OECD Economics Department Working Papers No. 1058

Assessing the Efficiency of Welfare Spending in Slovenia with Data Envelopment Analysis

Matevz Hribernik,

Rafal Kierzenkowski

https://dx.doi.org/10.1787/5k44v5373q0q-en

OECD

Unclassified **ECO/WKP(2013)50**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development **14-Jun-2013**

English - Or. English

ECONOMICS DEPARTMENT

ECO/WKP(2013)50
Unclassified

ASSESSING THE EFFICIENCY OF WELFARE SPENDING IN SLOVENIA WITH DATA ENVELOPMENT ANALYSIS

ECONOMICS DEPARTMENT WORKING PAPERS No. 1058

By Matevz Hribernik and Rafał Kierzenkowski

JT03341873

Complete document available on OLIS in its original format

English - Or. English

ABSTRACT/RÉSUMÉ

Assessing the efficiency of welfare spending in Slovenia with data envelopment analysis

This paper derives estimates of the efficiency of welfare spending in Slovenia and the other OECD countries from data envelopment analysis based on model specifications used in earlier OECD studies. Results suggest that Slovenia ranks about 25th among OECD countries for output efficiency: for a given level of spending outcomes fall short by around 3.5% in health care, by 10% in secondary education and by around one third in public administration. Results also suggests that Slovenia ranks 18th to 27th in the OECD for input efficiency as the same outcomes could be reached by scaling back costs by around half. Alternatively, spending increases could be contained and outcomes improved by increased cost efficiency. Statistical uncertainty surrounding input efficiency estimates is high for countries with the smallest scope for potential savings. Confidence intervals around output efficiency scores are also wide for some emerging market economies.

JEL Classification: C14, I18, I28, I38, H83
Keywords: Slovenia, OECD, welfare spending, health, secondary education, PISA, public administration, data envelopment analysis, efficiency.

****

Évaluation de l'efficacité des dépenses sociales en Slovénie avec la méthode d'enveloppement des données

Cet article déduit les estimations de l'efficacité des dépenses sociales en Slovénie et dans les autres pays de l'OCDE à partir de l'analyse d'enveloppement des données basée sur les spécifications de modèles utilisés dans les études antérieures de l'OCDE. Les résultats suggèrent que la Slovénie se classe 25ème parmi les pays de l'OCDE pour l'efficacité productive: pour un niveau donné de dépenses les résultats sont en deçà d'environ 3,5% dans les soins de santé, de 10% dans l'enseignement secondaire et d'environ un tiers dans l'administration publique. Les résultats suggèrent également que la Slovénie se classe entre le 18ème et 27ème rang au sein de l'OCDE pour l'efficacité des intrants puisque les mêmes résultats peuvent être obtenus en réduisant les coûts de moitié environ. Alternativement, les hausses de dépenses pourraient être contenues et les résultats améliorés grâce à une meilleure efficacité-coût. L'incertitude statistique entourant les estimations de l'efficacité des intrants est élevée pour les pays ayant la plus faible marge de manœuvre en termes d'économies potentielles. Les intervalles de confiance autour des scores d'efficacité productive sont également larges pour certains pays émergents.

Classification JEL : C14, I12, I28, I38, H83
Mots clefs : Slovénie, OCDE, dépenses sociales, santé, enseignement secondaire, PISA, administration publique, méthode d'enveloppement des données, efficacité.

TABLE OF CONTENTS

Tables

Figures

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law

Assessing the efficiency of welfare spending in Slovenia with data envelopment analysis

By

Matevz Hribernik and Rafał Kierzenkowski[1]

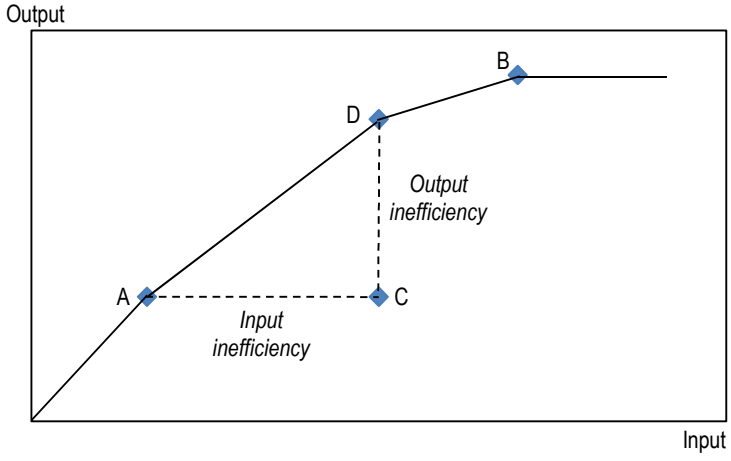
Some methodological aspects

Data envelopment analysis (DEA) is a statistical technique to assess the performance of countries in achieving the best outcomes, as measured against those achieved in other countries, using monetary inputs. More precisely, the method identifies an efficiency frontier by combining best-practice countries, which "envelop" those that are less efficient, in the sense of producing less output for the same input, or having higher costs for the same output. Potential output efficiency gains measure how much output quantities produced could be increased without changing the input quantities used, whereas potential input efficiency gains capture how much input quantities can be scaled back for a given level of output.

Figure 1 illustrates the DEA method for one output and one input. Countries on the frontier (A, B, D) are the most efficient, in the sense that they produce the most output for any input, or use the least inputs to produce a given output. The country below the efficiency frontier (C) can achieve greater cost efficiency for a given level of output (i.e. move from C to A) or by increasing output for a constant input (i.e. move from C to D). The distance to the frontier represents the extent of inefficiency. Other methodological issues and potential caveats regarding this approach are reviewed in Annex A1.

Figure 1. Example of an efficiency frontier

One input and one output, non-increasing returns to scale



1. Economist at the Institute of Macroeconomic Analysis and Development in Slovenia (matevz.hribernik@gov.si), and Senior Economist at the OECD (rafal.kierzenkowski@oecd.org), respectively. The paper was prepared when Matevz Hribernik was external consultant to the OECD and Rafał Kierzenkowski was Head of Hungary/Slovenia desk. The authors are grateful to Debra Bloch, Isabelle Joumard, Cyrille Schwellnus and Douglas Sutherland for substantial technical help about the DEA method, to Pierre Beynet and Robert Ford for comments, and to Desney Erb for statistical assistance.

Health care efficiency

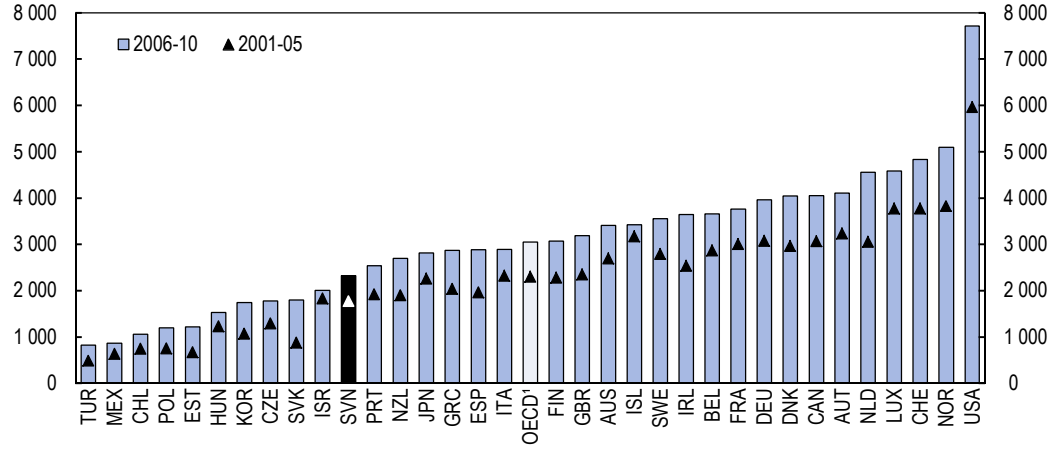
Model specification

The calculation of efficiency scores for health care is based on Häkkinen and Joumard (2007) and Joumard et al. (2008), where health care efficiency is estimated using life expectancy at birth as a proxy of health system's outcomes. Life expectancy has the advantage of being a very broad measure of population's health and is correlated with other indicators of health status. Its main drawback is that it is influenced by factors not directly related to the health system, for example it does not reflect lifestyle differences. Health care spending and a composite indicator controlling for the socio-economic environment and lifestyle factors are two input variables used. Total health spending includes public and private components and is expressed per capita. The composite environment indicator is based on GDP per capita, educational attainment of adult population, nitrogen oxide emissions, fruit and vegetable consumption and alcohol and tobacco consumption. It is calculated using equal weights. The sample includes all 34 OECD countries. The variables used in the estimates are provided in Table A3.1.

There have been noticeable changes and improvements in the health sector in the past decade in OECD countries (Joumard et al., 2010). Life expectancy increased by 2.5 years in the OECD between 2000 and 2010, which reflects reduced mortality at all ages, improved lifestyle and nutrition, and better access to health services. However, total health spending per capita has risen significantly in many countries in nominal terms (Figure 2) and there are large differences in life expectancy at birth and health care spending across the OECD (Figure 3).

