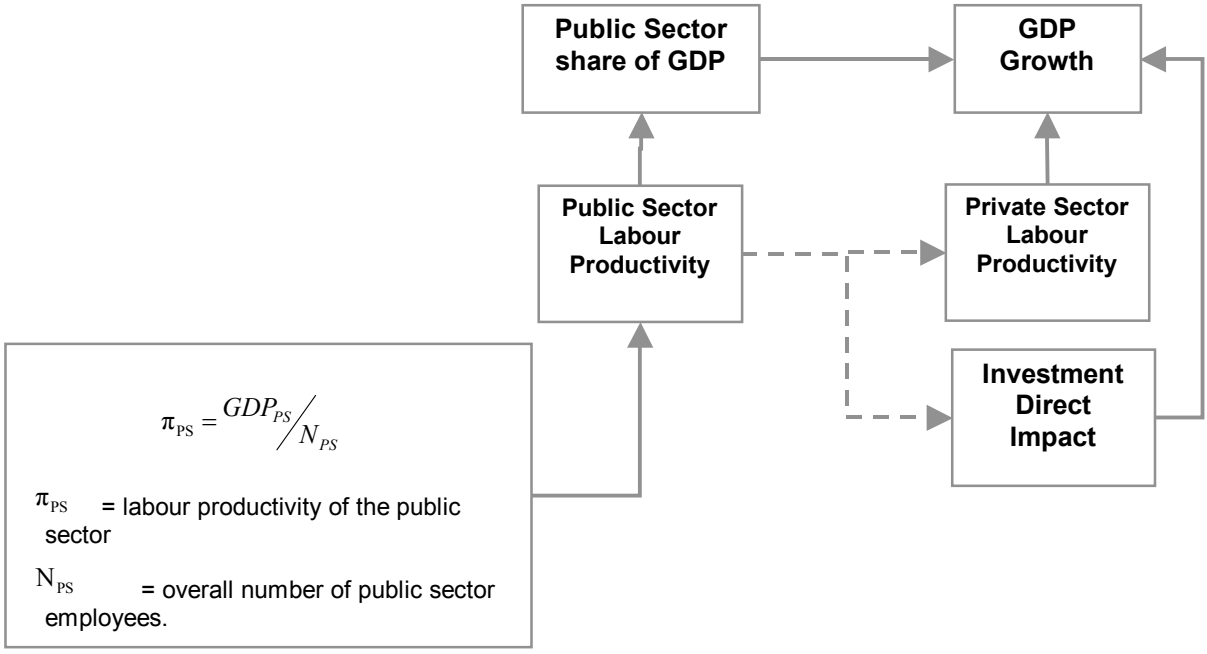
- The push towards innovation in the public sector exerted by the community (the more innovative processes are used in every-day life, the more they will be in demand)
- The high level of ICT literacy of civil servants, as well as of users, which boosts the use of advanced services.

Starting from these premises, the estimation model aims at showing the different ways in which eGovernment turns into efficiency. Particular emphasis is placed on productivity growth in the Public Sector, presumably one of the main reasons why single eGovernment projects are undertaken, which is tantamount to saying that Public Administrations grow more efficient and public employees provide more goods and services. Given the large share of PS in European countries' GDP, efficiency in the PAs is an objective per se and a major driver of international competitiveness and economic welfare (the first channel).

Two other effects depart from the growth of PS's productivity. On the one hand, publicly provided goods and services contribute to welfare and are part of a country's Gross Domestic Product, hence their growth should be entered in national accounts (the second channel). Moreover, a more efficient public administration contributes directly to the efficiency of the economy as a whole and to the productivity of the Private Sector[6] in particular, and – at macroeconomic level - stimulates innovation and the growth of the most competitive and innovative industries (the first, "indirect", part of the third channel).

A more direct part of the third channel through which eGovernment contributes to GDP growth is its being part of Aggregate Demand, a particularly important part due to its technologically innovative content. This channel is labelled in the model "Investment Direct Impact", implying, at macroeconomic level, that this impact could further extend to multiplier and accelerator phenomena.[7]

Exhibit 1: The Economic Impact of eGovernment



3. From Economic Theory to *e*Practice

The proposed economic model aims at assessing the impact of eGovernment on the economy by assessing its impact on GDP.

Before proceeding to an empirical analysis of the model, it is worth emphasising that a search is under way for other relevant effects of the reorganisation of the Public Sector (PS) following the adoption of the ICT technologies: increased accountability and transparency of Public Administration, better dissemination of information, improved participation to democratic processes, strengthening the efficacy of public policies. Thus the estimated effects of the implementation of eGovernment on GDP are likely to underestimate the pervasive impact on society. At the same time, a number of indirect effects not easily subject to precise measurement nor univocally defined in theory - such as, for example, increased international competitiveness of the economy - might prove relevant in the long run, even from a strictly economic point of view.

In general, public intervention in the economy is not a mono-dimensional phenomenon, but rather has many objectives and instruments at the same time. The choice of the present study has been to focus on volume measures of the goods and services provided by the Public Sector (PS), not because they are the most important aspect, but because they are easier to measure. The multidimensionality of PS is inherited by its process of innovation and transformation, thus eGovernment is likely to be pursued for many policy reasons and can be studied from several points of view. However, any theoretical model is subject to limitations: its rationale, subject to cognitive limits, is the isolation and explanation of selected aspects of the problem

considered, in order to highlight the dynamic effects regarded as most relevant; it proves incomplete by definition, but its empirical value should be judged on the basis of its ability to answer the questions it is designed to address.

