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Autores (as)	Antônio Afonso
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CHAPTER 10

THE EFFICIENCY OF THE STATE

Antônio Afonso*

As referred to by Feldstein (2002), one of the main changes in the public finance literature of the last three decades is the inclusion of public expenditures alongside the study of taxes as a major research topic. On the other hand, the simple use of measures for the size of the State, such as the weight of public expenditures in the GDP, does not render much information on the quality of the results that those expenditures provide. The relevant issue is not so much the size of the expenditure, but the results obtained from this expenditure.

Public expenditure is considered in generic terms an important factor for the promotion of economic growth and social well being. For example, a low level of public expenditure means that less public revenues will be needed, which also means less taxes and a bigger contribution to stimulate growth and employment.

For example, Lucas (1988) argues that public investment in education increases the level of human capital and that this may be seen as the main source of long-term economic growth. In turn, Barro (1990) defends the importance of public expenditures in infrastructure for economic growth, while Romer (1990) draws attention to the relevance of expenditures in research and development. That is, the composition of the public expenditure is also a relevant aspect; thus it is important that the economic decision-makers earmark public resources to the most productive expenditures.

On the other hand, public expenditure is equally a key variable in the sustainability of public finances. In this sense, strict control and reductions in public expenditures, when possible, are important to establish the appropriate balance between smaller public debt, less taxes and the financing of public investment in key areas of the economy. Thus, and in generic terms, it would be pertinent to redirect public expenditure to increase physical and human capital accumulation, while still supporting research, development and innovation.

* Department of Economic and UECE – Study Unit on Complexity and Economy, Higher Institute of Economics and Management – Technical University of Lisbon, R. Miguel Lupi 20, 1249-078 Lisboa, Portugal, email: aafonso@iseg.utl.pt.

This paper is organized as follows: in section two, the most usual methodology for the analysis of the efficiency of State public expenditure is referred to. Section three presents some of the existing evidence on international comparisons of overall State performance and efficiency, both for OECD countries and emerging economies. In section four, the same review is done on efficiency in the education and health sectors of OECD countries. Section five concludes the paper.

1 HOW TO EVALUATE EFFICIENCY OF PUBLIC EXPENDITURE

In order to evaluate the efficiency of public expenditure, most studies turn to the so-called non-parametric methods, where a group of inputs (not only physical, but also monetary) and of outputs are used to build a frontier of production possibilities. This type of analysis allows one to determine, for example, the level of performance that a certain amount of public expenditure should reach in a given country, by comparison with other countries. Put differently, what would be the possible reduction in terms of costs, without reducing the level of performance, if these resources were used in the most efficient way.

This strategy of relative efficiency analysis, which draws on the evaluation of efficiency of entrepreneurial units, can be applied to various entities and/or sub-sectors of public administration. For example, a relative efficiency analysis of secondary education can be done with several countries, or the relative efficiency of a group of secondary schools in a certain country can be evaluated.

Some of the methods used most often in efficiency analysis in the public sector have been the *Free Disposable Hull* (FDH) and the *Data Envelopment Analysis* (DEA).[1] The terminology "envelopment" results from the fact that the efficient frontier takes the form of an "envelope" that embraces all the observations, as seen in the examples of pictures 2 and 4. Therefore, non-parametric methods are used that do not require the use of econometric estimates of coefficients and are based on the resolution of math programming problems.