Figure 2. Total healthcare spending in OECD countries

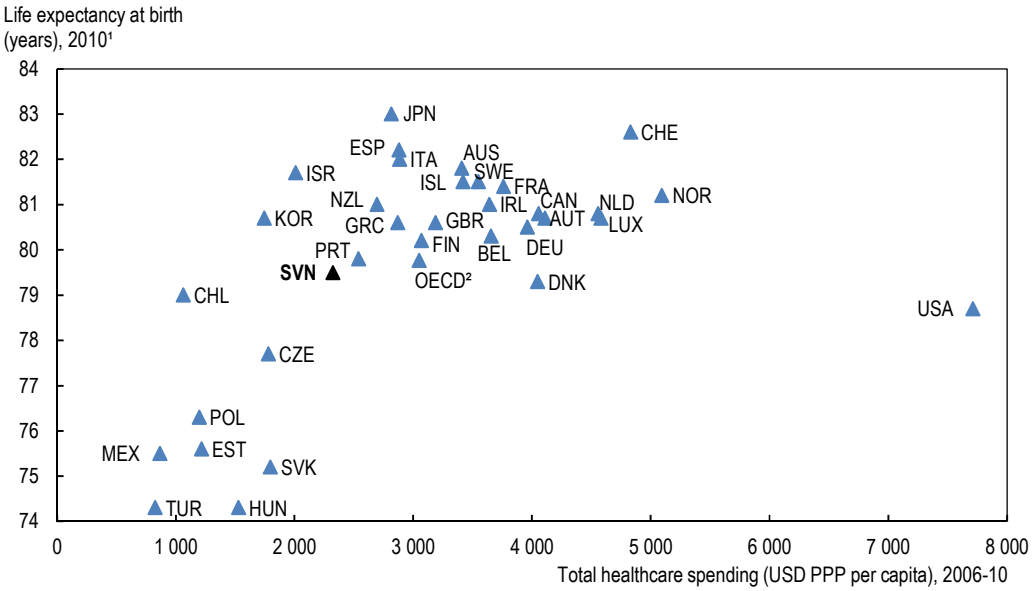
USD PPP per capita, current prices



1. Unweighted average of data shown.

Source: OECD (2012), *OECD Health Statistics* (database).

Figure 3. Life expectancy at birth and healthcare spending in the OECD



1. 2009 for Italy and 2008 for Canada.
2. Unweighted average of data shown.

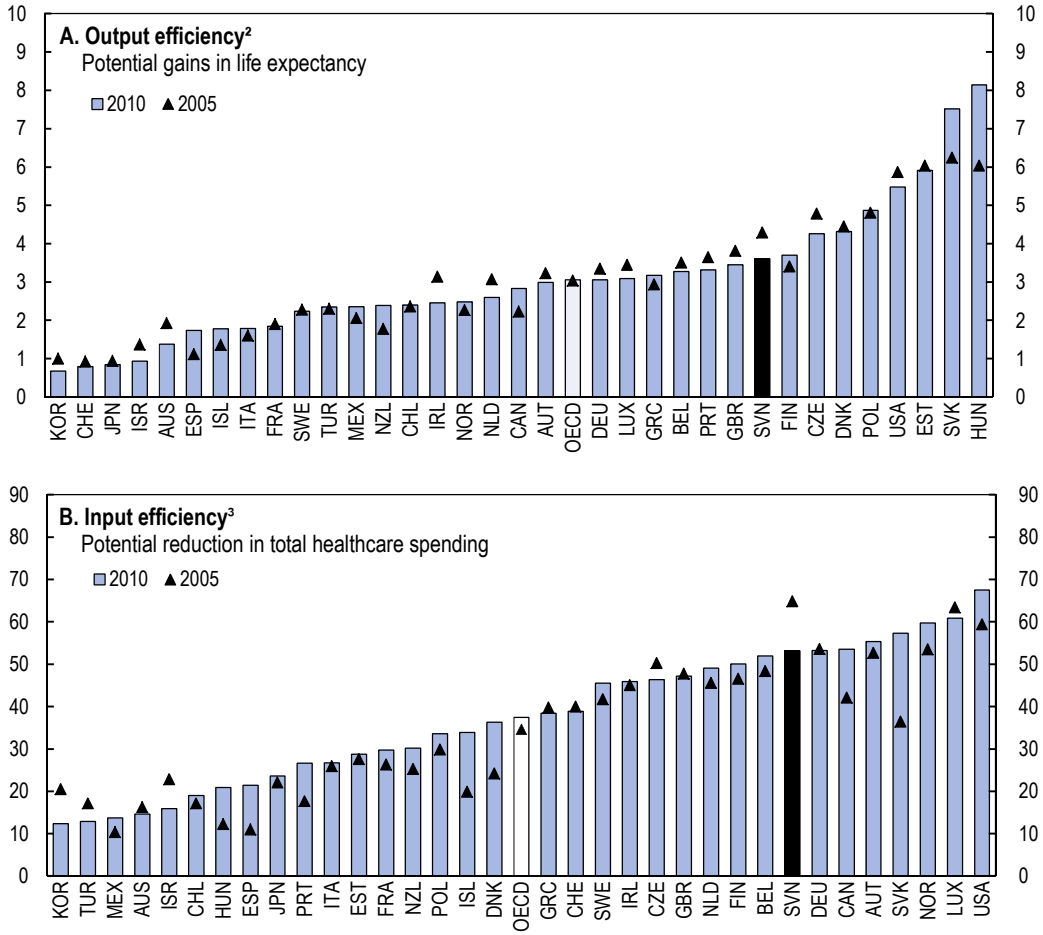
Source: OECD (2012), *OECD Health Statistics* (database).

Estimation results

Results derived from the DEA analysis suggest there is significant scope to boost efficiency by moving to international best practice in health care. Out of 34 OECD countries, Slovenia ranks 26th for output efficiency: life expectancy could be increased by 3.6% (or almost three years) with a more productive use of resources (Figure 4, Panel A). However, Slovenia has a lower efficiency gap than other Central and Eastern European countries (CEECs) and, relative to 2005, it improved its ranking by one notch. For input efficiency, Slovenia ranks 27th (Figure 4, Panel B). Despite a significant improvement in its comparative position since 2005, spending per capita could still be cut by about half while preserving the same life expectancy if efficiency gains were to be exploited fully. However, caution is needed in the interpretation of these results as confidence intervals for input efficiency scores are relatively large for countries that appear close to best practice (see Figure A2.1 and A2.2). Uncertainty surrounding the output efficiency estimates is also quite high for some emerging market economies.

Figure 4. Potential efficiency gains in health care[1]

Per cent



1. Data envelopment analysis (DEA) was performed with one output (life expectancy at birth for 2010 or 2005) and two inputs (a composite indicator of the socio-economic environment and lifestyle factors for 2010 or 2005 and healthcare spending). Averages over the periods 2006-10 and 2001-05 were used for expenditure to capture its effects on performance and smooth its developments.
2. Potential gains are measured if efficiency in a country were to be raised to the level implied by the estimated efficiency frontier while holding inputs constant and under the assumption of non-increasing returns to scale.
3. Potential savings are measured if efficiency in a country were to be raised to the level implied by the estimated efficiency frontier while holding the output variable constant and under the assumption of non-increasing returns to scale.

Population ageing will put pressure on healthcare spending in OECD countries, including Slovenia. If potential efficiency gains were fully exploited, only a 10% increase in spending per capita would be needed in Slovenia (and in most of the OECD countries) to sustain the same gains in life expectancy from 2010 to 2020 as have occurred over the previous ten years (Figure 5). Put differently, there is scope to reduce health expenditure in Slovenia by nearly 1.5% of GDP in 2020 by reaping efficiency gains relative to an increase in spending at the same pace as occurred between 2000 and 2010 (Figure 6).

Figure 5. Rise in per capita spending needed to improve health outcomes as much as in the previous decade

Percentage increase

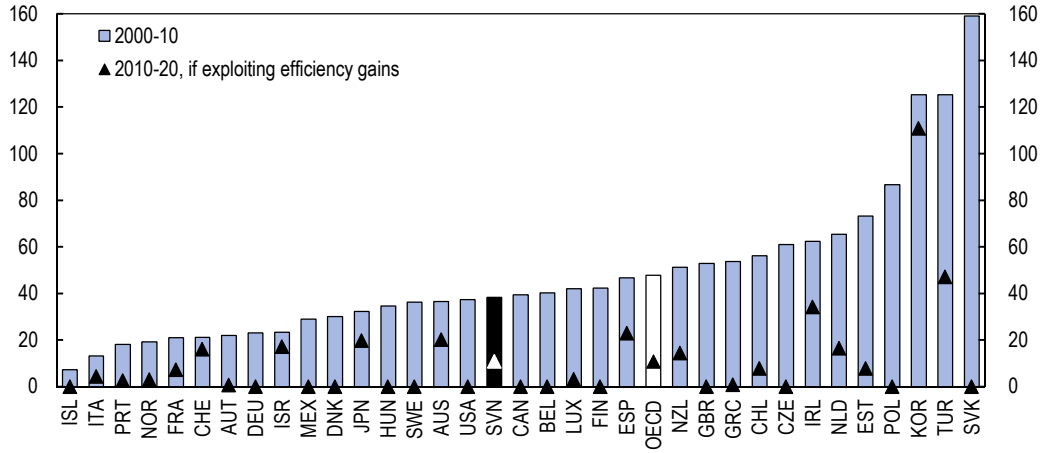
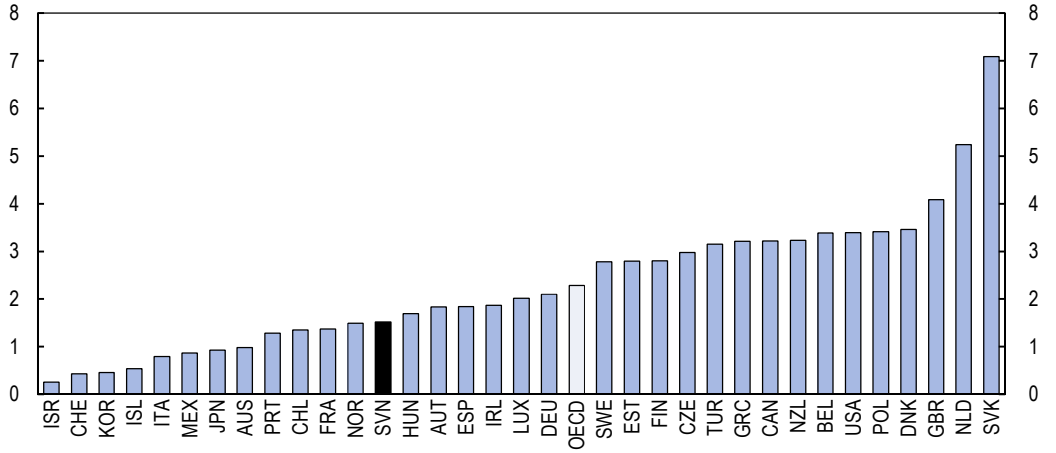


Figure 6. Potential savings in future healthcare spending[1]

Per cent of 2020 GDP



1. Potential savings represent the difference between a no-reform scenario and a scenario where countries would exploit efficiency gains. The no-reform scenario assumes that between 2010 and 2020 life expectancy and spending increase at the same pace as over the previous ten years and that the mix between public and private spending remains constant over time.