From this point of view, the proposed Economic Model has basically two uses: at the micro-level, it may constitute a tool with which single PAs can assess the benefits of alternative projects in terms of output, especially by organising all relevant information (estimated cost savings, etc..) within a single, coherent set-up. At the macro-level, the ambitious objective is to assess the relevance of eGovernment for economic growth, as a significant aspect of welfare.

3.1. The variables in the model and their real-world counterparts

In shaping an empirical dimension for the relevant variables presented in the economic model, the first element to be analysed is the ***level*** of analysis.

It is clear, from the proposed theoretical model, that since eGovernment is a complex phenomenon, it unfolds its effects both within the single Public Administrations which carry out eGovernment projects, and beyond the Public Sector in the rest of the economy. It is therefore necessary to distinguish the form in which the single effects take place.

The basic pillar of the Model, the analysis of productivity in the Public Sector and the different effects of eGovernment on it (Smith's, Ricardo's, Back-Office, Schumpeter's) are defined at a microeconomic level, that is, they refer to a single Organisational Unit; also the growth of goods and services provided by the PA is first taken into account as the single PA's output, and then summed up to constitute the Public Sector aggregate output (PS share of GDP). Instead, the other effects of eGovernment on GDP, namely the indirect stimulus to productivity in the Private Sector and the Investment Direct Impact on GDP (with its industry selection and Aggregate Demand implications), are best suited to an aggregate dimension.

This distinction is empirically relevant because, despite the fact that aggregate measures are constructed as the sum of micro-variables, when it comes to macroeconomic variables we should expect their dimension to be generally different from the (weighted) average of the micro-level observations, because all economic activities are interrelated and virtually no change within one unit is without effects on another (e.g., a growth in some PA's efficiency is likely to benefit some of the other PAs that interact with it).

By contrast, some of the effects that the model aims to analyse are only defined at a macroeconomic level: e.g., effectiveness of Public Sector (within Smith's effect), as measured by indicators of socio-economic development such as social inclusion or health; and many of the effects linked to take-up, namely the technological scenario and education level. These two groups of effects are not defined at micro-level, because they relate to the environment in which the PAs operate, environment considered both as an effect and as a source of innovation and change.

3.2. Availability of data and statistical challenges

In the discussion above, it was implicit that aggregation by summing or averaging implies a common unit of measurement. For the Private Sector, economic activities are aggregated on a market-value basis, that is, their quantity is multiplied by their

"price" (say, average price during the year) and then the total "market value" is calculated for all goods and services.

It follows that aggregating all economic activities within the Public Sector is, at present, impossible: many PAs do not serve final users (government-to-government activities), some do not charge a price for their supply, others only receive a minimum compensation (e.g., a tax) which most of the times is a means for rationing demand (with the aim of selecting, within a potentially infinite number consumers, those who really need the service) rather than covering (even partially) costs. In short, a major part of the Public Sector does not have a market to face.

Other problems are that some public services are actually designed with the objective of not providing something (i.e. PAs operating towards prevention) and some do not involve transactions (all so-called "public goods", such as infrastructures, whose use is collective and/or whose use by single consumers cannot be prevented). All these problems may be summed up by saying that there is often no clear definition of PS output and that this output is often lacking a univocally determined value.

A common solution for the Public Sector in the National Accounts has been to label the sum of total activities providing final users with goods and services at a charge greater than 50% of unitary cost "market", and the rest "non market". Market supply is then aggregated on market-value basis, while non-market activities are usually computed at their cost.[8] This procedure contrasts a direct impediment to any estimate of PS's productivity, since imposing the equality "cost = output" implicitly presumes constant productivity.

There is a clear commitment on the part of the European national statistics institutes to gradually overcome this barrier. Sir Atkinson's Final Report, claims that the United Kingdom is presently at the forefront, estimating roughly two-thirds of PS with direct output measures; unfortunately, even in the countries immediately behind such as Italy and the Netherlands, which also give priority to developing direct volume measures, the current share of directly measured output does not even reach 50 per cent. Finally, a correct measure of output volume must include adjustments for quality change: this feature is another feature as yet underdeveloped within National Accounts current practices but expected to improve.

There are reasons for optimism here, but it must be recalled that even after correctly estimating the market value of PS output, this would not be a proper measure of its contribution to welfare, because of the many (indirect) goals also attached to economic policies. To quote Sir Atkinson's: "The statistic obtained by dividing output by input may no longer be equal to 1 by definition, but no single number, however carefully constructed, can fully capture the performance of complex public services with multiple objectives" (p. 14).

4. Testing Strategy

In the face of the obstacles and challenges explained above, we aim to test the feasibility of our economic model by collecting empirical evidence at EU level.