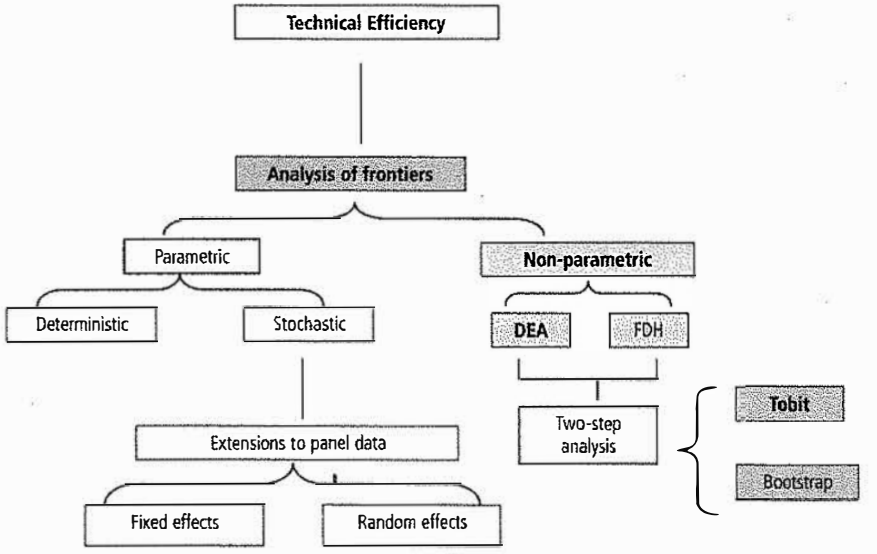
On the other hand, after determining the degree of efficiency/inefficiency, the literature also seeks to explain the reasons for the inefficiency by resorting to a two-step analysis. In the second moment of the analysis, conducted through the use of Tobit models or bootstrap techniques, non-discretionary or

1. Possible references on these methodologies, are for example, Thanassoulis (2001) and Coelli, Rao and Battese (2002).

exogenous variables are usually used to explain in part the degree of inefficiency detected in the first step.[2]

Besides the non-parametric methods, other approaches are equally possible, namely the parametric, deterministic or stochastic methods. Normally, and in the absence of market prices for the outputs of the public goods or services, what is calculated in practice is the so-called efficiency technique. A summary of some of these methodologies is presented in picture 1.

PICTURE 1
Analysis of efficiency: methodologies



Prepared by the author.

Technical efficiency is one of the two components of economic efficiency, also denominated X-efficiency. The second component is allocation efficiency and both are combined as follows: *economic efficiency* = *technical efficiency* × *allocation efficiency*. The unit of decision (country, agency, school, sector, company, etc.) is technically efficient if it is capable of obtaining maximum output based on a certain group of inputs (output orientation) or if it is capable of minimizing the inputs used in the production of the same level of output (input orientation). On the other hand, allocation efficiency reflects the capacity of the decision unit to use the various inputs in optimal proportions.

2. The reader interessed in these methods may consult, for example, Simar and Wilson (2007) for further technical details.

The following example illustrates in a simple manner the construction and use of a frontier of production possibilities, or efficient frontier, using the FDH non-parametric method. Supposing that the followings values for a performance indicator in the public sector, output, as well as the respective levels of public expenditure, input, are observed in three countries:

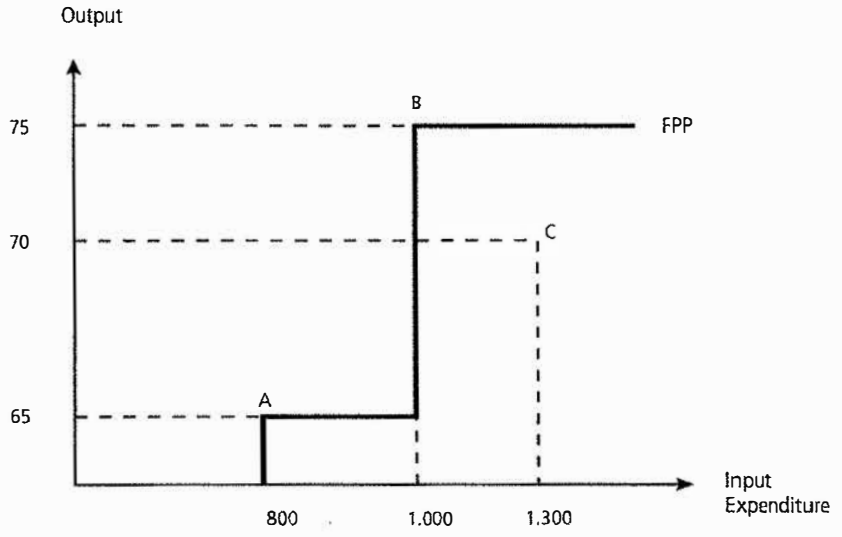
TABLE 1
Performance and public expenditures in countries A, B and C

Country	performance Index	Public expenditure (thousand euros)
A	65	800
B	75	1.000
C	70	1.300

Prepared by the author.

