



Higher Education Funding and Economic Growth: Empirical Evidence from Croatia

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Abstract

Deprived of investment in education, no country can expect sustainable economic growth and development. Higher education is particularly a priceless tool in today's era of globalization that requires continuous education to keep up with new knowledge. According to UNESCO (2014), higher education is no longer a luxury; it is essential to national, social and economic development. The impact of education on economic growth is possible to observe within the so-called 'education led growth hypothesis'. The main aim of this paper is to analyse the higher education size and structure, model and financing sources in Croatia and to test the 'education led growth hypothesis' on the example of Croatia. The study will apply the Granger causality test to evaluate if there is any causal relationship between investment in higher education and economic growth in Croatia.

Keywords: economic growth; education; sustainable development; higher education; Granger causality; Croatia.

JEL classification: C58; H52; I25; O47.

1. INTRODUCTION

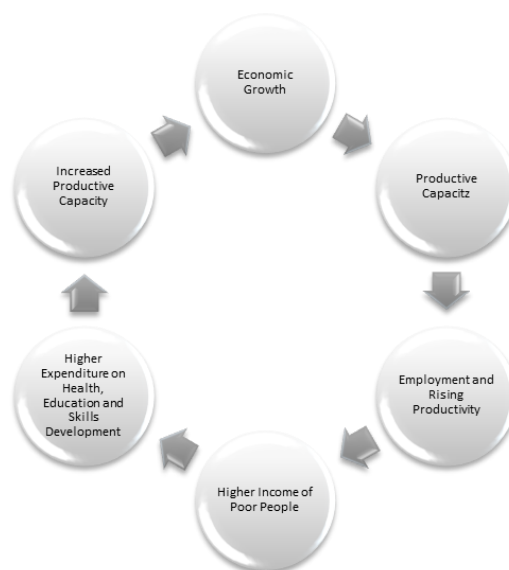
We live in times when every country strives, or should strive, to have as high as possible share of the highly educated population. As Appiah (2017) said, denying any individual the opportunity for education automatically implies denying the country's expected tax revenues and economic growth. Nevertheless, it is not just the share of highly educated population or enrollment rate that counts for economic growth, but rather the knowledge and skills acquired through education (Hanushek and Wossmann, 2010). Therefore, the public authorities must place special emphasis on the quality of the education system, which cannot be achieved without additional investments.

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The theory of human capital was founded in the 20th century (Lucas, 1988). Mankiw *et al.* (1992) expanded the standard Solow model of economic growth by giving a large role to the human capital. Their work assumes that different levels of education and skills can affect the per capita income of a particular country. These findings highlight the importance of education and training and open up the possibility that governing structures may affect the standard of living in the country (Nikšić Radić and Dragičević, 2016).

Romer (1990) suggested that the educated workforce has the potential to create and apply new technologies and foster economic growth. As can be seen from the following figure, back in 1971, Schultz pointed to the fact that there is a significant correlation between education levels and economic growth.



Source: Schultz (1971)

Figure no. 1 – Virtuous cycle of links between economic growth, human capital and physical capital

Higher expenditure on education and skill development, among others, are the key variables that affect the economic growth. Countries whose policies are aimed at encouraging a well-educated population are consistent evidence of superior living standards compared to those that do not (Prettner, 2016). It is also interesting to point out that countries with higher levels of human capital accumulation have a higher voter turnout (Campante and Chor, 2012).

Education, as one of the most important components of human capital, is unequivocally a sustainable economic growth factor (Goode, 1959; Schultz, 1971). Lucas (1993) defined it as the accumulation of human capital that represents the main engine of economic growth. Author also analyses the discrepancies in nations' living standards, and found them to be associated with variations in human capital.

Tertiary education, comprising both public and private universities, colleges, technical training institutes and vocational schools, is generally defined as the level of education following secondary schooling. In the 21st century, it is considered as the most important resource, supporting economic and social development of countries. It continues to improve the well-being and ensures numerous social benefits not just for the individuals, but society in general.