Table 1. General Government aggregates

	Economic Model	**Variables**	**Sources**
ALP	AVERAGE LABOUR PRODUCTIVITY	Output/full-time equivalent employees	Eurostat[1]
PS	PUBLIC SECTOR SHARE	Gen. Gov. Output as a % of GDP	Eurostat[1]
I	INVESTMENT	Gross Fixed Capital Formation of Gen.Gov.	Eurostat[1]
Y	MARKET DIMENSION	General Government Output	Eurostat[1]
W	COST OF STAFF	Compensation of Employees in Gen.Gov.*	Eurostat[1]
K	COST OF CAPITAL EQUIPMENT	Price Index of Investment Goods in Gen. Gov.	Eurostat[1]
H	COST OF HARDWARE	Estimated Expenditure	eGEP[2]
S	COST OF SOFTWARE	Estimated Expenditure	eGEP[2]
C	COST OF CONSULTANCY	Estimated Expenditure	eGEP[2]
T	COST OF TRAINING	Estimated Expenditure	eGEP[2]

* *for Hungary, Ireland, Norway, Slovenia the relevant variable is Gross Compensation of Employees of Public Administration, not General Government, because of unavailability of data.*

[1] *National Accounts*

[2] *Expenditure Study*

Following a macro approach we have fitted our model with aggregate data, so as to produce tentative predictions for productivity and GDP behaviour in the next years, while providing a first validation of the proposed economic model. From this point of view, we can affirm that our results are encouraging.

Table 1 summarises our data sources and highlights the link between our *ex ante* theoretical model and the *ex post* applied estimation.

We choose to limit our analysis to General Government for two reasons. On the one hand, within the context of National Accounts there is a wider availability of data for this branch: we have collected estimates for nineteen EU countries[9] and Norway, although covering a rather short time span (1999-2005).[10] On the other hand, the selection of General Government proves a good compromise between the need to limit the lack of homogeneity (which we discussed in the previous paragraph) that characterises the many goods and services produced by the Public Sector, and the

requirement not to restrict the analysis to minor subdivisions of PS or too specific PAs, which could result in our estimates being less significant.

Indeed, on average, General Government accounts approximately for 18.09% of GDP, which we consider as a sufficiently representative base value.

Despite the limited number of variables, those illustrated in Table 1 have provided a powerful tool to interpret recent trends of productivity in the Public Sector. Indeed, even with the limited number of periods for which we could estimate the relevant values, the variables included in Table 1 proved abundant: thus we decided to aggregate ICT-related public expenditure within a new "eGOV" expenditure variable.[11]

Also, the short time horizon hampered the possibility of identifying the true time-lag structure of the different effects. We therefore decided to estimate - by means of regression analysis - two forms of our model, in order to exploit, as much as possible, the limited number of observations at our disposal: one based on growth rates, explicitly investigated by the theoretical model (labelled "A"), and one based on absolute values ("B").[12]

Adopting the convention that dotted variables express rates of growth, we have:

A) $$\dot{ALP} = a + b\dot{Y} + c\dot{W} + d\dot{K} + eI + f\,EGOV$$

B) $$ALP = a + bY + cW + dK + eI + f\,EGOV$$

Investments in machinery and eGovernment are always expressed in absolute values, because they already constitute increases in capital equipment. Recalling that our model predicts positive values for all coefficients except *d*, the results reported in Table 2 seem to confirm the validity of our theoretical hypothesis.[13] In any case, it would be unwise to explore the implications of the relative magnitudes of these parameters, given the small number of observations from which they were estimated.

Table 2. Estimation results (sign of coefficients)

		Equation "A"	**Equation "B"**
Smith's Effect	***Y***	+ *	+ *
Ricardo's Effect	***W***	+ *	+ *
	K	- *	+
Schumpeter's Effect	***I***	+ *	+ *
	eGOV	+ *	+ *

** : coefficient significantly different from 0 at 95% confidence level*

Note: Costant-price variables (Y, I, eGOV) expressed in millions of euros, basic year 2000. Equation "A" was fitted with a Fixed-Effects Panel model (68 observations), Equation "B" was estimated with the "Arellano-Bond" technique (68 observations).

Our estimates imply rather strong effects of eGovernment expenditure on ALP growth, even if we only consider the direct effect, i.e. we ignore the potential effect of increased PS efficiency on productivity in the private sector, without even considering multiplier and/or accelerator effects.

For example, we developed a simulation exercise to forecast the implications of eGovernment expenditure on GDP growth for the period 2005-2010. As said above, our projections are likely to underestimate the complete potential productivity growth, because they do not consider several further transmission channels (both as a prudential feature and as a consequence of unavailability of data and scarce significance of punctual projections based on too few observations). We assumed that GDP would grow at the same pace as PS, and that no change in all relevant variables but eGovernment expenditure would take place: in other words, we assume *coeteris paribus* conditions.

Given these hypotheses, we investigated the direct effect of the projected expenditure for eGovernment in the twenty countries over the next three years (2005-2007).[14]

Table 3. Percentage growth of ALP (EU average)

	2005	**2006**	**2007**	**2008**	**2009**	**2010**
"A"	2.53	2.22	2.34	1.02	0.45	0.2
"B"	2.81	2.64	2.77	1.58	0.91	0.53

As shown in Table 3, the estimated equations provide slightly different results. Indeed, the estimation based on the original formulation of the model (model "A", based on growth rates) implies that investments and eGovernment expenditure play a greater part than in model "B", which instead features a higher weight for economies of scale and cumulative processes. For this reason, "B" retains higher positive values of ALP growth even after the occurrence of eGOV expenditure (which is assumed to be zero from 2008). In contrast, after 2007, the ALP growth projected by model "A" falls more rapidly, as a consequence of smaller cumulative processes.