Secondary education efficiency

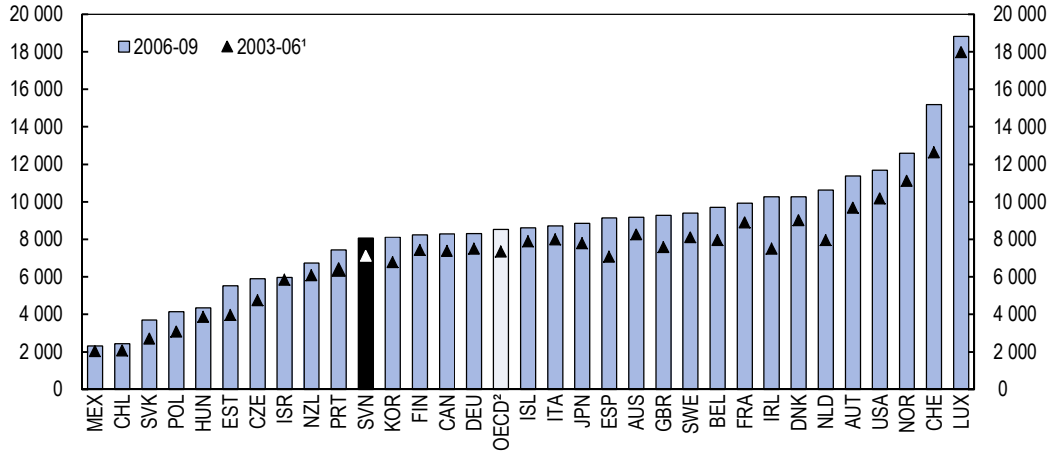
Model specification

The model specification used in the calculation of the efficiency of the education system is based on the approach developed by Sutherland et al. (2007), and extended by Schwellnus (2009). The outcome variable is the PISA (Programme for International Student Assessment) synthetic score, which combines, with equal weights, mean scores of reading literacy, mathematics and science. The inputs are full-time equivalent spending per student in secondary education and, to control for family background, the PISA index of economic, social and cultural status. It would have been preferable to use cumulative spending over students' theoretical years of schooling or include primary school expenditure per student. Such data are either not available for Slovenia or available only for a limited subset of OECD countries. The sample includes 32 OECD countries and the variables used in the estimates are provided in Table A3.2.

Spending per student has risen in nominal terms in all OECD countries (Figure 7), which in many countries has been driven by a high share of compensation of employees. In Slovenia, employee compensation is almost 80% of total expenditure in non-tertiary education, which is similar to the OECD average. Spending per student in secondary education is in Slovenia at a higher end of countries with broadly comparable levels of economic development. At the same time, Slovenia's synthetic PISA score is lower than in Korea or New Zealand, but higher than in the Czech Republic, Israel or Portugal (Figure 8).

Figure 7. Spending on secondary education in OECD countries

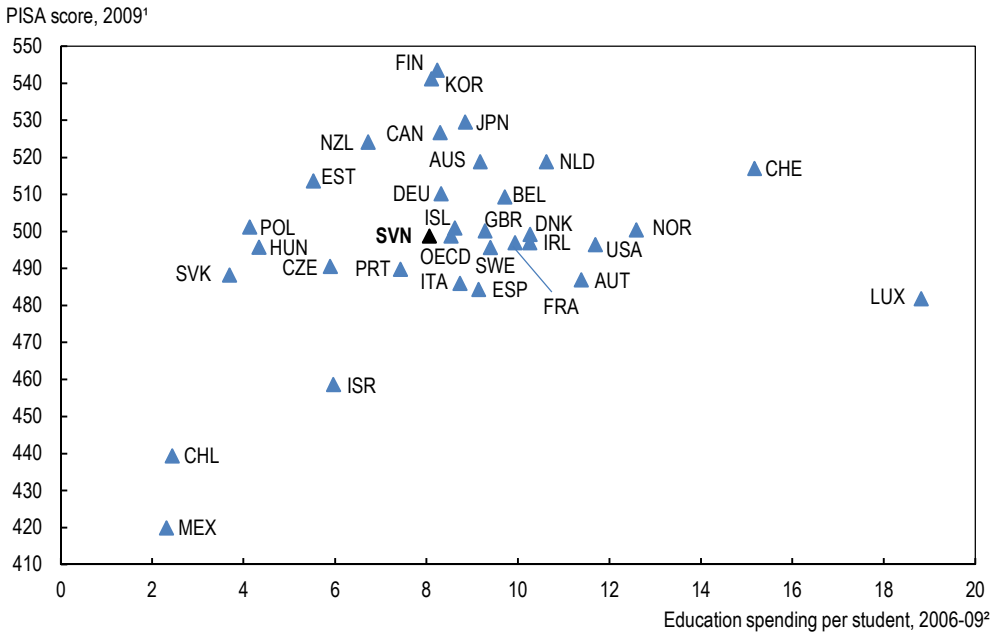
USD PPP per student, current prices



1. 2004-06 for Estonia and Slovenia.
2. Unweighted average of data shown; Greece and Turkey are excluded since no data is available for recent years.

Source: OECD (2006-12), *Education at a Glance*, annual editions.

Figure 8. Performance in secondary education and spending per student in the OECD



1. PISA synthetic score (mean score of reading literacy, mathematics and science).
2. Spending per student in secondary education, in USD at purchasing power parities, average 2006-09.

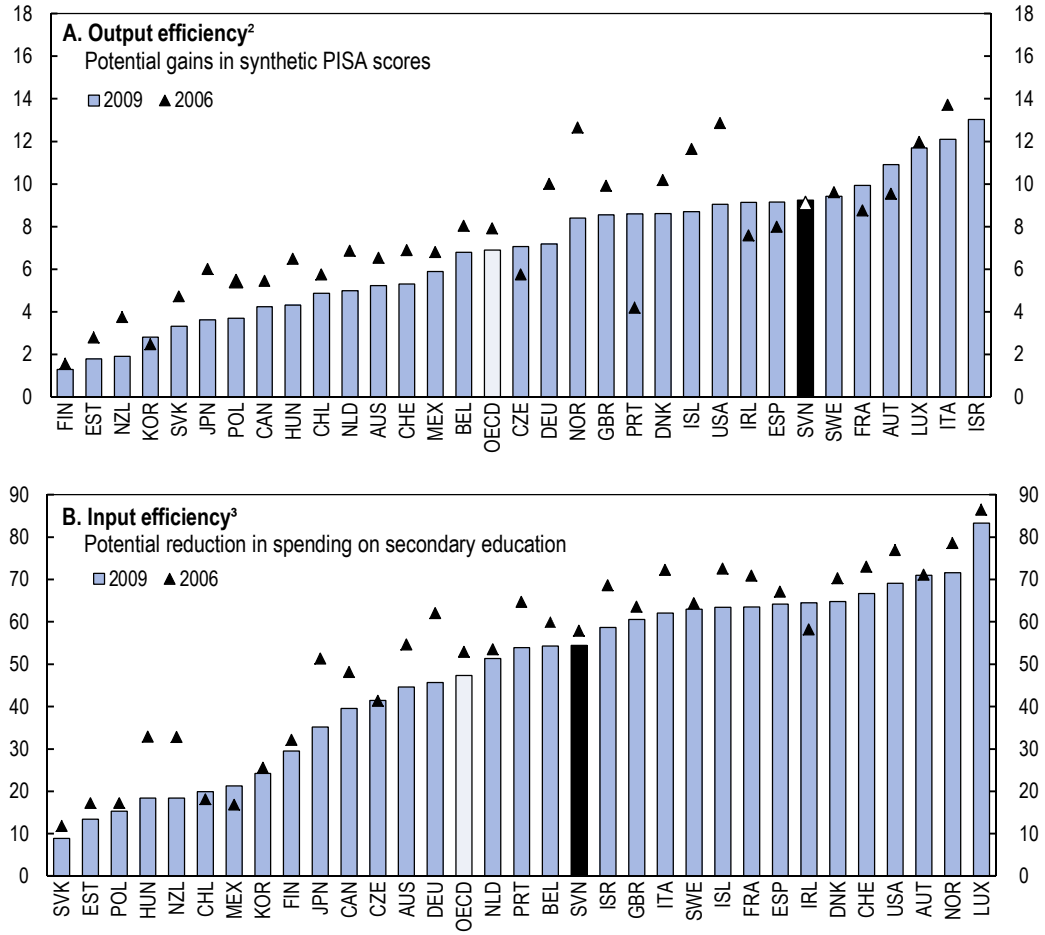
Source: OECD (2009-12), *Education at a Glance*, annual editions and OECD (2010), *PISA 2009 Results: What Students Know and Can Do - Student Performance in Reading, Mathematics and Science* (Volume 1).

Estimation results

The results of the DEA analysis for output efficiency imply that Slovenia ranks 26th out of 32 OECD countries: it could raise its synthetic PISA score by about 9% (or 46 points) at the current level of education spending if resources were used efficiently (Figure 9, Panel A). This is worse than other Central and Eastern European countries, which achieve similar results in PISA scores with lower spending per student. Slovenia's comparative efficiency score has deteriorated over time as the country was ranked 21st in 2006. For input efficiency, Slovenia ranks 18th (Figure 4, Panel B) and the same PISA score could be achieved with slightly less than half of the current spending per capita if Slovenia were to move to the frontier.