Public expenditure is smaller in the country A, but the level of performance is also the lowest. Country C has the highest value of expenditure, but country B is the one that obtains the most value in terms of performance. The example referred to allows one to build the frontier of production possibilities (or efficient frontier) represented in picture 2.

PICTURE 2
Frontier of Production Possibilities (FPP)



Prepared by the author.
Obs.: Input – expenditure in thousand euros;
Output – performance index.

Country C may be considered inefficient given that its performance is lower than that of country B, which obtains better performance with a lower level of expenditure. On the other hand, neither country A nor country B can be considered inefficient according to the above criterion. Countries A and B are supposedly located on the frontier of production possibilities.

The inefficiency of country C can be measured in two alternative forms:

a) Through the vertical distance between point C and the efficient frontier, the difference between the level of output that would be obtained in case all the expenditure was done in an efficient way and the level effective of output are evaluated. In the current example, the loss in terms of efficiency is of five units, i.e., in efficiency conditions country C should obtain, at least, the same level of performance as country B. That is, the loss in terms of efficiency in country C is of around 6.7% (=5/75). Here, efficiency is evaluated in terms of output.

b) Through the horizontal distance between point C and the efficient frontier. In this case, the difference between the level of input that should be necessary and that effectively used is evaluated, being the loss in terms of expenditure of 300 thousand euros. That is, the loss in terms of efficiency in country C is of around 23.1% (=300/1.300) of the expenditure done. To reach the level of performance of 70, it should not be necessary to spend more than 1000 thousand euros, as may be seen in the case of country B. In this case, efficiency is evaluated in terms of input.

It should be noted that instead of using the FDH method, such as in Picture 2, which does not impose restriction on convexity, if the DEA method is used, the efficient frontier would link in a straight line points A and B, which implies that the degree of inefficiency in country C would be even larger in terms of input. Indeed, the DEA method is more demanding than the FDH method – the country that is efficient in a FDH analysis isn't always efficient in a DEA analysis, but the country that is efficient in a DEA analysis will also be efficient in the FDH approach. In more generic terms, the coefficients of efficiency of input and of output in the FDH will be smaller than or equal to the coefficients in the DEA.

2 RELATIVE EFFICIENCY OF THE STATE

Usually the empirical studies on efficiency consider financial measures as the most relevant variables. Actually, one may assume that the public expenditure in percentage of the GDP may reflect the costs of opportunity to reach a certain

level of performance in the public sector. Therefore, it is possible to observe that in the OECD the ratio of public expenditure to GDP has dropped moderately since the 1993 peak, remaining at a little over 40 percent in 2002. However, the public expenditure ratio varies considerably among OECD member countries. For example, the average public expenditure in 1990 ranged from around 35 percent of GDP in the to 64 percent in Sweden. These differences are essentially related to the larger or smaller extension of the State social security programs in each country, being that significant differences are also found in terms of public expenditure in education and health in several countries.[3]

As seen before, it is important to know to what extent public expenditures are done in an efficient manner. Therefore, one needs to try to measure appropriately the efficiency of the State, particularly with respect to the rendering of public goods and services. It is a difficult issue to address, since studies on performance and efficiency in the public sector are not common, in particular when one intends to do international comparisons.[4]

Even though admitting the possibility that in some cases the costs of rendering public goods and services may grow more than in the private sector, the increase of public expenditure must be seen as a cause for concern in several countries. In this context, the existence of performance indicators in the public sector that allow the establishment international comparisons is very useful. These indicators may be used to determine the relative efficiency of each country or sector of activity in the State.

