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Efficiency of public expenditure on education in Croatia

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Estonia, Poland, Slovakia, Lithuania and Latvia recorded better PISA 2009 results than Croatia with lower levels of expenditure on education. According to the Legatum Prosperity Index (2010), Croatia is placed 44th among 110 countries according to the education sub-index score. With regard to ten new EU member states, only Bulgaria had a lower education sub-index than Croatia. This may suggest that Croatia is faced with inefficiency in public spending on education, which can be partially explained by several facts. The number of teachers per 100 students is higher than the average of the observed 30 European countries, USA and Japan, indicating possibilities for savings by rationalization of teaching staff. Analysis showed a possible excess of a total of 4,942 teachers at all levels of education. According to adverse future demographic trends, these inefficiencies might become even higher. Teachers' salaries should also be revised in order to compete with those in private sector, since they indirectly influence students' performance and are very important for attracting, developing and retaining skilled and high-quality teachers. The analysis showed that mechanisms of the allocation of public resources targeted to education will inevitably have to be improved.

INTRODUCTION

The aim of the Lisbon Agenda for members of the European Union (EU) is to achieve a knowledge-based society as well as the highest economic competence, where education is considered one of the most important pillars in achieving these goals. The goals defined in this way are a standard in some developed EU-15 countries, a realistic perspective in other EU members and a hardly achieved objective in some other countries, particularly out of the EU. In Croatia the adjustment of education process has already started, but it requires fundamental changes in the process of thinking and shifting from classic "adaptive" models based on receiving information to more "creative" models of learning by improving abilities (Mujić, 2007).

It is important to stress the relevance of the quality of education and its implications for the future competitiveness of Croatian workers in the international labour market. It is also proven that educational level is positively correlated with industrial development, but the influence of education on industry and development acts in many ways, generally improving freedom, peace, cooperation, trust and all the institutional goodness that favours socio-economic development (Guisan, Aguayo and Exposito, 2001).

This article will analyze the efficiency of Croatian public expenditure on education by creating a link between expenditure on education as an input and PISA scores as an output indicator. For determination of (in)efficiency, a cross-country analysis will be made[1]. In the end, we will

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1 Cross-country sample in this paper include 37 European countries, the United States of America and Japan based on Eurostat and PISA data. Still, for some analyses not all countries' data were available, so these countries were excluded from these analyses. Therefore, the list of observed countries in different figures and tables may vary.

try to provide several explanations of possible sources of inefficiencies in government spending on education in Croatia and suggestions for their solution. The conceptual framework of efficiency and effectiveness is explained in Appendix.

PUBLIC EXPENDITURE ON EDUCATION AND PISA SCORES

The provision, i.e. the funding of education is one of the major public sector activities around the world. In most countries, education is compulsory and children have to attend school up to a certain age. Still, education is not exclusively provided by the state, so the option of attending a private school is also open to many, which is especially considerable in tertiary education. The Croatian education system is, like most European and transitional countries, mainly financed and operated by the public sector. Figure 1 shows total public expenditure on education in 2007, differentiated by levels of education, as a percentage of GDP.

In 31 observed countries (29 European countries, USA and Japan), the average public expenditure on education of 5% of GDP (straight line) was about 1 percentage point higher than total public expenditure on education in Croatia in 2007. Generally, northern European countries had the highest expenditure on education as a proportion of GDP. Denmark, whose total public expenditure on education was the highest among the observed countries, had an almost twice as high proportion of GDP targeted to education than Croatia. But what is even more interesting is that expenditure on pre-primary and primary levels of education in the case of Croatia accounts for about 59% of total expenditure on education, while in all other observed countries it is significantly lower and averages about 37% of total expenditure on education.

Public expenditure on education as a percentage of GDP is sometimes a not fully satisfactory measure for expenditure evaluation, since it does not take into account the total student population, a country's standard of living etc. Accordingly it is more interesting to analyze total public expenditure on public educational institutions per pupil/student in EUR PPS[2], which is shown together with GDP per capita PPS on Figure 2.

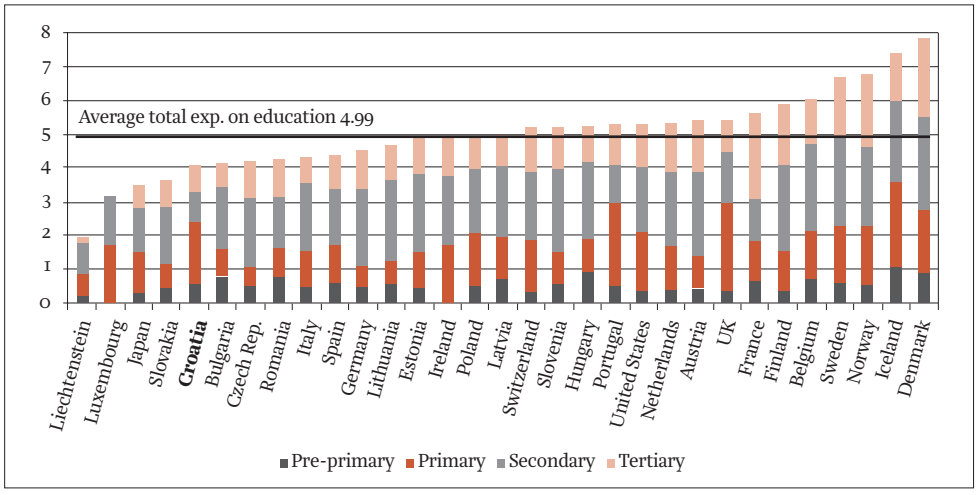
Croatia has relatively low expenditure on public educational institutions, about 40% lower than the average of the countries seen in Figure 2. On the other hand, it can be noted that the majority of new EU member states have even lower expenditures on education per pupil/student in EUR PPS than Croatia. The line in Figure 2 shows GDP per capita PPS, which is a very good indicator of a country's standard of living, and it shows that the public expenditure on educational institutions is positively correlated with the country's standard of living, i.e. countries with higher GDP per capita usually have also higher public expenditure per pupil/student and vice versa. Figure 3 shows total public expenditure on public educational institutions per pupil/student corrected by GDP per capita.