Figure 9. Potential efficiency gains in secondary education[1]

Per cent



1. Data envelopment analysis (DEA) was performed with one output (PISA scores for 2009 or 2006) and two inputs (a composite indicator of the socio-economic environment and lifestyle factors for 2009 or 2006 and education spending). Averages over the periods 2006-09 or 2003-06 were used for expenditure to capture its effects on performance and smooth its developments.
2. Potential gains are measured if efficiency in a country were to be raised to the level implied by the estimated efficiency frontier while holding inputs constant and under the assumption of non-increasing returns to scale.
3. Potential savings are measured if efficiency in a country were to be raised to the level implied by the estimated efficiency frontier while holding the output variable constant and under the assumption of non-increasing returns to scale.

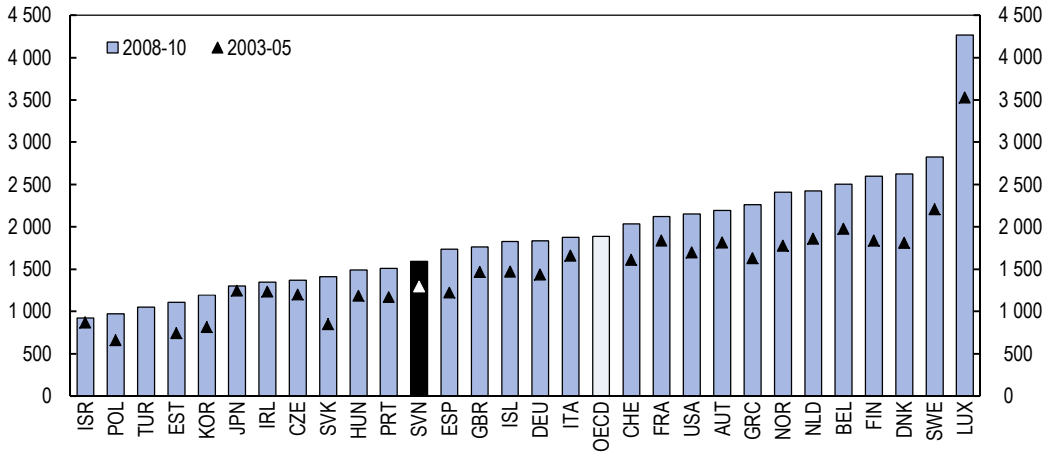
Public administration efficiency

Model specification

Measuring public administration efficiency is difficult due to the selection of relevant outcome indicators. The estimates here are based on the approach proposed by Forthun and Hagemann (2010), first applied by Afonso et al. (2006). A synthetic public administration outcome indicator is constructed, with equal weights, using international surveys on the quality of justice, level of corruption, government inefficiency and bureaucracy. The data are derived from the Global Competitiveness Report of the World Economic Forum (WEF, 2012). The synthetic indicator also includes the level of administrative burden as proxied by the OECD's Product Market Regulation (PMR) index. Total government spending on general public services per capita in current prices (Figure 10) is used as an input variable, augmented with spending on order and safety. Spending on interest payments is not included. In general, higher spending is associated with better outcomes (Figure 11). GDP per capita is used as an environmental variable. The sample is composed of 29 OECD countries and the variables used in the estimates are detailed in Table A3.3.

Figure 10. General public services spending in OECD countries

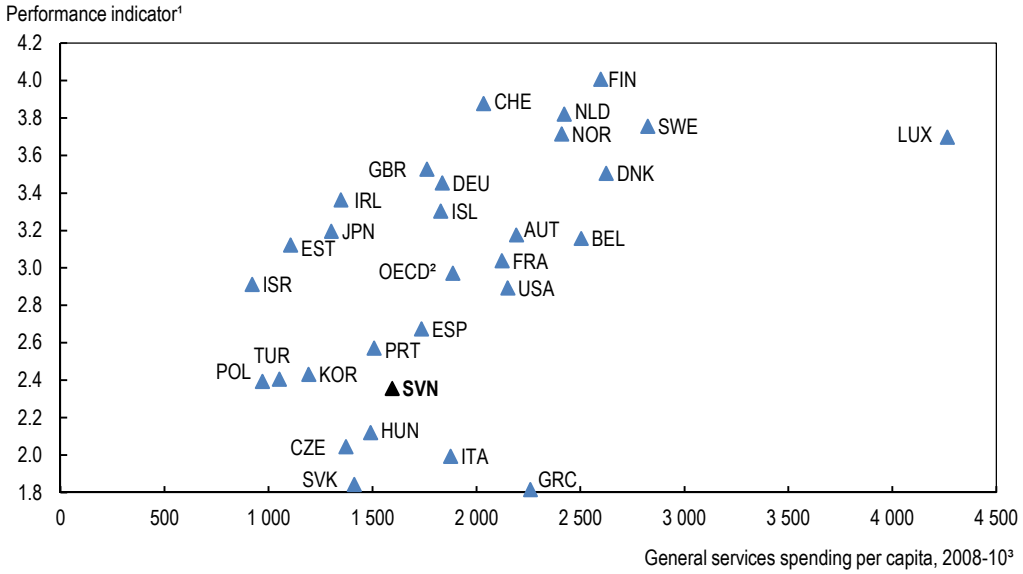
Excluding interest payments, in USD PPP per capita, current prices[1]



1. The OECD aggregate is an unweighted average of data shown. Data for Japan and Switzerland are estimated for 2003-05.

Source: OECD (2012), *OECD National Accounts Statistics* (database).

Figure 11. Performance in public administration and spending on general services in the OECD



1. Composite performance indicator for public administration outcome based on OECD's Product Market Regulation Indicator (for 2008) to proxy the levels of bureaucracy and results of the 2012 WEF survey on the quality of justice, level of corruption and government inefficiency (data for 2010).
2. Unweighted average of data shown, excluding Australia, Canada, Chile, Mexico and New Zealand due to missing data.
3. In USD purchasing power parities per capita; excluding interest payments.

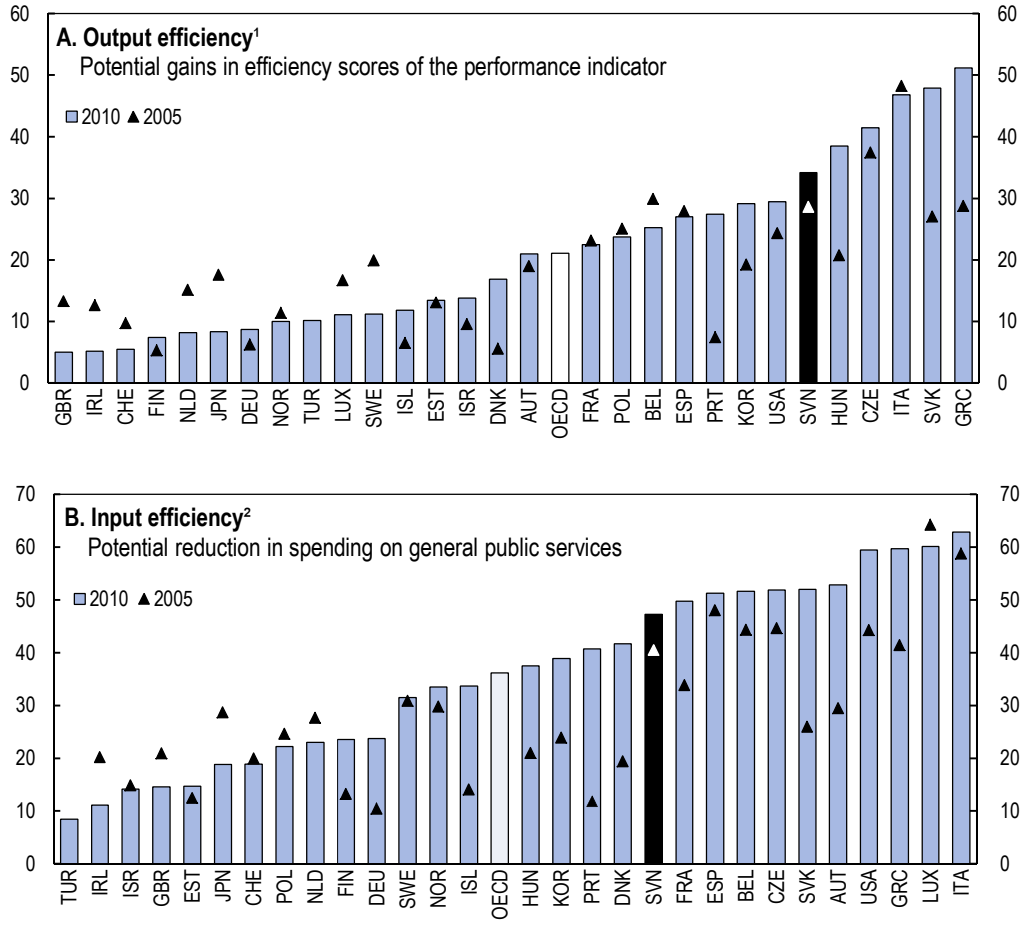
Source: Calculations based on OECD (2012), *OECD National Accounts Statistics* and *OECD Product Market Regulation Statistics* (databases); and WEF (2012), *The Global Competitiveness Index 2012-2013 Data Platform*, World Economic Forum.

Estimation results

Results derived from the DEA approach imply that Slovenia ranks 24th on output efficiency (Figure 12, Panel A). Moreover, the comparative distance to best practice did not change between 2005 and 2010. At the same time, Slovenia could achieve the same output results with a substantial decrease in resources (Figure 12, Panel B). Spending on public administration could be cut by almost half while preserving the same performance if Slovenia were on the efficiency frontier. In interpreting these results, it should be noted that some of the outcome variables used in the analysis are soft (survey-based) indicators, which could be influenced by cyclical developments and general confidence in the economy, among others. For instance, notwithstanding changes in relative prices, large drops in efficiency are recorded in Portugal, Greece and Hungary, countries which have been hard hit by the crisis.