As a matter of fact, the estimation procedure adopted for model "A" assumes that part of ALP growth can be explained by country-specific dynamics, but in our projections we abstained from inserting an average of these country-specific factors, because there are too few observations for each country and because the interpretation of such a mean would be uncertain.

Since we assumed that Private and Public Sector grow together, PS share of GDP is constant over the projection horizon. Thus, similar dynamics characterise the projected growth of GDP stimulated - again, only as a direct effect - by eGovernment expenditure forecast for the period 2005-07. ***In scenario "A" a 1.14% cumulative growth would occur before year 2010, 1.54% according to scenario "B".***

Graph1. Percentage growth of GDP (EU average)

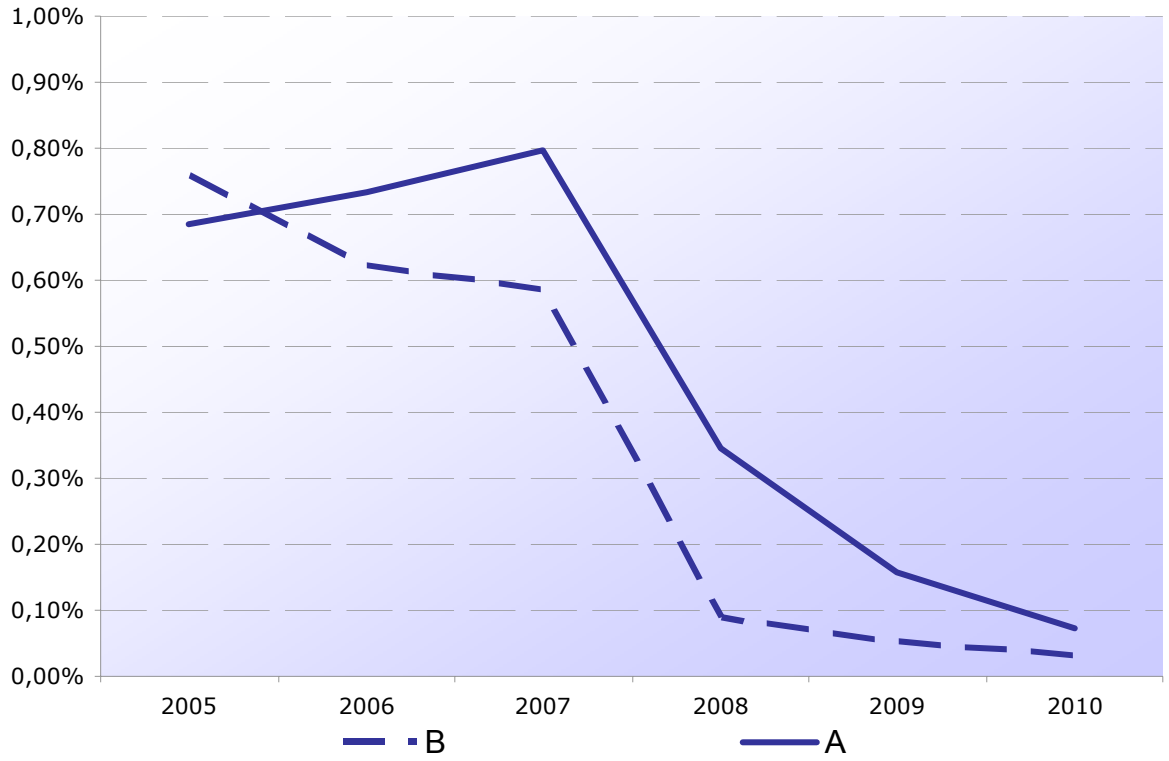
Box1: Taking into account eProcurement

The Ministerial Declaration approved unanimously in Manchester, on 24 November 2005 agrees that "*the effective use of ICT in public procurement is an area of great significance for achieving efficiency gains: public sector purchases in Europe account for 15-20% of GDP and electronic public procurement can reduce costs by as much as 5%*".

We have developed a simulation exercise to take into account the aggregate impact of cost savings related both to eProcurement and eGovernment expenditure on GDP growth for the period 2005-2010. In particular, **we have assumed that all cost savings related to eProcurement would turn into additional investments by PAs** during the period 2005-2007 and that no change in all relevant variables except eGovernment expenditure would take place over the same period.

As shown in Graph 2, the estimated equations provide slightly different results. Indeed, it is obvious that our hypotheses on the reinvestment of cost savings imply a reversal in the ranking of the two scenarios: in particular, due to **the considerable role in stimulating growth attributed to investments and eGOV expenditure** in model "A", from the very second period of projection the increase in investments made possible by eProcurement causes the projected growth of ALP and GDP in model "A" to exceed the projections of model "B", to the extent of causing higher cumulative processes even after the period of projected spending (after 2008).

Graph 2. GDP growth taking into account eProcurement (EU average)



As in the previous simulation exercise, our projections are likely to underestimate the complete potential for GDP growth, because they do not consider several further transmission channels (both as a prudential feature and as a consequence of unavailability of data and scarce significance of punctual projections based on too few observations), such as, for example, the increased productivity in the private sector which can be fuelled by eProcurement through increased competition and increased technology content of demand.

In scenario "A" a 2.06% cumulative growth would occur before year 2010, 1.36% according to scenario "B": it is clear that eProcurement can constitute a powerful tool to stimulate growth, even if we only consider direct effects, most notably for the possibility for the PS to recover Investments without increasing the burden on taxpayers or worsening the overall public budget.