Indexes from Figure 3 are calculated by dividing the public expenditure from Figure 2 by GDP per capita and

2 The purchasing power standard (PPS) is an artificial currency unit that can be interpreted as the equivalent of the euro with respect to purchasing power, i.e. as the euro in real terms. Theoretically, one PPS can buy the same amount of goods and services in each country. For that reason this indicator is used for comparisons of monetary indicators of different countries.

Figure 1

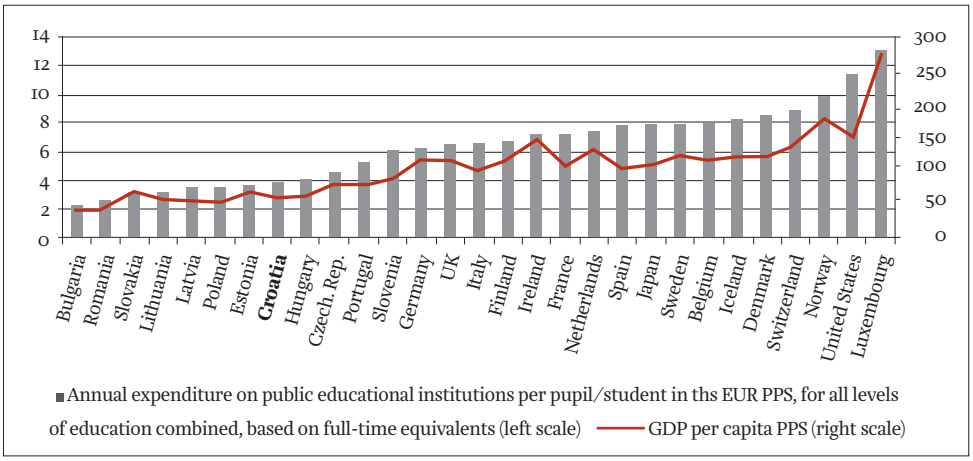
Total public expenditure on education by levels of education in 2007 (% GDP)



Source: Eurostat

Figure 2

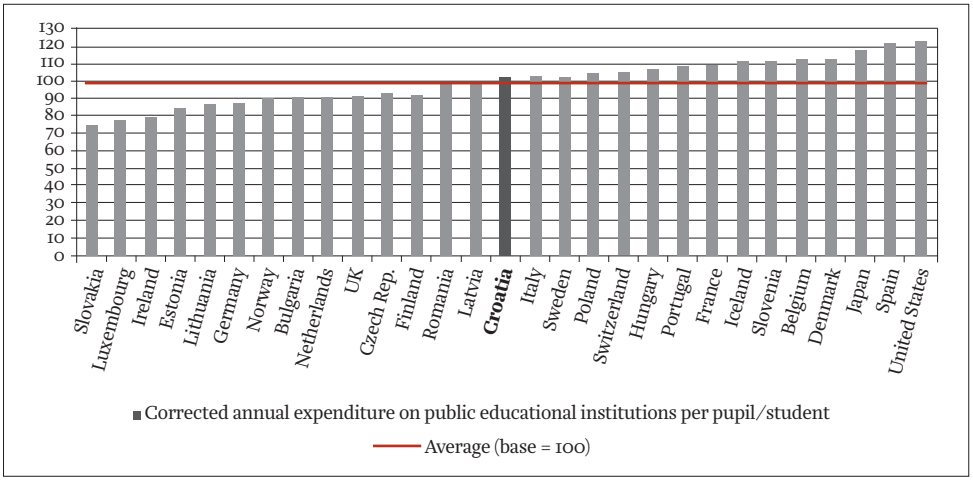
Total public expenditure on public educational institutions per pupil/student in thousand EUR PPS and GDP per capita (reference year 2007)



Source: Eurostat

Figure 3

Total public expenditure on public educational institutions per pupil/student corrected by GDP per capita (reference year 2007)