Figure 12. Potential efficiency gains in public administration

Per cent



1. Data envelopment analysis (DEA) was performed with one output (composite performance indicator for 2005 or 2010) and two inputs (GDP per capita for 2005 or 2010 and public administration spending). Averages over the periods 2008-10 or 2003-05 were used for expenditure to capture its effects on performance and smooth its developments.
2. Potential gains are measured if efficiency in a country were to be raised to the level implied by the estimated efficiency frontier while holding the input variable constant and under the assumption of non-increasing returns to scale.
3. Potential savings are measured if efficiency in a country were to be raised to the level implied by the estimated efficiency frontier while holding the output variable constant and under the assumption of non-increasing returns to scale.

Bibliography

Afonso, A., L. Schuknecht and V. Tanzi (2006), "Public Sector Efficiency: Evidence for New EU Members and Emerging Markets", *Working Paper Series*, No. 581, European Central Bank.

Charnes, A., W.W. Cooper and E. Rhodes (1978), "Measuring the Efficiency of Decision Making Units", *European Journal of Operational Research*, Vol. 2, No. 6, Elsevier.

Eugene, B (2008), "The Efficiency Frontier as a Method for Gauging the Performance of Public Expenditure: a Belgian Case Study", Working Paper, No. 138, National Bank of Belgium. http://dx.doi.org/10.2139/ssrn.1685244.

Farrell, M.J. (1957), "The Measurement of Productive Efficiency", *Journal of the Royal Statistical Society*, Vol. 120, No. 3.

Forthun, C. and R.P. Hagemann (2010), "Sustaining the Momentum of Fiscal Reform in Hungary", *OECD Economics Department Working Papers*, No. 802, OECD Publishing, http://dx.doi.org/10.1787/5km7pf8fkg24-en.

Häkkinen, U. and I. Joumard (2007), "Cross-Country Analysis of Efficiency in OECD Health Care Sectors: Options for Research", *OECD Economics Department Working Papers*, No. 554, OECD Publishing, http://dx.doi.org/10.1787/178861806081.

Joumard, I., C. André, C. Nicq and O. Chatal (2008), "Health Status Determinants: Lifestyle, Environment, Health Care Resources and Efficiency", *OECD Economics Department Working Papers*, No. 627, OECD Publishing, http://dx.doi.org//10.1787/240858500130.

Joumard, I., C. André and C. Nicq (2010), "Health Care Systems: Efficiency and Institutions", *OECD Economics Department Working Papers*, No. 769, OECD Publishing, http://dx.doi.org/10.1787/5kmfp51f5f9t-en.

Mattina, T. and V. Gunnarsson (2007), "Budget Rigidity and Expenditure Efficiency in Slovenia", *IMF Working Paper*, No. WP/07/131, International Monetary Fund.

OECD (2011), "A New Look at OECD Health Care Systems: Typology, Efficiency and Policies", *Economic Policy Reforms: Going for Growth 2011*, OECD Publishing.

Schwellnus, C. (2009), "Achieving Higher Performance: Enhancing Spending Efficiency in Health and Education in Mexico", *OECD Economics Department Working Papers*, No. 732, OECD Publishing, http://dx.doi.org/10.1787/220731242856.

Simar, L. and P.W. Wilson (1998), "A General Methodology for Bootstrapping in Non-Parametric Frontier Models", *Papers*, No. 9811, Université Catholique de Louvain, Institut de statistique.

Simar, L. and P.W. Wilson (2000), "Performance of the Bootstrap for DEA Estimators and Iterating the Principle", *Papers*, No. 2, Université Catholique de Louvain, Institut de statistique.

Simar, L. and P.W. Wilson (2005), "Estimation and Inference in Two-stage, Semi-parametric Models of Production Processes", *Journal of Econometrics*, Vol. 136, No. 1, Elsevier.

St. Aubyn, M., A, Pina, F. Garcia and J. Pais (2009), "Study on the Efficiency and Effectiveness of Public Spending on Tertiary Education", *Economic Papers*, No. 390, European Economy, European Commission.

Sutherland, D., R. Price, I. Joumard and C. Nicq (2007), "Performance Indicators for Public Spending Efficiency in Primary and Secondary Education", *OECD Economics Department Working Papers*, No. 546, OECD Publishing, http://dx.doi.org/10.1787/285006168603.

WEF (2012), *The Global Competitiveness Report 2011-12*, World Economic Forum, Geneva

Annex A1. Other methodological issues

The shape of the efficiency frontier depends on the assumption about returns to scale (Sutherland et al., 2007). The results are robust to the specification used and those reported were derived for non-increasing returns to scale. The efficiency scores were corrected for small sample bias using the "bootstrapping" procedure proposed by Simar and Wilson (1998, 2000). This method also provides confidence intervals for the efficiency scores, as the estimates are sensitive to measurement errors, statistical noise and outliers. However, the reliability of an efficiency score depends on the density of observations in the region of the frontier where a country is located. Countries with atypical levels of inputs and outputs could be considered as efficient, but such result could be merely the consequence of a lack of comparable observations (Simar and Wilson, 2005; Joumard et al., 2010).

The DEA method does not require the specification of a production function since this is a non-parametric technique. Yet several potential caveats should be mentioned regarding its implementation (Sutherland et al. 2007; Mattina and Gunnarsson, 2007; Forthun and Hagemann, 2010):

- *Selection of input and output indicators.* It is important to ensure that inputs are compared with outcomes that are actually targeted by policymakers. Identifying a one-size-fits-all model could be difficult in international comparison including a large number of countries. A potential lack of data harmonisation between countries could also be a source of concern. Due to missing price deflators for different types of expenditure, the use of spending in nominal terms does not allow a comparison of changes in efficiency across time (in particular for countries witnessing high inflation), but only across countries. As the DEA method focuses on inputs and outputs that can be quantified, quality effects are not properly accounted for.
- *Sensitivity to outliers and samples.* The DEA method is sensitive to sample selection and outliers can distort efficiency scores. The estimates are likely to be biased upwards when excluding outlier observations from the sample. This problem is aggravated as the number of inputs and outputs rises. If the number of inputs and output is increased in a small sample or if irrelevant variables are included, this is also likely to lead to overestimated efficiency scores.
- *Composite indicators.* Composite indicators are used to summarise complex and multidimensional issues. However, aggregation methods may have a non-negligible impact on results. An undesirable feature of additive aggregation is the implied compensation – poor performance in some indicators can be offset by favourable values of other indicators. This paper assumes equal weights for composite indicators as such approach is, nevertheless, transparent and provides a weighting scheme insensitive to change in period and country coverage.