5. Policy Recommendations

In order to exploit the potential of eGovernment to the hilt - along the lines of the economic model - it is necessary to work in three directions:

1. ***Increase both the efficiency and the effectiveness of eGovernment inside Public Administrations with reference to their main stakeholders (policies 1 to 4);***
2. ***Promote the dissemination of specific tools to measure performance, together with a favourable cultural background (policy no. 5);***
3. ***Set-up a number of complementary policies, in order to foster the "take-up" effect, and finally promote productivity and growth.***

In this section, we emphasize that an EU-level eGovernment strategy should benefit from a strong and focused commitment on the part of policy makers, whose importance is stressed also in the Ministerial Declaration approved unanimously in Manchester, on 24 November 2005, as well as from the availability of a commonly agreed tool for internal and external performance measurement. To this end, of course, we consider that eGovernment exerts a positive effect on GDP growth as discussed in the previous section.

With reference to the recommendations we will explicit below, the Manchester Ministerial Declaration, together with our eGEP economic model, represent a basic tenet. In particular, much attention has been placed on the relevance of creating a common e-Government solution framework among EU25 Countries: proposals from the European Council and from Austria in particular, have been taken up in some of our policy issues, when referring to the opportunity of fostering best experiences and solutions exchange and re-use among Member States. At the same time, efforts to achieve user-centred e-services, which pervade the Ministerial Declaration, represented a starting point for our recommendations on how to achieve efficient and effective services while respecting some of the basic budgetary constraints. Specialisation, inclusion and back-office reorganisation efforts, also represent a huge bottom line for our considerations.

In general, we refer to the effect that such policies should have on how to achieve a better, more efficient and effective e-Government, explicating the links with eGEP economic model. Recommendation 1 and 5 represent an exception, because they inherit a general attitude to e-Government itself (1) and to the measurement issues (5) respectively.

Policy no. 1: To share eGovernment goals

In the light of such a strategic about-turn, Member States should agree on a new definition of eGovernment, which takes into account both the benefits and the needs of this pervasive action. The Manchester declaration is indeed a step forward in this direction, but a number of clear and promptly applicable elements should become part of such an agreement.

- Focusing every eGovernment project on front-office as well as on back-office, paying much attention both to the deployment of easy-to-use services and to ***the setting up of productivity-sensitive policies, such as those for general and specific training or re-organisational issues***.

- Promoting a favourable scenario, where social, economic, financial, legal and institutional issues play a major part in overall ***local*** growth when adequately oriented.
- Defining an operational measurement framework, which also favours the ***establishment of comparative benchmarking and prizing processes***.

Neither a strong effort in policy making nor an eGEP-like economic framework could be put in place, without a political commitment of this kind.

Policy no. 2: To guide eGovernment towards shared objectives.

Guiding eGovernment towards such objectives would bring about a change in both EU and Member States' policies. In particular, this would imply a *locally-aimed*, *extensive* and *user-centred* eGovernment.

Specifically, it is essential to pursue a horizontal application of eGovernment, instead of a vertical one: to aim at transforming an entire set of e-services at a proximity-level (i.e., a Municipality), instead of a single e-service (i.e., justice) following a national perspective. The adoption of a horizontal approach is necessary in order to obtain significant effects in terms of back-office reorganisation, productivity, returns on efficiency and effectiveness: on the contrary, a vertical approach does not automatically imply an impact on the ability of PAs to take into account user needs or to generate an economic effect at local level.

This does not imply completely discarding the vertical approach: on the contrary, it should be transformed, in order to become a benchmark for the adoption of common standards and procedures for re-use and implementation of existing applications, especially in a pan-European e-services perspective. Those standards should stem from a mixed bottom-up and top-down strategy, aimed at reaching maximum consideration of user needs when defining and deploying e-services. In this light, setting up complementary policies is indispensable to promote the "spill-over", related e-services and e-policies, that will act as a multiplier of virtuous cycles.

Policies to be implemented refer to:

- **The promotion of a horizontal eGovernment**. This approach is best suited to make a thorough re-organisation of the Public Sector possible in the medium term. It implies global intervention on PAs, aiming at transforming the entire set of ICT-enabled public services, in line with the Back-Office Re-Organisation Effect to which we referred above. Also, a higher degree of efficiency should be pursued through benchmarking processes and the diffusion of the best technological, organisational and training solutions, as well as through a strong commitment to interoperability among organisational units.
- **A review of eGovernment vertical policies**. The present EU approach, aimed at promoting high efficiency and effectiveness standards with reference to single services at country-level, should be partially reviewed and integrated. In particular, the EU should deploy substantial efforts to: (a) develop a modular system for ready-to-use eGovernment solutions; (b) build up a European data bank of best eGovernment solutions. To this end, the Austrian Presidency's proposal to realize a European eGovernment Resource Network (http://europa.eu.int/idabc/servlets/Doc?id=23794) could positively reinforce this perspective, fostering Member States in collecting best projects, solutions and methodologies, making them available at an European level. Greater attention should be paid to finding solutions that could have an impact on

productivity and growth, according to the proposed economic model. In this way, two objectives would be pursued: the definition of pan-European "higher standards" and the promotion of wider and deeper re-use.