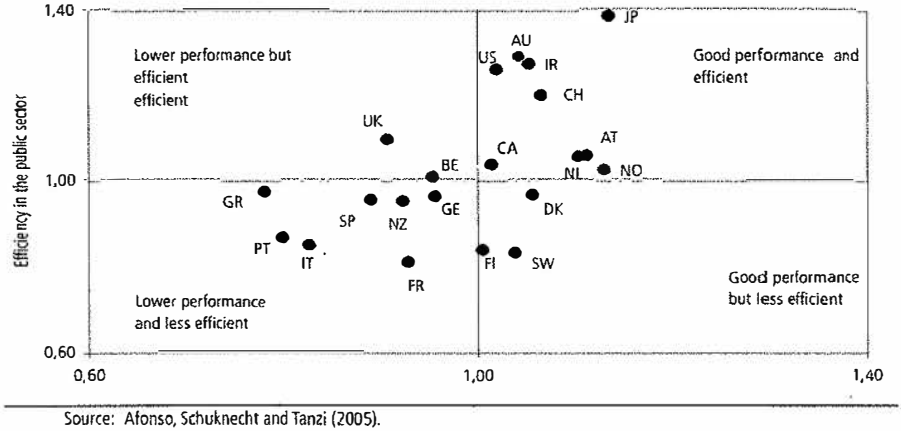
In order to obtain a composite indicator to evaluate the performance of public administrations, Afonso, Schuknecht and Tanzi (2005) used several performance sub-indicators of the public sector that take into consideration, for example, the performance of the areas of administration, education, health and public infrastructure. The use of a larger group of indicators also allows the use of information on the functions of the State enunciated by Musgrave: macroeconomic stabilization, redistribution of returns and efficient resource allocation. Therefore, it is possible to obtain performance indicators compiled

3. See, for example, EC (2002) and OECD (2003).

4. Some recent examples of evaluation of the efficiency in public expenditures may be referred to: Clements (2002), eduction in Europea; Gupta and Verhoeven (2001), education and health in Africa; Afonso, Schuknecht and Tanzi (2005, 2006), performanece and efficiency of the public expenditure in OECD and the new Member States of the EU; Afonso and St. Aubyn (2005, 2006), health and education in OECD; Afonso and Santos (2005), University tuition in Portugal; Afonso and Scaglioni (2005), regions in Italy; Afonso and Fernandes (2006), expenditures of the municipalities of the Lisbon region; Boueri and Gaparini (2006), expenditures of the municipalities in Brazil; Afonso and St. Aubyn (2006a, b), respectivelly for educaçtion and health in OECD controlling the existence of exogenous factors.

from the several indexes. For example, in the construction of the performance index of the public sector in the administrative area, Afonso, Schuknecht and Tanzi (2005) ascribe the weight of 25% to each sub-indicator related with bureaucracy, efficiency in the judicial system, corruption and size of the underground economy.

PICTURE 3
Performance and efficiency (2000)



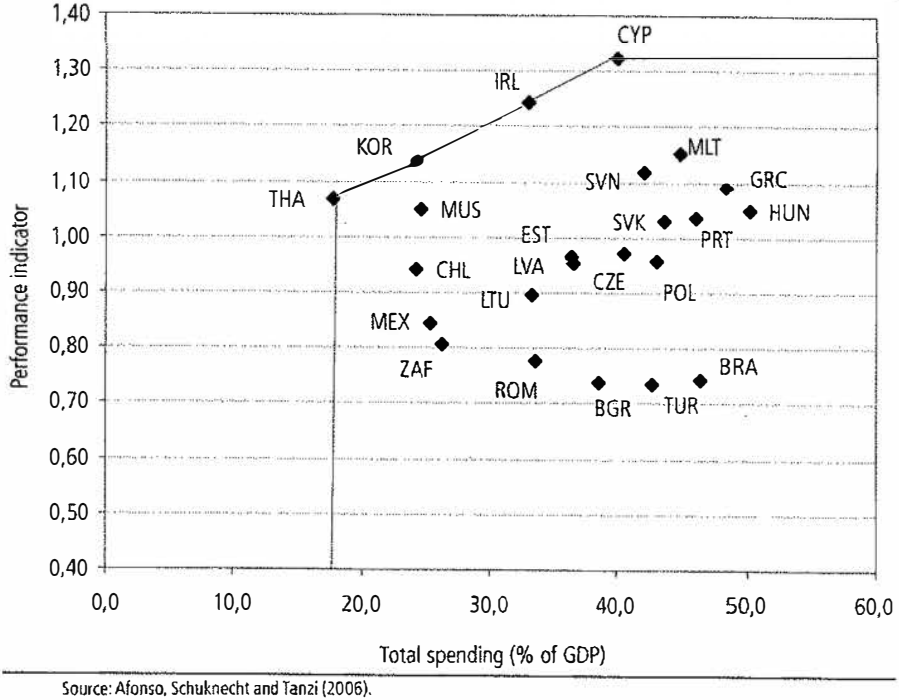
Source: Afonso, Schuknecht and Tanzi (2005).
Note: AU – Australia, AT – Austria, GR – Greece, GE – Germany, NZ – New Zealand, SP – Spain, IT – Italy, PT – Portugal, FR – France, FI – Finland, SW – Sweden, DK – Denmark, BE – Belgium, UK – United Kingdom, - CA – Canada, NL – Holland, NO – Norway, CH – Switzerland, IR – Ireland, JP – Japan, US –United States of America.