According to Eurostat (2020), 19.8 million students were enrolled and attending one of the European Union's tertiary education programmes during the 2017. Furthermore, 7.3 % of those were attendants of short-cycle tertiary education, 61.3 % were studying in order to obtain an undergraduate degree. The rest of the above mentioned number are students enrolled in postgraduate Master (27.6 %) and Doctoral (3.9 %) studies. In addition, higher education system comprised almost 1.5 million teachers in the territory of EU-28. During the same period, Croatia had 165,200 students enrolled and 16,600 teaching staff in HE system. According to Croatian Bureau of Statistics (CBS) (2018), 4.5% of those were attending short-cycle tertiary education, 61.2% were enrolled in undergraduate studies and 33.2% aiming for Master's degrees. The rest, precisely 1.1%, were PhD students.

Strategy named "Europe 2020" put knowledge at the focus of the Union's efforts to achieve smart, sustainable and inclusive growth (Pegkas and Tsamadias, 2014). Strategy's goal was that minimum of 40% of those who are between 30 and 34 years old in the Member States of the European Union should have completed tertiary education by 2020. In 2019, this was achieved with the percentage of 40.3%. In addition, the percentage of early leavers from this educational level (aged 18-24) has significantly decreased, from 16.9% in 2002 to 10.2% in 2019. In 2019, the lowest share of 'early school leavers' were registered in Croatia (3.0%), while it remains for this country to achieve the above mentioned "Europe 2020" strategy's target. According to the latest 2019 report, 35% of 30-34-year-old Croatian completed tertiary education (Eurostat, 2020).

The main goal of this paper is to test the causality relationship amongst higher education expenditure and economic growth in Croatia. According to the authors' knowledge, subject research has not yet been conducted at the level of Croatia, and given the importance that the European Union assigns to knowledge, it is necessary to explore it. Section 2 provides literature review of the relationship between education, education expenditure and economic growth. Section 3 describes the higher education system in Croatia. Data and research methodology are elaborated in Section 4, while Section 5 indicates the results and discussion of the empirical study. Lastly, a concluding remarks as well as policy implications could be found in Section 6.

2. LITERATURE REVIEW

There is a broad scope of literature focusing, both theoretically and empirically, at the importance of education for economic growth (Lucas, 1988; Mankiw *et al.*, 1992; Barro and Sala-i-Martin, 1995; Greiner, 2005; Awel, 2013). Barro (2002, 2013) analysed education-economic growth relationship and its causality, giving strong empirical evidence that education significantly influences economic growth.

Benos and Zotou (2014) offer different theoretical contributions about many educational mechanisms resulting with economic growth, from increase in labor productivity to boosting the innovative capacity or knowledge about new technologies. In

their meta-analysis, comprising 57 studies with the total of 989 estimates, authors confirm that there is noticeable publication selection indicating a positive education-growth relationship. Nelson and Phelps (1966) emphasized the role and the significance of education for the process of the technological diffusion. Gyimah-Brempong and Wilson (2004) suggested that education leads to improvement in the process of generating health and physical capital, and those are essential factors of economic growth. Keller (2006) argues that there are diverse mechanisms of education favourably affecting growth rates, from increase in productivity and literacy, to numerous spillover effects.

In their cross – country investigation, Benhabib and Spiegel (1994) find no evidence about direct education-economic growth relationship. Nevertheless, author's analysis confirmed that tertiary education can result in economic upswing, indirectly through technical advancement. None of the above-mentioned authors interrogated the role of higher education specifically, but education in general.

In recent years, number of studies identify higher education as determining factor of economic growth, equally in short and long term (Pencavel, 1993; Francis and Iyare, 2006; Permani, 2009; Pegkas and Tsamadias, 2014; Tsamadias, 2019). McMahon (1987) confirms a positive effect of higher education on income growth, but with a time lag of more than seven years. Similar to this, Katircioglu (2009) obtained a long term relationship between higher education and economic growth in North Cyprus. In the case of Romania, findings also indicated the relevance of higher education-growth correlation (Danacica, 2010; Dragoescu, 2015). Agiomirgianakis *et al.* (2002) analysed economic growth in Greece. Their work was aimed at identifying the connecting link between the number of students enrolled (in all educational levels) and economic growth. For primary and secondary education levels in Greece, authors noticed a direct causal relationship, and yet a reverse causation amongst higher education and economic growth.