- **Specific principles, linked to technical features**. Apart from general W3C compliance, policies should be promoted to reach a complete and effective **current e-services main features knowledge management**, not looking at software solutions alone, but rather at organisational topics and gained results as well. This should lead to the **creation of a European data warehouse of these elements**. The use of **open-source software**, in addition to **a strong commitment to "solution re-using"** should foster this.
- **The promotion of both a user-centred and a locally-aimed eGovernment.** Due to budget constraints, eGovernment policies should not be oriented only to local growth, but should also take into account user needs, while respecting the Internal Stability Pact. As a consequence, further implementation should be based upon a number of subjective and objective priorities, combining the need to satisfy user needs and the opportunity of realising programmes which refer to the true needs and potential of local areas, such as macroeconomic entities. This would lead to a progressive deployment of eGovernment projects, following different priorities in different areas, maybe not homogeneous, thus giving measurement, monitoring and fine tuning activities a sharper and more effective meaning, in the light of promoting sustainable and lasting local growth.
- **The promotion of specialisation within the Public Sector.** Horizontal and pervasive eGovernment should benefit from a higher degree of local specialisation within different branches of Public Administration (if accompanied by perfect interoperability), rather than from an indiscriminate upgrade of organisational issues within the entire Public Sector. However, in general, the size of single Administrations matters: while a Region, a Central Department or even a large Municipality may find it more useful to identify and promote such economies internally, smaller administrations may find outsourcing to be a smarter and more suitable solution.

These policies have an effect on the economic model at various levels. Promoting horizontal eGovernment means in particular fostering the re-organisation of the units involved in the back-office process, both at an inter- and intra-Administration level, thus impacting the Back-Office effect. In addition, horizontal eGovernment should lead to integrated services, thus affecting the efficiency and the effectiveness of the Public Sector (via Smith's effect), generating not only cost savings, but also new revenues.

At the same time, reviewing eGovernment vertical policies should generate an impact on Ricardo's Effect, since by developing high-quality, known solutions, it could at first lower the cost of building up the same solutions in a different context, while shifting investments to more productive goals, thus also multiplying the Schumpeter effect and, possibly, even impacting take-up.

Affecting the setup of an effective knowledge-management system and promoting the creation of a data-warehouse of solutions for re-use should also put pressure on Ricardo's effect, lowering the cost of accessing e-Government solutions. Meanwhile, this should generate an impact on the Schumpeter effects by favouring more productive investments, and on the Back-Office effect by generating pressure in favour of more effective reorganisation models.

User-centred and locally-aimed eGovernment should generate results in terms of Smiths' effect, as services specifically focused on local and user needs should become more effective: this should also produce effects on the ability of Public Administration to generate new revenues, going so far as to apply different fees to different kinds of constituencies. The Back-Office level should also be affected, and pressure in favour of reorganising should be another result of this policy. Finally, more "fitting" e-Government could translate into positive effects on the scenario variables, thus fostering positive circular and cumulative effects on Take-Up.

Similar effects should be generated by the adoption of greater specialisation at an inter- and intra-Administration level, thanks to a stronger effect on more effective services (Smith's effect), cheaper solutions (Ricardo's effect), more productive Investments (Schumpeter effects) and a huge re-organisation (Back-Office effect).

Policy no. 3: To favour a performance-friendly environment within the Public Sector

In order to obtain concrete results in terms of efficiency and effectiveness, a "performance-friendly" environment must be set up in the Public Sector. At the moment, there are not enough incentives aimed at promoting efficiency and effectiveness gains through eGovernment at a personal or at PA level.

Since this goal does not refer to measurement issues alone, but to personnel motivation in particular, a number of measures must be taken in order to support public managers' and workers' will and ability to achieve higher performance. Nevertheless, as we specifically point out in policy no. 5, not only should a performance-friendly environment benefit from the adoption of a commonly agreed set of measurement tools at European level, but its economic significance actually requires performance measurement to be made mandatory. Measurement should become a "complementary and necessary investment", instead of being simply a "cost", because only through monitoring and fine-tuning activities, can targeted results be achieved.

In this light, three activities should be promoted:

- **Accelerating the shift from evaluation to performance rewarding**. Together with a mandatory measurement approach, performance should be linked to a "prizes and penalties" mechanism. Public Administrations do not have strong incentives to set particularly ambitious objectives and to try to achieve them. This could lead to vicious circles: an adverse selection mechanism could take place, where establishing goals that are too ambitious could mean risking not reaching them. The only way to break these vicious circles is to ensure strong financial and career incentives linked to performance for both personnel and public managers.
- **Working against motivational crowding out**. Motivational crowding out, which could appear as a consequence of the introduction of ICT, can lead to the failure of any eGovernment-related re-organisation policy, as Luc Soete points out. [15] Our model predicts that successful "internal" policies will have substantial "external" implications (in terms of productivity and growth): that is why decision-makers should pay much attention to defining and sharing eGovernment-related objectives clearly at all levels, as well as providing support tools. The more local representatives are informed of prospective goals

and local "returns" from eGovernment, the more the risk of motivational crowding out will fade away.

- **Fostering the adoption of reforms that encourage performance measurement.** Finally, such a framework requires regulatory and legislative *ad hoc* reform promotion: this refers, for instance, not only to the above-mentioned "prize and penalty" mechanism, but also to guaranteeing mandatory performance measurement, and linking legitimisation of policy makers' decisions to e-democracy tools. In this respect, further research ought to look into which reforms should be put into place, to what extent, and to what degree of homogeneity within the European Union.