Picture 3 shows the ranking of the OECD countries in terms of performance-efficiency in the State in 2000.[5] It is interesting to observe the existence of countries with a good level of performance (in the two quadrants on the right side), not only with low level of efficiency (Finland, Sweden and Denmark), but also with high level of efficiency (Austria, Japan, Ireland and USA). Overall, it is possible to conclude that similar levels of outputs in the public sector, and above average, can be reached with different levels of resources allocated to public expenditure. In practice, such economic policy decisions should be seen as specific for each country.

Based on a similar methodology, Afonso, Schuknecht and Tanzi (2006) evaluate equally the efficiency of the State expenditure for a group of emerging economies and for the new European Union Member States. The efficient frontier resulting from the use of the input (public expenditure) and the output (composite performance indicator) is presented in picture 4.

5. More detailed data are presented in the Appendix.

PICTURE 4
Frontier of production possibilities (2001-03)



Source: Afonso, Schuknecht and Tanzi (2006).

BGR – Bulgaria; BRA – Brazil; CHL – Chile; CYP – Cyprus; CZE – Czech Republic; EST – Estonia; GRC – Greece; HUN – Hungry; IRL – Ireland; KOR – Korea; LTU – Lithuania; LVA – Latonia; MEX – Mexico; MLT – Malta; MUS – Mauritius; POL – Poland PRT – Portugal; ROM – Romania; SVK - Slovakia; SVN – Slovenia; THA – Thailand; TUR – Turkey; ZAF – South Africa.

In the case of the new member states of the European Union, a different behavior is observed, with some of these countries being quite distant from the efficient frontier. Four countries, some of which obtained in the sample the highest performance composite index, are located either on the efficient frontier or very near it: Thailand, Korea, Ireland and Cyprus. Brazil, Bulgaria, Turkey and Romania are the farthest from the frontier, indicating that there is some room for improvement of the efficient rendering of public goods and services in these cases.[6]

3 EFFICIENCY IN EDUCATION AND IN HEALTH

The expenditures done in the sectors of education and health are the expenditure programs that in principle contribute most to improve the redistribution of resources, and that seek to address the issue of rendering goods and services

6. See Appendix.

to correct some of the weaknesses of the market mechanisms. On the other hand, the expenditure in education, whether public or private, is normally considered one of the sources of long-term economic growth.

For example, Afonso and St. Aubyn (2005) evaluate the efficiency of education in secondary education of the OECD countries in 2003 using quantitative and financial measures (public expenditure in education at the secondary education level) as inputs. As performance indicator in the secondary education an index calculated by the OECD (the PISA indicator) is used, being the input indicators the followings: number of hours a year spent in the school by the students and number of teachers per students. The results of the analysis of efficiency in education in secondary education are partially reproduced in table 2.[7]

In the first sentence it seems that expenditures with education are included. In the second, it seems that the inputs are only for number of hours a year spent at school by the students and number of teachers per students and that the output is the PISA indicator.

TABLE 2
Efficiency in education, secondary education (2003)

Country	Efficiency of the inputs	Ranking	Most efficient country
Germany	0.961	5	Korea
Australia	0.850	12	Korea
Belgium	0.689	17	Sweden
Korea	1	1	
Denmark	0.912	9	Sweden
Spain	0.876	11	Sweden
Finland	1	1	
France	0.832	13	Korea
Greece	0.758	15	Sweden
Hungry	0.801	14	Sweden
Italy	0.730	16	Sweden
Japan	1	1	
New Zealand	0.914	8	Korea
Portugal	0.879	10	Sweden
United Kingdom	0.922	7	Korea
Republic Czech	0.931	6	Sweden
Sweden	1	1	
Average	0.886		

Source: Afonso and St. Aubyn (2005).
FDH analysis: inputs (hours a year in school, teachers by 100 students), output (PISA indicator of the OECD for the performance of the students in secondary education), assuming a variable scale of returns.