Annex A2. Uncertainty surrounding efficiency estimates

Figure A2.1. Confidence intervals for healthcare efficiency in 2010

Per cent

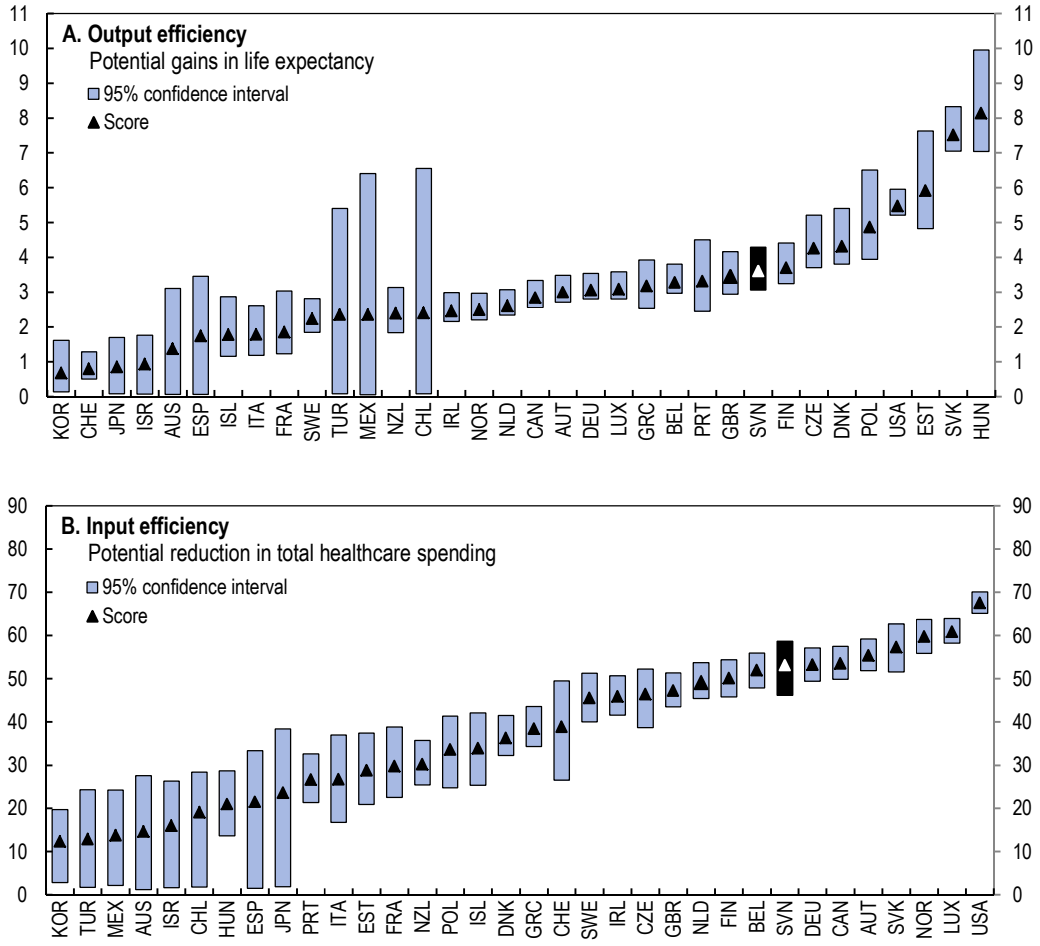


Figure A2.2. Confidence intervals for healthcare efficiency in 2005

Per cent

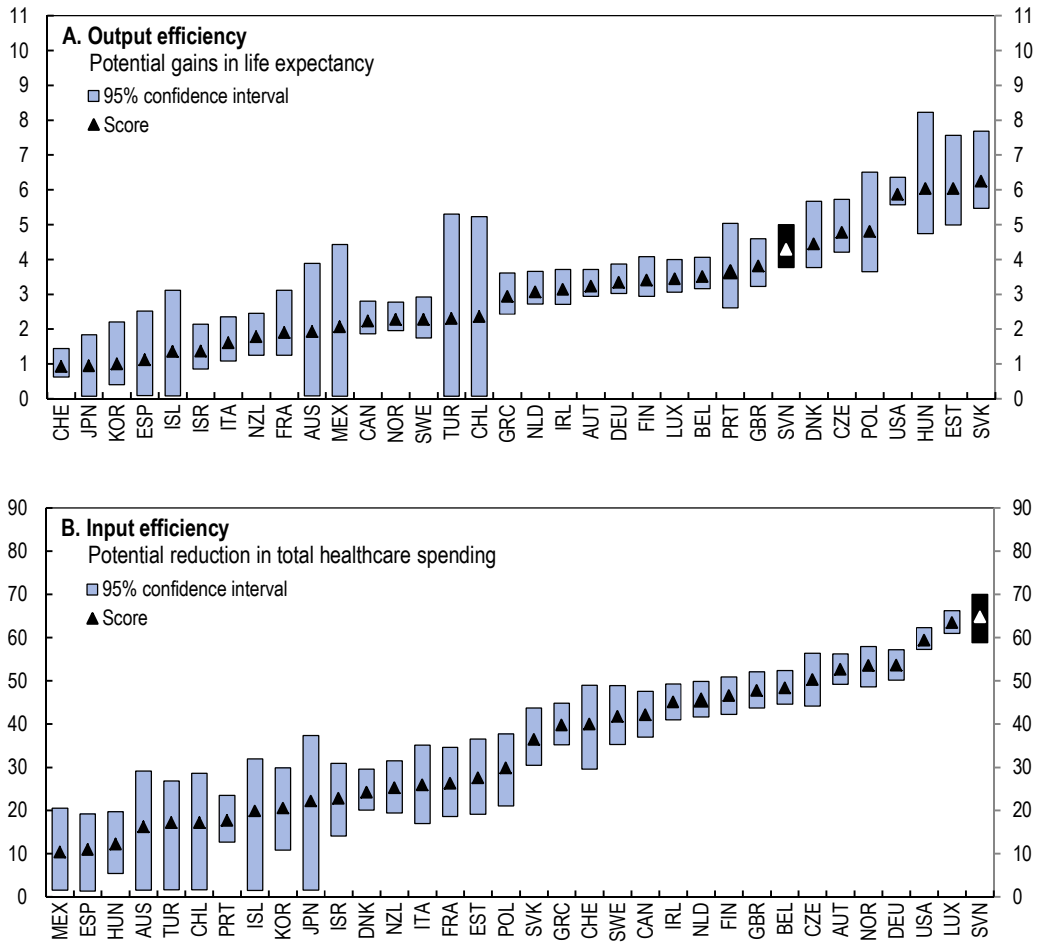


Figure A2.3. Confidence intervals for secondary education efficiency in 2009

Per cent

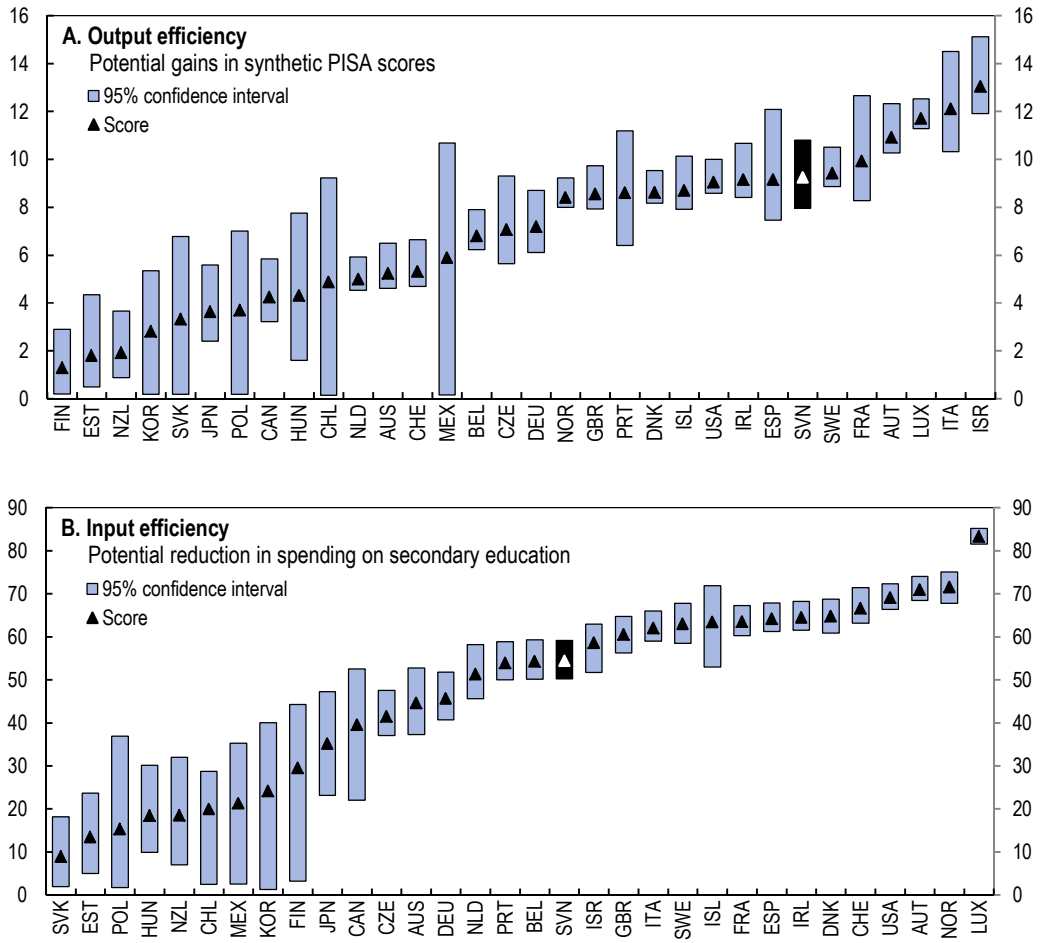


Figure A2.4. Confidence intervals for secondary education efficiency in 2006

Per cent

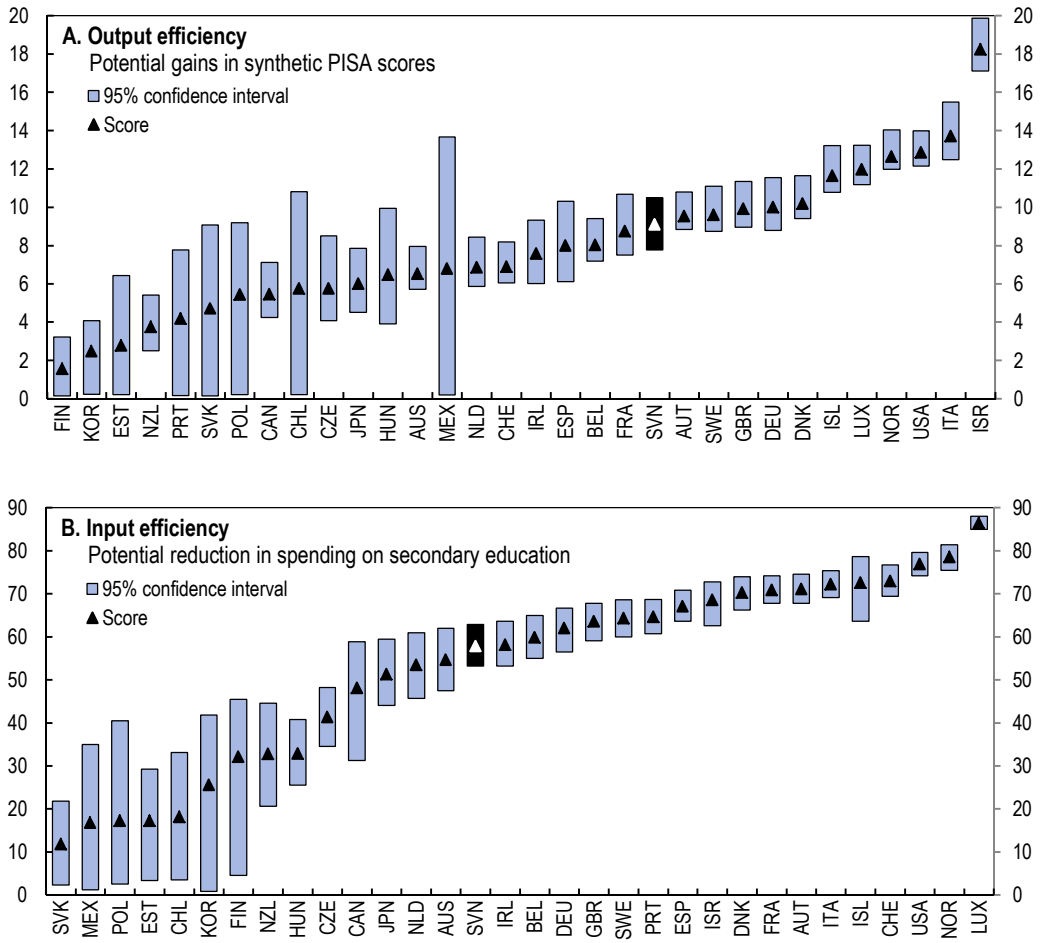


Figure A2.5. Confidence intervals for general public services efficiency in 2010

Per cent

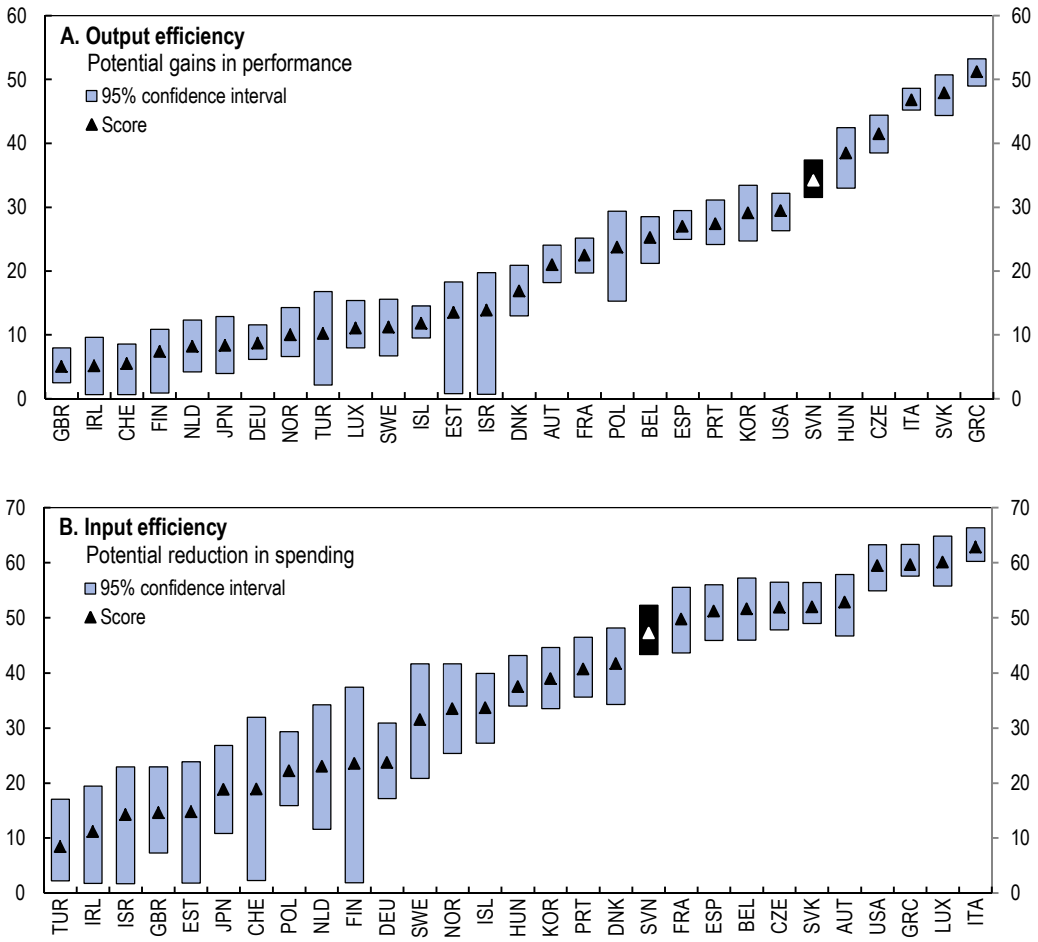
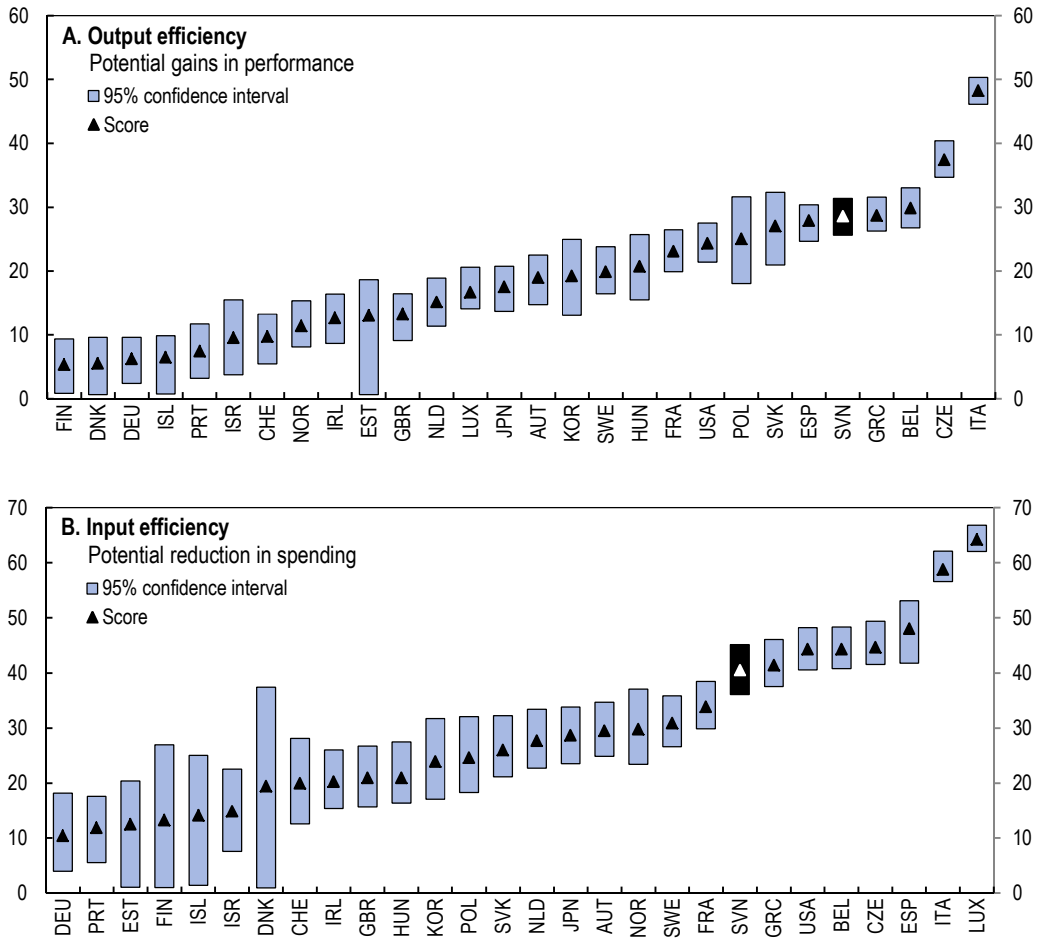


Figure A2.6. Confidence intervals for general public services efficiency in 2005

Per cent



Annex A3. Input and output variables

Table 1. Variables used in the estimates: Healthcare

	Life expectancy at birth (years)		Total healthcare spending (USD PPP per capita)[2]		Environment variable[3] (OECD = 1)	
	2005	2010[1]	2001-05	2006-10	2005	2010
Australia	80.9	81.8	2 695	3 409	0.585	0.574
Austria	79.4	80.7	3 234	4 112	1.121	1.170
Belgium	79.1	80.3	2 867	3 656	1.001	1.024
Canada	80.1	80.8	3 064	4 058	0.962	1.149
Chile	77.9	79.0	750	1 065	0.547	0.513
Czech Republic	76.1	77.7	1 294	1 783	0.954	0.816
Denmark	78.2	79.3	2 961	4 050	0.684	0.756
Estonia	72.7	75.6	672	1 218	0.855	0.625
Finland	79.1	80.2	2 282	3 072	1.052	1.107
France	80.3	81.4	3 004	3 761	0.703	0.723
Germany	79.4	80.5	3 074	3 964	1.184	1.062
Greece	79.2	80.6	2 038	2 870	1.039	0.932
Hungary	72.8	74.3	1 233	1 530	0.536	0.556
Iceland	81.2	81.5	3 166	3 421	0.612	0.750