Study by Petrakis and Stamatakis (2002) finds interesting results regarding the level of education and the growth effects. They suggested that those effects depend on the development stage. In other words, countries classified as underdeveloped mostly gain from primary and secondary education. For countries ranked as high income and developed, authors pointed out that these economies receive most benefit out of tertiary education. Sandar and Macdonald (2009) obtained results suggesting that higher education positively affects low income, lower middle income and upper middle income countries (including Croatia).

As can be seen from the literature review up to now, most of the previous research on the subject matter is focused on the impact of education on economic growth. The area related to the research of the impact of education expenditures on economic growth is sparsely researched. Their overview is given in the Table no. 1.

As evident from the Table no. 1, existing empirical research have come up with different results in view of link amongst education expenditure and economic growth and most of the researchers applied Granger causality test as a most appropriate research methodology. Blankenau *et al.* (2007), Bose *et al.* (2007), Mallick (2016) argued that the government expenditure on education causes economic growth. Quite the opposite, certain researches such as Francis and Iyare (2006) and Karaçor *et al.* (2017) provided evidence that education expenditures do not cause economic growth. It is also necessary to point out that some authors such as Yahya (2012) and Chandra (2010) have found bi-directional causality amongst the education expenditure and economic growth.

Table no. 1 – Empirical findings of previous studies

Authors	Sample and Period	Methodology	Results
Schneider and Frey (1985)	23 developed countries, 1960-2000	OLS	A significant positive impact of education expenditures on long-run economic growth in developed countries.
Francis and Iyare (2006)	Barbados, Jamaica, and Trinidad and Tobago, 1964-1998	Granger-causality test	No evidence of short or long term direct causality between expenditure on education (per capita) and gross national income (per capita) in Barbados, and Trinidad and Tobago. The empirical findings suggest some evidence of bi-directional causality in Jamaica, only short term.
Dragoescu (2015)	Romania, 1980-2013	Granger-causality test	Higher education Granger-cause economic growth.
Karaçor <i>et al.</i> (2017)	19 OECD countries, 1998 -2012	Panel data analysis	Education expenditure has no effect on GDP.
Kiran (2013)	18 Latin American countries, 1970–2009	Cointegration test procedure	Cointegration relationship is found amongst educational expenditures and economic growth (except Chile, Guyana, Jamaica, Nicaragua, Paraguay, Peru and Uruguay).
Bose <i>et al.</i> (2007)	30 developing countries, 1970–1990	Regression analysis	Long-lasting link amongst government expenditure on education and economic prosperity.
Yahya (2012)	Malaysia, 1970-2010	Granger-causality test	By-directional Granger causality amongst government expenditure on education and economic growth.
Mallick (2016)	14 selected Asian countries , 1973-2012	Granger-causality test	Long-lasting link amongst expenditure on education and economic growth.
Chandra (2010)	India, 1951-2009	Granger-causality test	By-directional Granger causality amongst education expenditure and economic growth.

Source: Author's own elaboration

Although the causality between higher education and economic growth has been reviewed and analyzed in a large number of papers, there are very few studies relating to Croatian higher education. [Aristovnik \(2011\)](#), [Arbula Blecich \(2012\)](#) and [Obadic and Aristovnik \(2011\)](#) focused on the government expenditure's relevance regarding the efficiency of higher education. [Ahec Šonje *et al.* \(2018\)](#) examined public expenditure's efficiency (regarding secondary and tertiary education in the European Union) with a special focus on Croatia and New Member States of European Union. They concluded that the efficiency is low and emphasized that education is a significant research topic in the field of economic growth. However, there is lack of literature upon the higher education – growth relationship regarding Croatia. Even more noteworthy, according to the author's knowledge, causality test between higher education expenditure and economic growth has not been implemented in the case of Croatia so far. The authors recognized the necessity for such an empirical analysis.

3. HIGHER EDUCATION IN CROATIA

Regulation of Croatian higher education system is conducted on the national level. The system has been under intensive reforms since 2003, driven by the Bologna Process, which Croatia entered in 2001.