All these policies should generate effects on Smiths', Back-office and Schumpeter's effect. With reference to the first one, more performing organisational units should lead to more efficient and effective e-services; at the same time, more productive units should generate positive effects also at a back-office effect level, lowering the cost of labour through a rise in productivity. Finally, Schumpeter's effect should also be affected, thanks to pressure for more productive investments, which could stem from a performance-friendly environment.

Policy no.4: To create a friendly financial framework for eGovernment

Since eGovernment should be considered simply as a part of integrated action in favour of a more efficient and effective Public Sector, whose final effect is an increase in local GDP, a new financial framework is required in order to promote it. This matter is strictly related to the huge amount of investments that must be planned by the Public Sector in order to comply with high eGovernment standards, as well as to other matters relating to Back-Office re-organisation.

This might involve both the development of more "heterodox" public budget rules– i.e. those related to compliance with the Stability and Growth Pact – and more "creative" application solutions, such as discriminatory investment strategies and user segmentation.

- **Let Administrations invest, if useful.** Given the broad goals of eGovernment objectives, in terms not only of internal effects, but also of external growth, Administrations should enjoy more freedom when deciding how to invest. This freedom, of course, should be strongly linked to the commitment of single PAs to develop an eGovernment that complies with the proposed reference model: in other words, for investments, a sort of "golden rule" should be applied if these policies are designed to affect the economic system and promote a sustainable, ICT-enabled growth. Here, how these investments are split among internal and external re-organisation, human capital empowerment, and ICT should be one of the strongest indicators. ***If eGovernment projects include all these features, Stability Pact restrictions could be partially mitigated.***
- **Reward the best Administrations and Organisational Units**. Under the current conditions, efficiency gains stemming from eGovernment may produce not only monetary savings, but also a "perverse" effect leading to allocation inefficiencies, as Public Administrations have a strong incentive to hide these cost savings for fear of budget cuts from Central Government. However, even in such critical moments for public budgets, the principle that the best

Administrations and Organisational Units should be rewarded for their performance improvements remains valid. Aside from productivity prizes for single employees, a more complex regulatory system should be developed, in order to make general Budget Rules compatible with eGovernment need for huge investments: redistribution should go hand in hand with productivity, especially where a "horizontal" and "user-centred" approach represents the final aim of these measures. It is certainly not feasible to cover every potential e-service area in every Administration at the same time, however the introduction of monitoring, also at general budget level, should help the best PAs to take into account the need for gradual, but effective action to trigger ICT-enabling activities, while giving the worse PAs a strong signal to change their behaviour.

- **Invest Cost Savings.** Our Economic Model highlights the importance of innovation, and its potential for "making Europe a more attractive place to live, work, invest in", as envisaged by the Lisbon Agenda. Therefore, it is crucial to have a long-term view and allocate most of the resources freed by efficiency gains to productive investments instead of simple budget cuts, thus exploiting this sort of automatic financial inflow.

Clearly, a more friendly financial environment should exert strong pressure on eGovernment returns, facilitating and fostering the adoption of investments. Changes in Schumpeter's effect should be monitored, as well as changes in direct effects on GDP growth and on Take-Up: as a consequence of increased investments, scenario variables should be affected too. If sufficient attention is paid to the quality of investments (through Smith's effect), effectiveness and efficiency should be positively influenced as well. This kind of effect too could be directly linked to the above mentioned re-investment policy.

At the same time, rewarding the best organisational units should generate positive effects at Back-Office level, since it is an extra incentive for continuous productivity gains, as well as for better re-organisation programmes. As a consequence, more efficient and effective services should be pursued, thus positively affecting Smith's effect, and even Ricardo's effect: at the moment, this last effect cannot be clearly predicted since this policy could affect both the wage level (though not the "cost of labour", as productivity should vary in a proportionate manner) and the level of investments. In general, however, the overall effect on productivity and growth should be positive.

Policy no. 5: To make performance measurement mandatory

As recognized by the cited Ministerial Declaration, it is crucial to establish "*a sustained, comprehensive, evolving and regularly reviewed framework of sustainable targets relating to measurable benefits for businesses, citizens, public administrations and Europe's economy*" (Ministerial Declaration, approved unanimously on 24 November 2005, Manchester, United Kingdom, page 1). Below, we analyse some crucial measures to be taken.

- **Define a homogeneous road-map.** The entire Public Sector will certainly not increase its eGovernment readiness unanimously; however, it is necessary to define a clear and homogeneous road-map for such a complex transformation, with precise features and goals. Otherwise, the general enhancement of the Public Sector will be poor and eGovernment could be jeopardized. Moreover, if performance measurement aims to affect the budget (negatively or positively),

more attention should be paid to the definition of a general benchmark. Of course, many of these suggestions have been yet included by the Manchester Ministerial Declaration: nevertheless, a stronger effort could be required, in order to extend this road-map even at a local Government level, making compulsory the definition of a bench-learning process within every decision-making level.