Source: Eurostat; author's calculation

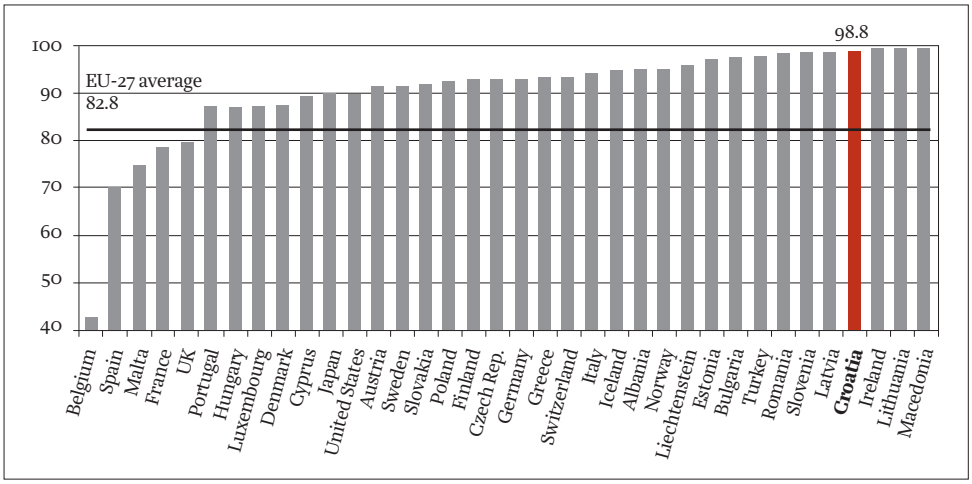
scaled in such a way that average corrected expenditure equals 100. Compared with the country's standard of living, Croatian expenditure on public educational institutions per pupil/student is slightly above average indexed expenditure. Even after correction, the majority of new member states had lower public education expenditures. It is interesting that some other countries, like Norway and Luxembourg, that had significantly higher uncorrected public expenditure, recorded lower corrected public expenditure on education than Croatia.

Since education can be provided by public or private sector, it is interesting to observe their shares in total educational sector. Figure 4 shows the proportion of students in public institutions as percentage of all students in public and private institutions for primary and secondary levels of education.

Croatia has the fourth highest proportion of students in public institutions among 36 observed, mainly European, countries and this proportion is 16 percentage points higher than the EU-27 average (straight line). This indicates that the primary and secondary private educational sector may still be underdeveloped in Croatia, but it also means that the public sector has to provide more resources than it would have to if there were a more developed private sector. As Jafarov and Gunnarsson (2008) stated, private expenditure on education in Croatia is mainly targeted to the pre-primary and tertiary education. This means that a more developed private primary

Figure 4

Students in public institutions as percentage of all students in public and private institutions (reference year 2007, primary and secondary levels of education)



Source: Eurostat

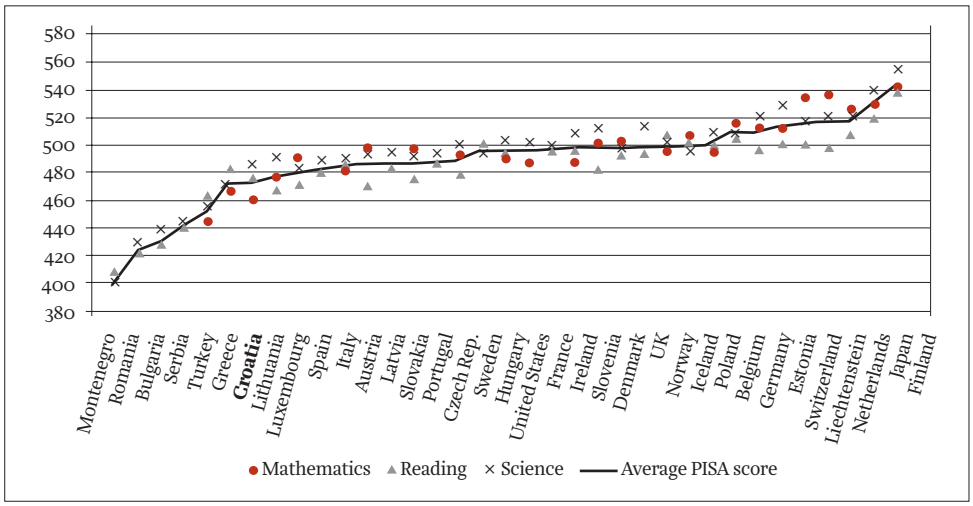
and secondary educational sector concurrently with an unchanged public expenditure on education may increase the quality of education, i.e. produced output.

After taking into account several educational input indicators, it is necessary to analyze gained output, which can be measured by PISA scores. PISA is an acronym taken from the Programme for International Student Assessment and it relates to a triennial OECD international survey of the knowledge and skills of 15-year-olds, an age at which students in most countries are nearing the end of their compulsory time in school. PISA ranks countries according to their performance in reading, mathematics and science by their mean score in each area. PISA scores can also be considered direct indicators of labour force competitiveness a decade after the survey. Figure 5 shows produced educational output measured as PISA 2009 scores in mathematics, reading and science.

Croatia with an average 2009 PISA score of 474 has the highest average score in the SEE countries included in the 2009 PISA analysis, but at the same time the lowest 2009 PISA score in CEE countries. The best performance of Croatian pupils was recorded in science (486), followed by reading (476) and mathematics (460). Slovakia, Liechtenstein, Luxembourg and Japan, which had lower public expenditures on education proportionately to GDP than Croatia, recorded better average PISA scores in 2009. This may be an indicator that Croatia is faced with inefficiency in public spending on education.

Figure 5

PISA 2009 scores in mathematics, reading and science



Source: OECD (2010a)

Besides pure technical efficiency, allocative efficiency also matters in creating the best possible output, since it reflects the link between the optimal combination of inputs, taking into account costs and benefits, and the output achieved (see Appendix – Efficiency and effectiveness). Thus it seems reasonable to create a link between public expenditure on education and PISA scores and to determine the strength of its influence. Figure 6 shows a scatter plot of annual expenditure on public educational institutions per pupil/student in thousand EUR PPS and average 2009 PISA score.