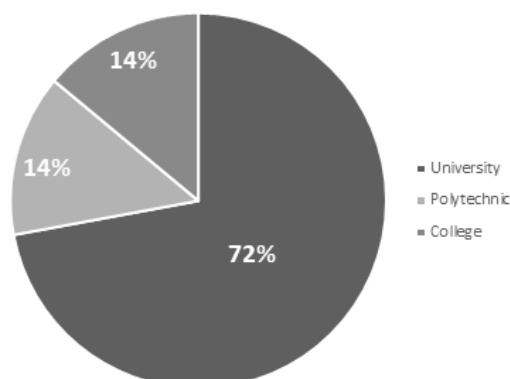
System's base and legal framework is the "[Act on Scientific Activity and Higher Education](#)," (Official Gazette, 123/03, 198/03, 105/04, 174/04, 02/07, 46/07, 45/09), and its implementation is within the competence of the Ministry of Science and Education. According to this framework, Croatian higher education system is constituted as a binary system, comprising two categories of study programmes: university and professional. Professional study programmes are offered and conducted in polytechnics, schools of professional higher education. Exceptionally, universities also offer those programmes and this is the specificity regarding Croatia ([Doolan et al., 2012](#)). The professional study programmes are organized as 3+2 years. On the other hand, academic studies are offered exclusively in universities. They are organized in three-cycle system – undergraduate, graduate and postgraduate. Since 2001, all study programmes are organized in accordance with the Bologna system. Croatian Agency for Science and Higher Education ([Agency for Science and Higher Education, 2020a, 2020b](#)) currently accredits 1358 study programmes in the Republic of Croatia.

According to the above-mentioned legal framework, higher education system in Croatia encompasses several types of higher education institutions offering university or professional degree programs:

- Universities - institutions offering university studies, carried out in minimum of two scientific and/or artistic fields in a bigger number of fields and interdisciplinary studies. The majority of Croatian universities are government-owned and mostly funded by the Ministry of Education and Science.
- Faculties - university's constituents that organize and conduct university studies and develop scientific professional work in minimally one or more scientific and professional fields.
- Art academies - university's constituents offering university art studies and fostering the development of top-level artistic creativity and scientific research in the field of art.
- Polytechnics – sub-systems of higher education providing at least three various studies in minimally three separate areas and cannot have colleges as constituents.
- Colleges - institutions that organize and conduct professional studies.

Although they are parts of universities, faculties and academies are legally considered separate and independent legal entities.

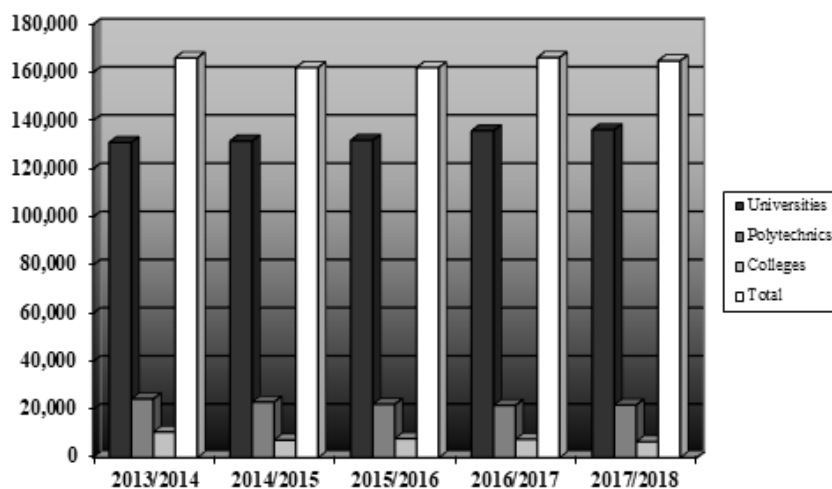
Regarding the size of the tertiary education system, according the Ministry of Science and Education and [Agency for Science and Higher Education \(2020a\)](#) data, there are currently 105 public and 24 private institutions of Higher Education in Croatia. In addition, those are 8 public universities (with 82 institutions) and 3 private ones, 12 public and 6 private polytechnics and 18 schools of professional higher education (3 public and 15 private).



Source: Agency for Science and Higher Education (2020a)

Figure no. 2 – Croatian higher education system in 2020, by type

In Croatian higher education system, public universities are the majority, with total of 92 institutions in Croatia. University of Zagreb is the oldest (founded in 1669), the largest and most numerous Croatian University. Rijeka, Split and Osijek also have larger universities, founded in the 1970s (University of Rijeka in 1973, University of Split in 1974 and J.J. Strossmayer University of Osijek in 1975). The last group is consisted of four relatively small and new universities - University of Juraj Dobrila in Pula (constituted in 2006), University of Dubrovnik (constituted in 2003), University of Zadar (constituted in 2002) and University Sjever (constituted in 2015).