7. According to the authors, the expenditures with education at the secondary education level are essentially public, mainly in Europe (in 2000, 92.4% of the total expenditures in education of the European Union was public). The public expenditures in health are usually more than half the total expenditure, being on average around 72.2% of the total in the OECD in 2000.

In table 2, the countries with the efficiency index of one (the maximum value) are positioned on the frontier of production possibilities. This is to say that for the sample of countries analyzed, no other country can obtain a higher performance using the same or a lower level of resources. In other words, the efficiency index of the inputs of the country indicates in this case the least inputs the country could use to obtain the same level of output. For example, on average, the sample of OECD countries would reach the same level of output in terms of secondary education with a 11.4% reduction of resources (1-0,886).[8]

According to the results presented by the authors, for example, Hungry is less efficient than Sweden, since the former presents a smaller number of hours spent in school by the students and the highest student-teacher ratio. On the other hand, Sweden has the best performance in terms of output in the PISA indicator of the OECD on the quality of the results in secondary education.[9]

It's not clear to me why in table 2 the reference efficient country is sometimes Sweden, sometimes Korea and why Japan and Finland, which also obtained index 1, are not used as references.

Afonso and St. Aubyn (2006b) also analyze efficiency in the rendering of public health services for the group of OECD countries, using namely quantitative inputs: number of doctors, nurses, hospital beds and medical equipment. As performance measures for each country, infant mortality, life expectancy and the number of years of life not lost are used. Table 3 presents a partial summary of some of the results obtained.

For this sample of OECD countries, and according to the results presented in table 3, efficiency gains would be possible on average, since the countries can obtain the same level of performance in terms of results in the health sector with 28.9% less resources (1-0,711).

8. These calculations may be seen as an approximation of the potential direct cost due to inefficiency in the rendering of public services. However, the indirect costs, which imply a greater loss in terms of consumer well being, should also be taken into account. Afonso and Gaspar (2006) analyze this issue.

9. It should be noted that these results are somewhat different, as the authors refer to, when a monetary measure of public expenditure is used directly as input, such as, for example, public expenditure by student in secondary education. Indeed, the fact that salaries are naturally higher in the more developed countries has to be taken into consideration.

TABLE 3
Efficiency in health (2003)

Country	Efficiency of the inputs	Ranking	Most efficient Country
Germany	0.780	14	Sweden, Japan
Australia	0.908	10	Canada, Sweden, Korea, Finland
Austria	0.767	15	Sweden, Japan
Canada	1	1	
Korea	1	1	
Denmark	0.731	16	Korea, Japan, Sweden, Finland
Slovakia	0.375	20	Korea, Sweden, Japan
Spain	1	1	
USA	1	1	
Finland	1	1	
France	0.904	11	Sweden, Spain
Hungry	0.228	21	Korea, Sweden, Japan
Italy	0.875	12	Sweden, Japan
Japan	1	1	
Luxemburg	0.729	17	Korea, Sweden, Japan
Poland	0.533	19	Spain, Korea
Portugal	0.923	9	Spain, Korea
United Kingdom	0.935	8	Canada, Sweden, Korea, Finland
Czeck Republic	0.628	18	Sweden, Japan
Sweden	1	1	
Switzerland	0.858	13	Sweden, Japan
Average	0.711		

Source: Afonso and St. Aubyn (2006b). DEA analysis: inputs (doctors, nurses, hospital beds, medical equipment); outputs (infant mortality, life expectancy and the number of years of life not lost), assuming variable returns of scale.

Seven countries are located on the efficient frontier: Canada, Korea, Spain, USA, Finland, Japan and Sweden. Canada, Finland, Japan, Spain and Sweden are on the efficient frontier for having good performance in terms of the composite output indicator, with above-average results. On the other hand, the Korea and the USA are normally below the average in terms of resources used. The other group of countries is located on the opposite side – Hungry, Slovakia and Poland. The DEA approach indicates that the output of these countries would increase significantly if they were located on the efficient frontier.