With lower expenditure on education, Estonia, Poland, Slovakia, Lithuania and Latvia recorded better 2009 PISA results than Croatia. This means that there potentially exists a waste of resources in case of Croatia, i.e. inefficiency of public expenditure on education. It seems that there exists a relatively clear logarithmic relationship between expenditure on public educational institutions per pupil/student and performances in PISA tests. Such regressed function has good local characteristics for the needs of our analysis, since it means that for higher level of expenditure, higher PISA score would be achieved, but with decreasing benefit. The presented model shows a relatively satisfactory fit of 37.4%, measured by R^2, which means that over one third of students' performance can be explained bythe level of public education funding. It has to be mentioned that such kind of relationship cannot be identified between public expenditure on education as a percentage of GDP and PISA scores for a variety of reasons, the number of pupils or students and purchasing power probably having the most influence.

Any positive or negative deviation of the observed sample value from the estimated value shown on Figure 6 may be considered an error, but it can actually be understood as the unobserved influence of non-financial variables like socio-economic indicators or the allocative (in)efficiency manifested in teachers' salaries, class size etc. According to logarithmic efficiency, we may conclude that Croatia is slightly inefficient, since the Croatian average PISA score is situated below the expected value for the amount of public expenditure on education.

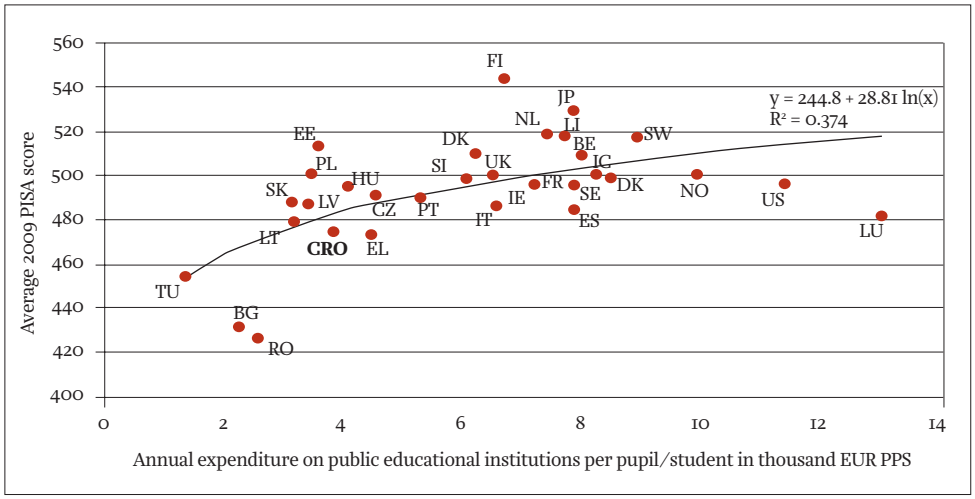
The education sub-index demonstrates how access to education allows citizens to develop their potential and contribute productively to their society. According to the latest available data from the Legatum Prosperity Index (2010), Croatia is situated 44th among 110 countries according to the education sub-index score which measures countries' performances in three areas: access to education, quality of education and human capital. With regard to the new EU member states, only Bulgaria had a lower education sub-index than Croatia. Thus some space for progress obviously exists, and the efficiency and effectiveness of education need unremitting attention.

POSSIBLE SOURCES OF INEFFICIENCY OF PUBLIC EXPENDITURE ON EDUCATION

Jafarov and Gunnarsson (2008) identified several inefficiencies of government spending on education related to size of teaching force, teachers' salaries, school infrastructure, subsidies etc. Aristovnik and Obadić (2011) showed that the relatively high public expenditure per student in Croatia in tertiary education should have resulted in a

Figure 6

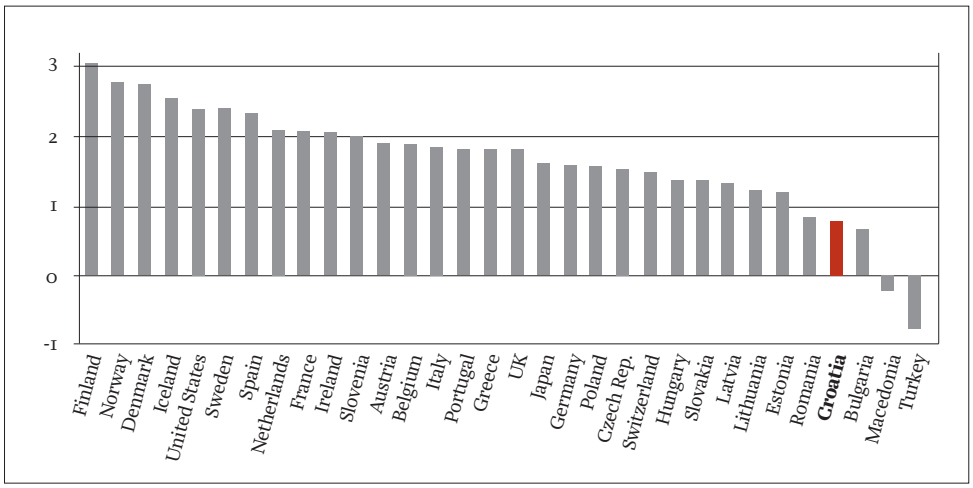
Scatter plot and regression function of annual expenditure on public educational institutions per pupil/student in thousand EUR PPS and average 2009 PISA score



Source: Eurostat; OECD (2010a); author's calculation

Figure 7

Legatum prosperity education sub-index 2010



Source: 2010 Legatum Prosperity Index database, author's calculation

better performance in terms of outputs/outcomes, i.e. a higher rate of higher education enrolment, a greater ratio of the labour force with higher education and a lower ratio of unemployed persons who have tertiary education.