Source: Agency for Science and Higher Education (2020a)

Figure no. 3 – Enrollment rates, Croatian Higher Education system

According to this data, the majority of Croatian students are traditionally enrolled at universities. The ratios are quite constant so as the total number of enrolled students, varying between 166.061 students in academic year 2013/2014 and 164.826 in academic year 2017/2018.

The quality of higher education is surely related to higher education funding. The percentage of GDP allocated to higher education and research differs from country to country and is one out of many possible indicators for the quality of higher education. Despite policies to increase revenues from students and companies, a typical European higher education institution still receives about two-thirds of the revenues from the basic state contribution (ETER - [European Tertiary Education Register, 2019](#)).

According to Eurostat (2020), 4.7% of Croatia's GDP is allocated on education (compared to the EU-28 average of 4.6%) in 2017. Observed as a percentage of total public expenditure, Croatian general education expenditure (10.5%) slightly exceeds the EU-28 average (10.2%). The proportion of higher education public expenditure is 21.5%, significantly higher in comparison to the Union's average of 15.0% (European Commission, 2019). Recent data for 2018 show that Croatia's government expenditure on higher education as a proportion of its GDP was 1.10%. This puts Croatia above the EU-28 average of 0.70% for the same year, in a group of countries that strongly focus on primary and tertiary education.

4. DATA AND METODOLOGICAL FRAMEWORK

In order to consider the causal link amongst higher education expenditure and economic growth in Croatia quarterly time series data from 2002(Q1) to 2018(Q4) are employed. Both variables have been obtained from Croatian Bureau of Statistics. The annual share of higher education expenditure in GDP in the respective quarters was used as a proxy for higher education expenditure. The value of GDP is expressed at constant prices. Both used variables are in logarithms and are seasonally adjusted (CENSUS-X12).

This research uses VAR methodology that is appropriate to test the research objectives as there is no a priori theory of causality amongst variables of interest, to be exact higher education expenditure and economic growth in Croatia. As part of the causal analysis, a unit root test will be performed first, then an appropriate VAR model will be set up, and finally a Granger causality test will be performed. describe

A conventional wisdom is that correlation does not imply causation. The relationship between the variables can be labeled with the causality concept developed by [Granger \(1969\)](#). The variable "X_t" is said to be Granger caused by "Y_t" if it helps in the prediction of "X_t", or, in other words, if the coefficients on the lagged values of "X_t" are statistically significant. The following models are specified to test the Granger causality in VAR environment:

$$\log gdp_t = a_0 + a_1 \log gdp_{t-1} + \dots + a_p \log gdp_{t-p} + b_1 \log hee_{t-1} + \dots + b_p \log hee_{t-p} + u_t \quad (1)$$

$$\log hee_t = c_0 + c_1 \log hee_{t-1} + \dots + c_p \log hee_{t-p} + d_1 \log gdp_{t-1} + \dots + d_p \log gdp_{t-p} + v_t \quad (2)$$

where $\log gdp$ i $\log hee$ are logarithms form of the gross domestic product and higher education expenditure in Croatia. P is attributed to the optimal lag length.

5. RESEARCH RESULTS

The first step was to test stationarity. Augmented Dickey-Fuller (ADF) Fischer test has been set to determine the order of integration of the variables involved in the model. Stationarity of the variables were tested for both time-series and, according to the results of the unit root test (ADF test), both series are stationary afterwards the first difference. The results are presented in [Table no. 2](#).