Ireland	79.4	81.0	2 532	3 644	1.007	1.031
Israel	80.2	81.7	1 833	2 010	1.859	1.769
Italy	80.8	82.0	2 323	2 886	1.123	1.163
Japan	82.0	83.0	2 257	2 816	1.339	1.237
Korea	78.5	80.7	1 071	1 747	1.047	1.111
Luxembourg	79.5	80.7	3 766	4 582	1.733	1.571
Mexico	74.6	75.5	637	869	0.611	0.533
Netherlands	79.4	80.8	3 049	4 557	0.957	0.999
New Zealand	79.8	81.0	1 900	2 695	0.978	0.990
Norway	80.3	81.2	3 821	5 095	1.218	1.318
Poland	75.1	76.3	757	1 198	0.849	0.853
Portugal	78.1	79.8	1 919	2 539	0.622	0.665
Slovak Republic	74.0	75.2	876	1 799	0.889	1.078
Slovenia	**77.7**	**79.5**	**1 775**	**2 323**	**1.339**	**1.180**
Spain	80.3	82.2	1 963	2 882	0.638	0.583
Sweden	80.6	81.5	2 790	3 550	1.476	1.553
Switzerland	81.4	82.6	3 766	4 832	1.211	1.219
Turkey	73.0	74.3	485	828	0.811	0.675
United Kingdom	79.2	80.6	2 350	3 189	1.196	1.260
United States	77.4	78.7	5 959	7 715	1.265	1.455
OECD[4]	78.5	79.8	2 299	3 051	1.000	1.000

1. 2009 for Italy, 2008 for Canada.
2. Total health spending in current US dollars at purchasing power parities. Average over the period.
3. GDP per capita, educational attainment of the adult population, nitrogen oxide emissions, fruit and vegetable consumption (latest data available), tobacco and alcohol consumption (15-year lag).
4. Unweighted average of data shown in the table.

Source: Calculations based on OECD (2012), *OECD Health Statistics* , *OECD National Accounts Statistics* and *OECD Environment Statistics* (databases); OECD (2007 and 2011), *Education at a Glance*; OECD (2007), *PISA 2006* (Volume 2) and OECD (2010), *PISA 2009 Results: What Students Know and Can Do - Student Performance in Reading, Mathematics and Science* (Volume 1).