To start with analysis of possible sources of inefficiency we should take a look at the number of pupils and students, institutions and teaching staff in Croatia for the period 2000-09, which is shown in Table 1.

Some evident trends of this 10-year period can be discerned from Table 1. The number of employees in education, i.e. teachers and teaching staff, has been increasing in all levels of education. On the other hand, the number of students has been rising only in tertiary education (a 45% increase), but significantly less than that of faculty (106%).

Figure 8 shows trends in number of pupils and students enrolled in education, schools and teaching staff in primary and secondary education.

Following the demographic trends, the number of pupils and students has decreased by 10% since 2000. At the same time, a trend for teaching staff to increase has been recorded, of about 21%. At the same time there has been an increase in the number of available schools, of about 2.5%. While at the beginning of the school year 2000/01 there was an average number of 217 pupils/students per school, this number had decreased by 12% to 190 pupils/students per school in 2009/10, showing a decrease of one whole class size. At the same time, the number of teachers per school had increased from an average of 17 in 2000/01 to an average of 20 in 2009/10 implying that the student-teacher ra-

Table 1

Number of pupils and students enrolled in education by level, at the beginning of school year, 2000-09

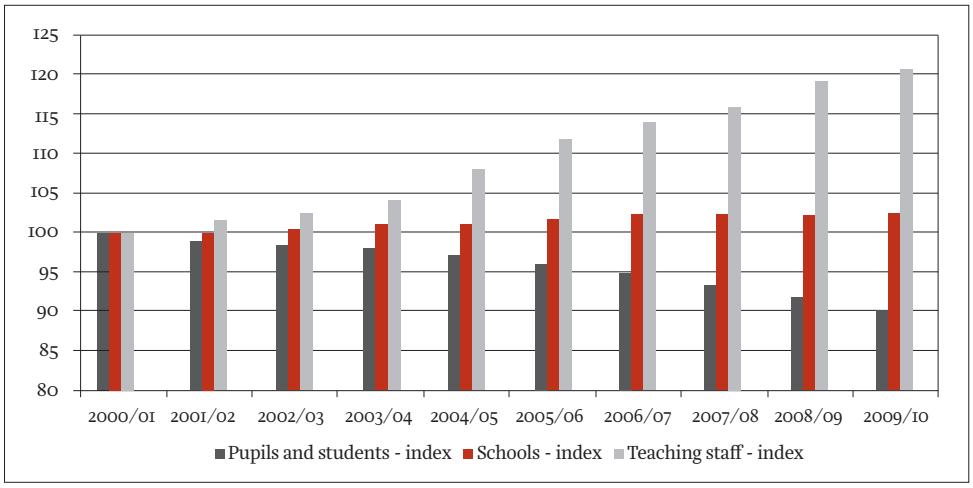
School/academic year	Basic education (ISCED 1-2)			Secondary education (ISCED 3)			Tertiary education (ISCED 5)		
	Schools	Pupils	Teachers	Schools	Students	Teachers	Institutions	Students	Teaching staff*
2000/01	2,141	405,682	27,147	634	195,120	19,325	93	100,297	7,701
2001/02	2,134	400,100	27,502	645	195,000	19,718	95	107,911	7,622
2002/03	2,139	395,702	27,905	650	196,147	19,733	100	116,434	8,132
2003/04	2,138	393,421	28,335	665	195,340	20,073	102	120,822	7,917
2004/05	2,141	391,744	29,485	665	192,076	20,701	103	128,670	8,764
2005/06	2,140	387,952	30,131	683	189,661	21,835	110	132,952	9,486
2006/07	2,146	382,441	30,450	693	187,977	22,573	114	136,129	13,075
2007/08	2,133	376,100	30,877	705	184,183	22,975	115	138,126	13,866
2008/09	2,127	369,698	31,621	710	181,878	23,772	126	134,188	14,995
2009/10	2,131	361,052	32,083	713	180,582	24,004	132	145,263	15,863

** Since the 2006/07 academic year, the coverage of the survey has been changed and adjusted to user needs. The figure includes all members of academic staff who teach at institutions of higher education. Since members of academic staff may teach at two or more institutions of higher education, the figure shown does not correspond to the actual number of persons.*

Source: CBS (2010:477).