4 CONCLUSION

Adequate evaluation of efficiency in the public sector and of the services rendered by the State is not always a simple theme to deal with empirically. On the other hand, there are few empiric studies that enable international comparisons in aggregate terms. Yet, most of the studies seam to conclude that the level of public expenditure may be reduced and more efficient. Additionally, it is always

necessary to consider the options of economic policy available to policy makers, which is difficult to include in any quantitative analysis.

Taking into account the existing results in the literature, countries with smaller public sectors seam to have a degree of efficiency above average. Nevertheless, the interpretation of the results has to take into consideration that correct measurement may have an important role when making comparisons between countries. Another aspect that requires some care in this type of comparison is, for example, the fact that countries differ in terms of the weight of public and private expenditure in relation to the total expenditure. For example, in sectors such as education and health, a possible source of inefficiencies may result from the interaction between those two types of financing of expenditure.

Be as it may, and even though the evaluation of quality and efficiency of public expenditure is extremely important, some care is needed in reading the results of the empirical studies. Indeed, more important than identifying the relative differences in the efficiency of specific sectors between countries, the major challenge is to reduce such differences. This issue is particularly relevant for countries with high public deficits, since their budget re-equilibrium necessarily requires public expenditure contention.

In this sense, decision makers may evaluate what is done differently in other countries, with a higher degree of efficiency, and see at which point modifications of economic policy are possible and/or desirable internally, to improve the efficiency of the respective public expenditure, whether totally or in sector terms. That is, the evaluation of the quality of every euro spent by the State is clearly becoming a more pertinent and current issue.

APPENDIX

TABLE A1
Efficiency index in the public sector (2000)

Country	Efficiency of the inputs	Ranking	Efficiency of the outputs	Ranking
Germany	0.72	16	0.79	17
Australia	0.99	4	0.92	7
Austria	0.67	17	0.92	8
Belgium	0.66	19	0.79	18
Canada	0.75	12	0.84	13
Denmark	0.62	21	0.87	11
Spain	0.8	10	0.78	19
USA	1	1	1	1
Finland	0.61	22	0.83	14
France	0.64	20	0.77	20
Greece	0.73	14	0.65	23
Holland	0.72	15	0.91	9
Ireland	0.96	5	0.93	6
Iceland	0.87	7	0.9	10
Italy	0.66	18	0.68	22
Japan	1	1	1	1
Luxemburg	1	1	1	1
Norway	0.73	13	0.93	5
New Zealand	0.83	9	0.81	15
Portugal	0.79	11	0.7	21
United Kingdom	0.84	8	0.8	16
Sweden	0.57	23	0.86	12
Switzerland	0.95	6	0.94	4
Average	0.79		0.85	

Source: Afonso, Schuknecht and Tanzi (2005). FDH, Assuming variable returns of scale.

TABLE A2

Efficiency index in the public sector (2001-03)

Country	Efficiency of the inputs	Ranking	Efficiency of the outputs	Ranking
South Africa	0.68	8	0.69	19
Brazil	0.38	22	0.56	22
Bulgaria	0.46	15	0.56	21
Chile	0.73	5	0.82	8
Cyprus	1	1	1	1
Korea	0.98	4	0.99	4
Slovakia	0.41	20	0.78	12
Slovenia	0.53	12	0.84	7
Estonia	0.49	13	0.75	13
Greece	0.41	19	0.82	9
Hungry	0.36	23	0.79	10
Ireland	1	1	1	1
Latvia	0.49	14	0.74	14
Lithuania	0.54	10	0.72	18
Malta	0.56	9	0.87	6
Mauritius	0.72	6	0.91	5
Mexico	0.70	7	0.73	16
Poland	0.41	18	0.72	17
Portugal	0.39	21	0.78	11
Republic Czech	0.44	16	0.74	15
Romania	0.53	11	0.62	20
Thailand	1	1	1	1
Turkey	0.42	17	0.56	23
Average	0.59		0.78	

Source: Afonso, Schuknecht and Tanzi (2006). DEA, Assuming variable returns of scale.