- **Define a clear, homogeneous and simple measurement framework.** Measurement tools should be easy to handle and use, but also as complete and effective as possible, in order to minimize any "coordination cost" that may arise. Furthermore, as more e-services gradually become ICT-enabled, the administrative burden to measure use, efficiency and satisfaction should decrease. In this case, even a limited "measurement effort", in absolute value, could be considered a substitute for the introduction of a more advanced eGovernment.
- **Local matters.** We believe that eGovernment will spread its effects on growth and performance especially at local level, and that the measurement framework should take this feature into account: an adequate observation scale should be achieved (i.e., NUTS3 areas). Indeed, internal measures could be aggregated in order to allow a comparison with external effects: this is a must when a prize/penalty framework is to be set up.
- **Measure the effort and the gap**. History matters, especially if budgetary cuts or gains depend on performance measurement. In this light, it becomes compulsory not only to take into account the effort and the results, measuring the period-by-period differences, but also to bear in mind the remaining gap and the absolute values of such efforts. Otherwise, the observation of political and administrative commitment may be distorted.

As we previously noted, this policy may not have a "direct" effect on productivity or growth, it does nevertheless make it possible to adopt the entire model correctly and is therefore a prerequisite for the overall eGEP economic model to function smoothly.

Endnotes

[1] The economic model is presented here in a discursive and graphic fashion. See Compendium for analytical algebraic notations.

[2] $GDP_{PS} = \alpha GDP$, where α simply represents the ratio with the overall GDP.

[3] $GDP_{PS} = \pi_{PS} * N_{PS}$, where π_{PS} stands for labour productivity of the public sector, and N_{PS} represents the overall number of public sector employees.

[4] $\pi_{PS} = \frac{Y_{PS}}{N^*_{PS}}$, where Y_{PS} represents a measure of the output generated by public sector, in monetary terms, and N^*_{PS} is the measure of those employees who are directly referred to the development of eGovernment programs (i.e. in terms of organisational units).

[5] The Sylos Labini (1984) productivity function for the private sector can be written as follows:

$$\hat{\pi} = b\hat{Y} + c(\hat{W} - \hat{P}_{ma})_{t-1} + d(\hat{L} - \hat{P}) + eI_{t-n}$$, where

$\hat{\pi}$ = variation in the labour productivity of the private sector, between period t-1 and t;

$\hat{Y}$ = variation in the output production of the private sector, between period t-1 and t;

$\hat{W}$ = variation in the level of wages of the private sector, in period t;

$\hat{P}_{ma}$ =variation in the level of prices of the machines, for the private sector, in period t;

$\hat{L}$ = variation in the labour cost, in the private sector, in period t, where $L = \frac{W}{\pi}$;

$\hat{P}$ = variation of the prices of supplied products of the private sector, in period t;

I_{t-n} = technology investments realized by private sector, n years before t, where t is the actual time (n ≥1 year).

In summary, this equation measures the contribution of many factors to the productivity growth: the main ones are:

1. market enlargement ($b\hat{Y}$), also known as "Smith's effect", from the assumptions of Adam Smith;
2. the driver as the increase in wages with respect to the price of machines ($c(\hat{W} - \hat{P}_{ma})_{t-1}$), known as "Ricardo's effect", from David Ricardo's studies;
3. the "re-organization push" ($d(\hat{L} - \hat{P})$), which works in the short-run;
4. the investment-led effect (eI_{t-n}) that we will name "Schumpeter's effect" referring to Joseph Schumpeter's work.

[6] For example, through costs or time savings for businesses. See Compendium for details.

[7] As already stressed in D.3.1., this implies the rejection of a full-employment analysis, a position that we believe is the most appropriate diagnosis for the European economy. See Compendium for details.

[8] For an up-to-date review of the current situation and a thorough discussion of accounting methodology, in particular in the context of estimating PS output, we refer to the Final Report of the review of the measurement of government output in the National Accounts

commissioned by UK National Statistical Office to Sir Anthony Atkinson, available online at www.statistics.gov.uk.

[9] Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, The Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

[10] Various causes concur to this unfortunate unavailability of estimates before year 1999: the smaller commitment of several countries to a thorough process of eGovernment (therefore the smaller amounts of money invested and the lesser commitment of statistical offices); the ongoing reformulation of Public Sector accountancy -especially, of the estimation of PS output-, which makes distant estimations hardly comparable; the more limited significance of very long-term trends for twenty different countries.

[11] $eGOV = H+S+C+T$. Technically, by doing this we gain three degrees of freedom for the estimation.

[12] The reason is that in estimating j time lags the first j and last j observations cannot be used, because of lack of relevant information: for example, first differencing -as in an equation based on growth rates- prevents us from exploiting the first and the last observations of the time-series. Presently there are not sufficient observations to estimate even a single (cross-country) value of productivity using one-period or two-period time lags, to provide some hints about the improvement that will accrue by repeating the estimation exercise in a more favourable future, when more data will be available. However, we are confident that such advantages will become apparent in due time.

[13] With the only exception of a coefficient of equation "B"; this can be disregarded because it is not significantly different from 0, from a statistical point of view.

[14] Relevant data were provided by the eGEP Expenditure Study.

[15] By motivational crowding out, Luc Soete refers to the difficulties public employees, and public organisations themselves, could experience, while trying to set-up ICT-enabled processes, without being fully acknowledged on the overall strategy, as well as on pros and contras they could benefit from / face during their re-organisational activities. Cfr. Soete, L., "The Economics of e-Government: a bird's eye view", *Journal of Communications Law and Policy,* Issue 8, Winter 2003/2004).

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