Figure 8

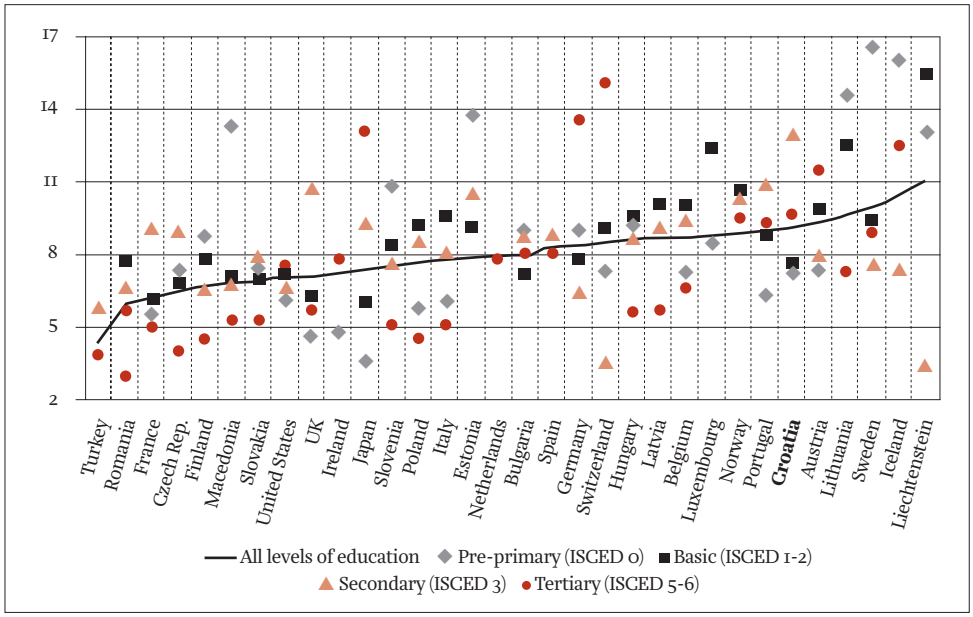
Trends in number of pupils and students enrolled in education, schools and teaching staff, for primary and secondary level of education, 2000-09 (base year 2000/01 – index 100)



Source: author based on Table 1

Figure 9

Number of teachers per 100 pupils/students (reference year 2008)



Source: Eurostat; author's calculation

tio had decreased by over 25%. Figure 9 shows the number of teachers per 100 pupils/students in 30 European countries, United States and Japan for all levels of education.

Croatia had relatively high average number of teachers per 100 students, of 9.2, about 1.2 more than the average of the observed European countries, USA and Japan. Only Austria, Lithuania, Sweden, Iceland and Liechtenstein had a higher number of teachers per 100 students and all of these countries recorded better average 2009 PISA scores than Croatia. Croatia had 4.1 teachers per 100 students more than the average of the observed countries in secondary education and 2.1 more in tertiary education, while it is slightly below average in pre-primary and basic (primary and lower secondary) education. Table 2 shows calculated discrepancies in teachers and teaching staff based on number of teachers and teaching staff per 100 pupils/students in Croatia and the averages of observed countries as the benchmark values.

Discrepancies in teachers and teaching staff are calculated as the difference between the average number of tea-

Table 2
Discrepancies in teachers and teaching staff

	Teachers per 100 students (2008)			Number of pupils/students in Croatia (2009/10)	Teachers and teaching staff discrepancies
	Average of observed countries*	Croatia	Difference (Croatia - Average)		
Pre-primary (ISCED 0)	8.57	7.32	-1.26	99,317	-1,247
Basic (ISCED 1-2)	8.86	7.70	-1.16	361,052	-4,195
Secondary (ISCED 3)	8.88	12.96	4.08	180,582	7,367
Tertiary (ISCED 5-6)	7.59	9.67	2.08	145,263	3,017
Total	8.07	9.22	1.15	786,214	4,942

** Observed countries include 30 European countries, United States of America and Japan as shown on Figure 9.*
Source: Eurostat; CBS (2010); author's calculation

chers per 100 students in observed countries and number of teachers per 100 students in Croatia (Difference column) multiplied by number of pupils/students in Croatia in the academic year 2009/10. Table 2 shows that in pre-primary and basic education 5,442 teachers are needed in order to achieve an average level of teachers per 100 students as in the sample of countries observed. On the other hand, in secondary and tertiary education Croatia has 10,384 teachers more than it would have if it had the average number of teachers per 100 students, taking all levels of education into account, we can conclude that in Croatia there might be an excess teaching force of 4,942 teachers. Rationalization of the teaching force to the average of observed countries could lead to declines in fiscal costs and rigidities that limit the scope for discretionary cuts in short-term education spending. This could be done by increasing the teaching hours, since teachers with a fulltime position are required to teach 16-22 hours per week (NN, 2011). Still, hours per week that teachers spend teaching in Croatia are mainly in line with OECD countries average weekly teaching hours in primary education of 21 and in lower secondary education of 19 hours (OECD, 2010b).

Nestić et al. (2006) showed that demographic trends indicate that the number of school age persons (aged 7-24 years) will fall dramatically up to 2050. Their estimations show a decrease of 34% in the case of constant enrolment rates and of 22% in the case of increasing enrolment rates, as compared to the numbers in 2005. Even in the case of a high fertility rate and increasing enrolment rates, which is the most optimistic scenario, the number of pupils and students will decrease by more than 7% up to 2050. Jafarof and Gunnarsson (2008) stated that future demographic trends imply significant potential for savings, if the number of teachers and overall education spending can be reduced in line. Also, as student numbers decline, schools could consider pooling resources by sharing teachers. Otherwise, further declines in the student-teacher ratio will lead to significant inefficiencies and aggravate the fiscal burden.

Although smaller groups are usually more efficient than the large ones (Barro and Lee, 2001), OECD (2010a) showed that higher teachers' salaries, but not smaller class sizes, are associated with better student performance, showing that raising teacher quality is a more effective route to improved student outcomes than creating smaller classes. Unfortunately, no comparable figures of teachers' salaries that include an assessment of Croatia are publicly available, so cross-country analysis is impossible in this text[3]. For that reason, we cannot conclude either that the teachers in Croatia are not paid enough or that they are paid too much as compared to other countries, but this may be a very good line of enquiry for some further research.