Table no. 2 – ADF test result

Variable	Level			First difference		
	Constant	Constant and Trend	None	Constant	Constant and Trend	None
Loggdp	-3.26**	-2.17	2.93	-5.96***	-6.38***	-4.47***
Loghee	-0.64	-0.97	-1.26	-10.55***	-10.51***	-10.43***

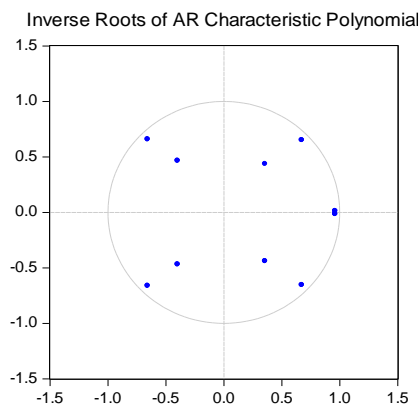
Note:

- The significance of p-value: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
- Lag length in the model is based on the Schwarz information criterion.

Source: Authors' calculations

ADF test results point to the fact that both variables are stationary after the first difference, so both series are denoted as I(1). Therefore, follows the conclusion that all the observed series do not contain the unit root. In other words, the zero hypothesis for non-stationarity has been rejected.

Selection of the optimal lag length is fundamental for the trustworthiness of VAR models (Liu, 2005). Akaike, Schwarz and Hannan-Quinn information criteria are used to choose the optimal number of lags. The dynamic stability of the VAR models is also checked. The optimal lag length selection was 5. The next step is to verify whether the model are 'dynamically stable'. [Figure no. 4](#) displays the above stated.



Source: Authors' calculations

Figure no. 4 – Stability of the VAR model

Given the circumstance that none of the roots lies outside the circle, it is concluded that the VAR models are stable. This implies results and deductions resulting from further analysis are not doubtful. Finally, the Granger causality was examined. Standard Granger

causality includes performing Wald test for the first p parameters of other variables in the VAR model. Consequently, if the Wald test was significant, it implies rejecting the null hypothesis of no causality.

Table no. 3 – Granger Causality Test

Dependent variables	Independent variables	
	loghee	loggdp
	$X^2 (b_i = 0; d_i = 0)$	
Loggdp	9.869810*	-
Loghee	-	4.436591
Critical values for X^2		
$X^2 (1):$ na 1% = 20.515, na 5% = 11.070, na 10% = 9.236		

Note: The significance of p-value: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Authors' calculations

Research results point to the conclusion that there is the short-run causality running from higher education expenditure to GDP in Croatia at the 10% level of significance. Consequently, null hypothesis 'loghee non-cause loggdp' is rejected.

As regards the other dependent variables, the second null hypothesis 'loggdp non-cause loghee' could not be rejected. Research results indicate that there is the absence of short-run causality running from gdp to higher education expenditure in Croatia.

6. CONCLUSION

In the 21st century, the goal of every country is to upgrade the quality of higher education. Higher education institutions may affect economic growth through a greater supply of human capital, more innovation, support for democratic values and demand effects (Valero and Van Reenen, 2018). Some previous research claim that public funding of higher education enhance human capital formation and therefore economic growth of a country (Arclean and Schiopu, 2009; Blankenau, 2005). It is also interesting to mention Arclean and Schiopu (2009) how found that "for a given public budget, a higher share of public funding induces higher private education spending overall, of which a larger share goes towards higher education".

Croatia is certainly amongst countries that could prosper from a higher amount of public funding of higher education. The need to invest in education may never have come to the fore as at this time of the pandemic. A digital gap between countries has become even deeper. The more countries have invested in their education so far, the more they are now ready to adequately respond to the needs of quality virtual teaching. The need for continuing education is pointless to discuss further.

This study recognizes the research gap regarding the relationship between higher education expenditure and its impact on GDP with respect to Croatia. The empirical outcomes of Granger causality within the VAR model established the one-way short-run causality relationships running from higher education expenditure to GDP in Croatia. Research results have confirmed the reasoning of the established research ground, especially having in mind there are very few studies relating to the specified topic in Croatia.

Study results have noteworthy political implications. It is suggested that the government should focus more on higher education, with emphasis to university education. In addition, this

means that future public expenditure for higher education should be increased, in order to accomplish accelerated economic growth and sustainable development. Increasing public investment, particularly in countries like Croatia, as well as striving to mobilize more private assets towards the wider framework of higher education and international excellence are set as the global policy ultimatums for higher education in European Union.

Notes

The present study has been presented at the 12th International Conference “Economies of the Balkan and Eastern European Countries”, EBEEC 2020, that has been online in Opatija, Croatia from May 29th to 31th 2020 (<http://ebeec.ihu.gr/>).

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