Table 2. Variables used in the estimates: Education

	PISA synthetic score[1]		Spending per student in secondary education (USD PPP)[2]		Environment variable (ESCS index)[3]	
	2006	2009	2003-06	2006-09	2006	2009
Australia	520	519	8 264	9 182	0.207	0.344
Austria	502	487	9 679	11 387	0.197	0.061
Belgium	511	509	7 948	9 720	0.173	0.196
Canada	529	527	7 364	8 301	0.368	0.503
Chile	431	439	2 079	2 442	-0.700	-0.568
Czech Republic	502	490	4 755	5 903	0.029	-0.086
Denmark	501	499	9 025	10 273	0.309	0.297
Estonia	516	514	3 967	5 530	0.141	0.152
Finland	553	543	7 425	8 242	0.256	0.371
France	493	497	8 905	9 941	-0.091	-0.133
Germany	505	510	7 483	8 320	0.293	0.182
Hungary	492	496	3 856	4 344	-0.085	-0.195
Iceland	494	501	7 881	8 623	0.767	0.718
Ireland	509	497	7 494	10 266	-0.015	0.047
Israel	445	459	5 844	5 967	0.216	-0.024
Italy	469	486	7 981	8 731	-0.070	-0.123
Japan	517	529	7 778	8 853	-0.011	-0.009
Korea	542	541	6 769	8 113	-0.007	-0.153
Luxembourg	485	482	17 986	18 823	0.088	0.188
Mexico	409	420	2 046	2 317	-0.990	-1.218
Netherlands	521	519	7 949	10 627	0.252	0.273
New Zealand	524	524	6 078	6 733	0.104	0.086
Norway	487	500	11 114	12 596	0.421	0.471
Poland	500	501	3 077	4 138	-0.301	-0.281
Portugal	471	490	6 395	7 437	-0.617	-0.317
Slovak Republic	482	488	2 706	3 699	-0.149	-0.093
Slovenia	**506**	**499**	**7 116**	**8 063**	**0.129**	**0.075**
Spain	476	484	7 071	9 147	-0.311	-0.314
Sweden	504	496	8 099	9 407	0.237	0.330
Switzerland	513	517	12 629	15 180	0.087	0.078
United Kingdom	502	500	7 578	9 289	0.191	0.204
United States	482	496	10 185	11 692	0.135	0.171
OECD[4]	497	499	7 329	8 540	0.039	0.039

1. Mean score of reading literacy, mathematics and science.
2. In current US dollars at purchasing power parities, average over period. 2004-06 instead of 2003-06 for Estonia and Slovenia.
3. Economic, social and cultural status index (ESCS).
4. Unweighted average of data shown in the table; Greece and Turkey are excluded since no data is available for recent years.

Source: Calculations based on OECD (2006-12), *Education at a Glance*, annual editions; OECD (2007), *PISA 2006* (Volume 2) and OECD (2010), *PISA 2009 Results: What Students Know and Can Do - Student Performance in Reading, Mathematics and Science* (Volume 1).

Table 3. Variables used in the estimates: General public services

	Performance[1] (synthetic indicator)		General services spending[2] (USD PPP per capita)		Environment variable (GDP per capita)[3]	
	2005	2010	2003-05	2008-10	2005	2010
Austria	3.48	3.18	1 815	2 193	33 637	40 411
Belgium	2.97	3.16	1 977	2 505	32 204	37 878
Czech Republic	2.06	2.04	1 199	1 373	21 268	25 364
Denmark	4.07	3.50	1 809	2 625	33 196	40 600
Estonia	2.73	3.12	743	1 107	16 531	20 093
Finland	3.96	4.01	1 839	2 599	30 708	36 029
France	3.11	3.04	1 837	2 124	29 554	34 395
Germany	3.68	3.45	1 436	1 836	31 117	37 661
Greece	2.52	1.82	1 631	2 260	24 348	27 539
Hungary	2.35	2.12	1 186	1 492	16 975	20 625
Iceland	3.91	3.30	1 473	1 829	34 992	35 510
Ireland	3.24	3.36	1 235	1 350	38 795	41 001
Israel	2.84	2.91	866	921	23 210	26 617
Italy	2.03	1.99	1 659	1 877	28 280	32 110
Japan	3.08	3.20	1 245	1 304	30 446	33 832
Korea	2.49	2.43	813	1 194	22 783	28 829
Luxembourg	3.50	3.70	3 529	4 265	68 211	84 672
Netherlands	3.62	3.82	1 860	2 424	35 111	41 682
Norway	3.75	3.71	1 775	2 411	47 640	57 454
Poland	1.87	2.39	658	971	13 786	19 862
Portugal	3.07	2.57	1 171	1 509	21 369	25 544
Slovak Republic	2.12	1.84	847	1 414	16 175	23 193
Slovenia	**2.49**	**2.36**	**1 297**	**1 595**	**23 472**	**26 649**
Spain	2.63	2.67	1 222	1 736	27 392	31 573
Sweden	3.40	3.76	2 206	2 824	32 701	39 251
Switzerland	3.78	3.88	1 610	2 035	36 648	48 962
Turkey	. .	2.40	. .	1 052	. .	15 775
United Kingdom	3.51	3.53	1 467	1 762	32 952	35 299
United States	3.18	2.89	1 698	2 151	42 448	46 548
OECD[4]	. .	2.97	. .	1 888	. .	34 999

1. Composite performance indicator for public administration outcome based on OECD's Product Market Regulation (PMR) Indicator (for 2003 and 2008) to proxy the levels of bureaucracy (33% of indicator) and results of the 2012 WEF survey on the quality of justice, level of corruption and government inefficiency (data for 2006 and 2010). For Estonia, Israel and Slovenia, the PMR used was 2008 for both periods.
2. Excluding interest payments. Estimated data for Japan and Switzerland for 2003-05.
3. In current US dollars at current prices and purchasing power parities.
4. Unweighted average of data shown in the table; excluding countries for which no data is available (Australia, Canada, Chile, Mexico and New Zealand.

Source: Calculations based on OECD (2012), *OECD National Accounts Statistics* and *OECD Product Market Regulation Statistics* (databases); and WEF (2012), *The Global Competitiveness Index 2012-2013 Data Platform*, World Economic Forum.

WORKING PAPERS

The full series of Economics Department Working Papers can be consulted at www.oecd.org/eco/workingpapers/

1057. *Policy determinants of school outcomes under model uncertainty: evidence from South Africa*
(June 2013) by Thomas Laurent, Fabrice Murtin, Geoff Barnard, Dean Janse van Rensburg, Vijay Reddy, George Frempong and Lolita Winnaar

1056. *Improving education quality in South Africa*
(June 2013) by Fabrice Murtin

1055. *The 90% public debt threshold: the rise and fall of a stylised fact*
(June 2013) by Balázs Égert

1054. *Challenges to sustain Poland's growth model*
(June 2013) by Balázs Égert and Rafał Kierzenkowski

1053. *Reforming agriculture and promoting Japan's integration in the world economy*
(May 2013) by Randall S. Jones and Shingo Kimura

1052. *Inequality and poverty in the United States: public policies for inclusive growth*
(May 2013) by Oliver Denk, Robert Hagemann, Patrick Lenain and Valentin Somma

1051. *Fiscal federalism and its impact on economic activity, public investment and the performance of educational systems*
(May 2013) by Hansjörg Blöchliger, Balázs Égert and Kaja Fredriksen

1050. *Restoring Japan's fiscal sustainability*
(May 2013) by Randall S. Jones and Satoshi Urasawa

1049. *Measuring total factor productivity at the firm level using OECD-ORBIS*
(May 2013) by Peter Gal

1048. *A projection method for public health and long-term care expenditures*
by Christine de la Maisonneuve and Joaquim Oliveira Martins (forthcoming)

1047. *R&D, patenting and growth: the role of public policy*
(May 2013) by Ben Westmore

1046. *Knowledge-based capital, innovation and resource allocation*
(May 2013) by Dan Andrews and Chiara Criscuolo

1045. *Reforms for a Cleaner, Healthier Environment in China*
(April 2013) by Sam Hill

1044. *Making the tax system less distortive in Switzerland*
(April 2013) by Andrés Fuentes

1043. *The determinants of informality in Mexico's states*
(April 2013) by Sean M. Dougherty and Octavio Escobar

1042. *Legal reform, contract enforcement and firm size in Mexico*
(April 2013) by Sean M. Dougherty

1041. *Improving the economic situation of young people in France*
(April 2013) by Hervé Boulhol
Améliorer la situation économique des jeunes en France
(avril 2013) par Hervé Boulhol

1040. *Improving employment prospects for young workers in Spain*
(April 2013) by Anita Wölfl

1039. *Youth labour market performance in Spain and its determinants - a micro-level perspective*
(April 2013) by Juan J. Dolado, Marcel Jansen, Florentino Felgueroso, Andres Fuentes and Anita Wölfl

1038. *The efficiency and equity of the tax and transfer system in France*
(April 2013) by Balázs Égert
Efficacité et équité du système de prélèvements et de transferts en France
(avril 2013) par Balázs Égert

1037. *Income inequality and poverty in Colombia. Part 2. The redistributive impact of taxes and transfers*
(April 2013) by Isabelle Joumard and Juliana Londoño Vélez

1036. *Income inequality and poverty in Colombia. Part 1. The role of the labour market*
(April 2013) by Isabelle Joumard and Juliana Londoño Vélez

1035. *Policy options to durably resolve euro area imbalances*
(March 2013) by Yvan Guillemette and Dave Turner

1034. *Labour market, welfare reform and inequality in the United Kingdom*
(March 2013) by Christophe André, Clara Garcia, Giulia Giupponi and Jon Kristian Pareliussen

1033. *Work incentives and Universal Credit – reform of the benefit system in the United Kingdom*
(March 2013) by Jon Kristian Pareliussen

1032. *Strengthening social cohesion in Luxembourg: making efficiency and equity go hand in hand*
(March 2013) by Jean-Marc Fournier and Clara Garcia

1031. *The price of oil – Will it start rising again?*
(March 2013) by Jean-Marc Fournier, Isabell Koske, Isabelle Wanner and Vera Zipperer

1030. *The system of revenue sharing and fiscal transfers in China*
(February 2013) by Xiao Wang and Richard Herd

1029. *The declining competitiveness of French firms reflects a generalised supply-side problem*
(February 2013) by Hervé Boulhol and Patrizio Sicari

1028. *Do the overall level and dispersion of socio-economic background measures explain France's gap in PISA scores?*
(February 2013 by Hervé Boulhol and Patrizio Sicari