Salaries and working conditions are important for attracting, developing and retaining skilled and high-quality teachers. In a competitive labour market, the equilibrium rate of salaries paid to different types of teachers in different regions of the country would reflect the supply of and demand for those teachers. This is often not the case in OECD countries, as salaries and other working conditions are often set centrally for all teachers (OECD, 2010b). The same problem is present in Croatia, where salaries are also set centrally for all teachers, without any consideration of demand and supply in different regions and/or teaching subjects. Salary levels at different career points may also be a bit problematic in Croatia, since the increases are mainly driven by working experience. In other words, qualified and motivated young teachers may not be adequately paid with regard to their teaching contribution. Therefore, an improvement of mechanisms of teacher assessment to bring them up to the level com-

3 For example, OECD Education at a Glance (2010b) includes annual teachers' salaries in public institutions (in US dollars PPP) for primary and secondary levels of education, but includes only OECD and several partner countries (Estonia, Indonesia, Israel and Slovenia).

mon in the private sector may result in high-quality teachers being attracted and motivated.

School infrastructure is used relatively intensively, but there are inequalities among regions and even among different schools in some bigger cities. According to estimates by the Ministry of Science, Education and Sports (MZOS, 2005), about 66% of schools had double shifts and 4% of schools had triple shifts, where 82.5% of primary school pupils and 88% of secondary school pupils attended multiple shift schools. For that reason, in 2005 the government started Education Development Project with one component, i.e. priority (of a total number of four), aiming at the elimination of triple shifts and a reduction of double shifts. According to the State Audit Office report (2011), the majority of all activities related to this priority had been accomplished by the end of 2009. Unfortunately, updated statistics on multiple shift schools and percentage of pupils that attend multiple shift schools are not publicly available. Rationalizing the school network would also help realize potential benefits from expected declines in the number of students. This could be facilitated by increases in spending on transportation and the usage of multi-grade teaching in small schools. The government's efforts to eliminate triple shifts are welcome, but attempts to eliminate double shifts need to be well planned to avoid unnecessary spending (Jafarov and Gunnarsson, 2008).

As for tertiary education, there is some previous research that identified several inefficiencies. In 2006, the University of Rijeka found that the average time for completion of a four-year program was 6.7 years and only about a third of students did complete, implying a two-thirds dropout rate. In other words, serious internal inefficiencies at the tertiary level do not seem to have diminished in recent years. Same research showed that those students that pay fees generally complete at higher rates, in a shorter time period and with better grades (World Bank, 2008). According to Filipić (2009), inefficiency in tertiary education can also be observed in student subsidies, which are numerous, and considerable in their financial volume, but they are directed only to the maintenance or the occasional enlargement of the number of higher educated citizens. However, they do not direct students towards professions appropriate to the modern structure of the economy and society as a whole, but, rather, interpret the needs of society in terms of the structure and capacities of higher education and do not stimulate excellence, but only mediocrity.
Jafarov and Gunnarsson (2008) stated that public subsidies to education mostly benefit households with higher incomes, since most scholarships and rewards go to students with better academic achievements, who tend to come from families in the top-income quintile that can spend more money to support education. In order to preserve social fairness and foster excellence, scholarships should be redistributed so as to include both students with better academic achievements and those that come from lower income families. However, benefits from other subsidies, such as dormitories and transportation, should be available primarily to students from lower income families.

Croatia will also have to pay as close, if not greater, attention to the quality of learning outcomes as to sustaining the increases in schooling among its population. The most recent adult literacy rates are only 98.1%, compared to 98.7% in Albania and over 99% in the new EU member states. Life-long learning programs exist, but are little used (World Bank, 2008). In a study of the Croatian Chamber of Economics (2010) that assessed needs for education in small and medium enterprises and trades, the high importance of the future development of employees was identified. On the other hand, this analysis showed that the system of governmental support does exist, but is not fully appropriate. Thus, it is important to continue with the promotion, availability and simplicity of state support for human resources development and education.

CONCLUSION

Croatia with an average 2009 PISA score of 474 has the highest average score with regard to the SEE countries included in the 2009 PISA analysis, but at the same time the lowest 2009 PISA score with regard to CEE countries. Total public expenditure on education in Croatia in 2007 of 4% of GDP was about 1 percentage point lower than the average public expenditure on education in 29 European countries, United States of America and Japan. According to the Legatum Prosperity Index (2010), Croatia is 44th out of 110 countries according to the education sub-index score, which measures countries' performances in three areas: access to education, quality of education and human capital. With regard to the new EU member states, only Bulgaria had a lower education sub-index than Croatia. This indicates that there still exists some space for improvement and that ongoing attention should be paid to the efficiency and effectiveness of education.

There is strong evidence that some other factors, apart from expenditure on education, play an important role in students' performance. This article has identified several main deficiencies that may have disturbed Croatian education efficiency. The first is directed to the high share of students in public institutions as compared to other European countries, which suggests that the private primary and secondary level educational sector may still be underdeveloped, but it also means that public sector has to

provide more resources than it would have to if there were a more developed private sector. Therefore, a more detailed analysis of possibilities of private education development in Croatia is suggested. Development of the private educational sector may decrease the current level of public expenditure on education and/or improve the allocation of the public funds over the long run.

The second problem is connected with the growth trends in teaching staff and number of educational institutions concomitant with declining enrolments. The number of teachers per 100 students is higher than the average of 30 European countries, United States of America and Japan, indicating possibilities for savings by rationalization of teaching staff. The analysis showed a possible surplus of a total of 4,942 teachers, in all levels of education. This is also consequence of the relatively modest weekly norms of 16-22 teaching hours, which can be increased.

Teachers' salaries and working conditions strongly influence student performance and are very important for attracting, developing and retaining skilled and high-quality teachers, accordingly needing special attention. Since there are no publicly available comparable figures of teachers' salaries of different countries that include an assessment of Croatia, further research into the adequacy of salary levels in Croatia as compared to that in other European countries is needed. When teacher's salaries are being determined, demand and supply in different regions and/or teaching subjects as well as the improvement of mechanisms of teacher assessment should be considered. At the moment, salaries in Croatia are set centrally for all teachers.

Growing urbanization, together with decreasing fertility rates, will lead to smaller class sizes particularly in the countryside, which are even now in some places too small. These will lead to the closure of schools with few pupils/students and the merging of several schools into one. Such actions should diminish current and maintenance costs of educational institutions and expenditures for teaching staff. Our recommendation is that the number of schools should follow the trends in enrolments. All of the above mentioned may lead to better performance from Croatian pupils and students with the same level of public expenditure, i.e. the gained future educational output might outperform the current output and improve Croatian education efficiency.

The government educational subsidy system should also be revised in order not only to foster excellence but also to help financially vulnerable groups in the education process. Therefore, scholarships and rewards should be directed both to students with better academic achievements and to those from households with lower income level. On the other hand, for programs providing subsidized transportation and dormitories, means-testing should be introduced in order to avoid such spending on students from higher income households. This would help to better target the vulnerable groups and curb education spending without sacrificing education outcomes. The existence, but under-usage of life-long learning programs underline the importance of the promotion, availability and simplicity of state support for human resources development and education. All of these changes might help to improve the educational structure, as well as the current and future competitiveness of the Croatian labour force on the international labour market.

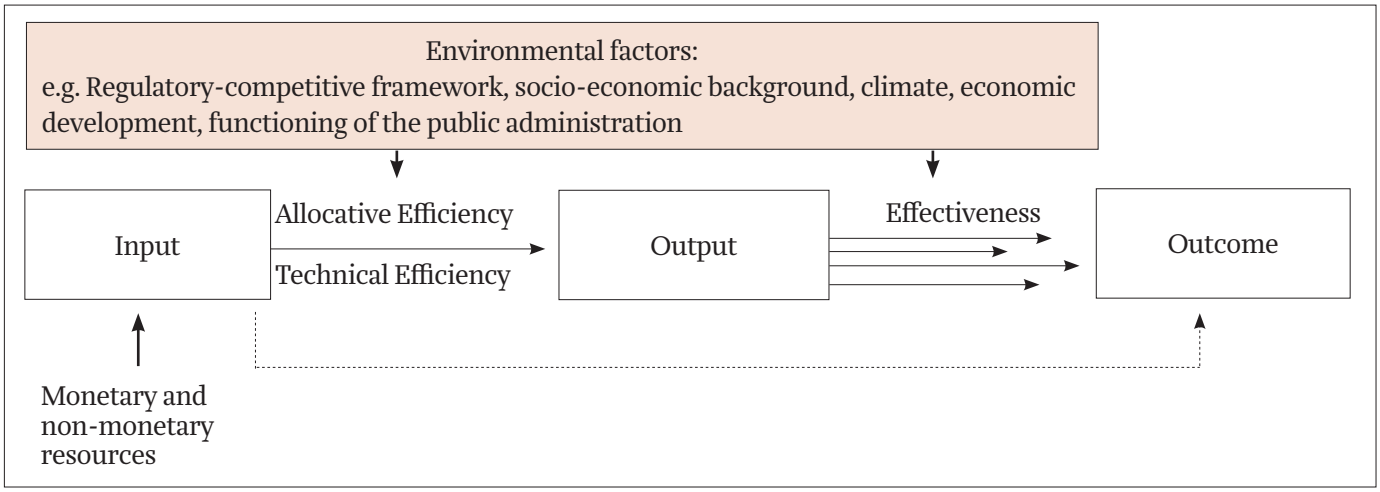
APPENDIX - EFFICIENCY AND EFFECTIVENESS

Efficiency is defined as the ratio between used input and produced output. Some activity is found more efficient if for a given input a greater output is produced or if for a given output a lower input was used. There has to be made a clear distinction between technical and allocative efficiency. Technical efficiency measures the pure relation between input and output taking the production-possibility frontier into account, i.e. technical efficiency gains are movements towards the production-possibility frontier. However, not every form of technical efficiency makes economic sense. Allocative efficiency reflects the link between the optimal combination of inputs taking into account costs and benefits and the output achieved (Mandl, Dierx and Ilzkovitz, 2008).

Another important term related to efficiency is effectiveness, which relates the input or the output to the final objectives to be achieved, that is the outcome. It can be stated that while efficiency considers how work is done, effectiveness looks into what is being done. For example, the output of an education system can be measured in terms of performance of pupils or students of a certain age. On the other hand, the final outcome can be understood to be the educational qualifications of the working-age population (Mandl, Dierx and Ilzkovitz, 2008). It is interesting to illustrate the conceptual framework of efficiency and effectiveness, which is shown on Figure A1.

Figure A1

Conceptual framework of efficiency and effectiveness



Source: Mandl, Dierx and Ilzkovitz (2008), figure 1, page 3.

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