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RETURN ON INVESTMENT IN EDUCATION. CASE STUDY ON EDUCATION IN ROMANIA

Pribac Loredana Ioana PhD
"Vasile Goldis" Western University of Arad
E-mail: pribacloredana@yahoo.com
Anghelina Andrei PhD
"Vasile Goldis" Western University of Arad
E-mail: a_anghelina@uvvg.ro
Blaga Radu Lucian PhD
"Vasile Goldis" Western University of Arad
E-mail: buteniradu@yahoo.com

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Abstract: The aim of this study is to develop, test and validate based on a conceptual research model, the influence of education on the GDP/ capita, starting from relevant theories and empirical models from literature or implementing additional impact models and variables. Building on the model developed by Mincer (1995) on the yield rates of investment in education, we applied econometric models for Romania, for the period 1960-2010. The results led to a main conclusion, namely, the importance of investment in education is undeniable, it has positive effect on the economic growth of Romania.
Key words: education, human capital, returns, investment in education
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Introduction

The causal relationship human capital (education) - growth, which we find at authors everywhere, being still of great interest, even though this research has gone through several stages and results and the results obtained and the assessments outlined range from emphasizing the importance of education up to denying it, get constant attention.

Literature on this topic is extremely broad and dynamic, rich in theory and practical lessons, proving to be a tool for continuing the research in light of the new evolutions and development of people and societies in the contemporary economy. Therefore, the aim of this study is to develop, test and validate based on a conceptual research model, the influence of education on the GDP / capita, starting from relevant theories and empirical models from literature or implementing additional impact models and variables. Thus, we have first considered a critical analysis of the specialty literature, comprising elements of founding the human capital concept and theory, then, using these pieces of knowledge and based on

statistical evidence, a second specific objective is related to the emphasis of the causal relationship human capital - economic growth.
The term „human capital" is reflected not only in economics, but also in other areas of investigation, this study being focused only on the relevance of education as an important factor influencing the growth of the GDP / capita.
These models tend to show that several options are provided to policymakers who want to increase the production level, providing information which supports the confidence in the role of education in this process. The study contributes to the empirical literature incorporating models developed on *panel* data, integrating the results obtained in the empirical generalizations recognized in terms of the role and the implications of human capital in society.

1. Literature review

Economists and specialists from other science domains dealt in their research with the influence factors of the process of the economic growth, finding in the current theoretical outline ideas which go more than two centuries back. Smith (1776), Schultz (1961), Becker (1975), Nelson and Phelps (1966), Romer (1986), Mankiw, Romer and Weil (1992), Benhabib and Spiegel (1994) Temple (2001), Kruger and Lindahl (2001), Pritchett (2001), Psacharopoulos and Patrinos (1993, 2004), Hanushek and Woessmann (2009) etc. are just some of those who proved that physical capital cannot, by itself, influence the increase of the income per capita and whose research efforts have led to an extremely voluminous literature, contributing to the widely accepted belief of the positive role of human capital circumscribed to education on people and the societies which they belong to, and on the world economy as a whole.
Thus, the role of human capital was gradually shaped, even though at first it was not assimilated to an independent factor, having itself an origin and own determinant factors. However if within their studies, some authors have emphasized the doubtlessly positive role of the human capital in relation to the growth process, and this especially in the early 1990s, others bring new contributions to the analysis of this relationship showing themselves, tough, more sceptical in considering the role of the human capital, usually expressed through the education component, as a determining factor in this process.
The educational process is one of formation and development of individuals, being, at the same time, a defining element of human society. Numerous times viewed by the perspective of its effects, the approaches of the issues related to education are very diverse. Thus, in the vision of Greiner and Semmler (2002), education represents a good for society, being the condition for some positive externalities of the investments in economy. On the other hand, Breton (2003) reckons that education creates human capital, which leads to generating the national income,

just as physical capital does. Mincer (1995) sees education as a way by which one can influence investments in economy, because educated people invest more than people having graduated from less higher education studies.

Education is associated with economic and social processes, one of the most grounded research studies regarding its role in the growth and development of a society. It has effects over a multitude of components of economic and social life, from productivity, salary, experience, poverty, unemployment, culture, etc., to aspects that have to deal with national and regional features. For example, Alan B. Krueger and Mikael Lindahl (2001), in the study *Education for Growth: Why and For Whom?* show that, in developed countries, education is negatively associated with the fertility rate and positively associated with the health rate of young children and with the participation of the labor force in the economic process.

Barro and Sala-i-Martin (1990) reckon that educational process cannot take place in a short time, as it is a long-term process. Whereas cars and buildings can be built in a short time, people cannot be educated quickly.

An important relation is that between education (the education system) and national governments which influence education decisively, as it is compulsory until children reach a certain age, but it becomes a choice after a certain point. In many countries, this choice is not possible, because the education system is not properly developed and this way people's chance to benefit from education is limited. In Romania, studies show that, for example: participation at decision taking, a good communication and a beneficial psychological environment have values in education sectors in the employers' view in 2013 times in Romania. (Neagu et. al, 2014) In 2013 the raise of globalization index is accompanied by an increase of income inequality in Romania. Increasing values of globalization has led to the deepening of the gap between individuals' and households incomes in Romania. (Neagu, 2014)

2. Education and efficiency rates of investments in education

Education has an important role to society, as it interacts at different levels, with different factors, and the results are seen in economy. Any economic effort directed towards an investment in human capital will stimulate economic growth by an increase in the productivity. The marginal efficiency of the investment in human capital has to decrease as the effort increases.

As any other investment, investments in human capital (in education) may be assessed through the efficiency rate, representing the increase of the individual gains after an additional study year. Stevens and Weale (2003) state that the efficiency of each school year increases to the point that the marginal efficiency of education equals the marginal benefit wished for by each individual.

In literature, efficiency rates of investments in education (the benefits of education) are found in three forms, thus: *the social efficiency rate* (the social gains) refers to the gains for the whole of an economy, including externalities, that is other's benefits, that can be obtained by an investor; *the public efficiency rate* measures the lucrativeness of the investment in education from the government's point of view and assesses to what extent the tax-payer incomes (the tax for the supplementary revenue obtained by individuals) exceed the costs for sustaining the education system; *the private efficiency rate* assesses the potential gains of individuals who invest in education, indicating whether it is profitable to contain his/her studies or whether it is better to start working. This rate compares costs and benefits from education, supported by, respectively obtained by a pupil or a student who makes this investment.

The assessment of these efficiency rates of the investment in education may be done by comparing the benefits and the costs involved by education, and after this assessment one may make a decision regarding the investment in education. This investment must be viewed through the perspective of time, as the period of recovering the invested capital is limited by the age of individuals. The comparison of the costs and benefits in education highlights private efficiency much higher than the social rate of upgrading (Pascharopoulois, 2004, p. 13).

In the opinion of Krueger and Lindahl (2001), social efficiency may be higher than the private one in education, because education leads to technological progress, to the reduction of the criminality rate, to the improvement of the health level and to political decisions taken because of better information. Bloom, Canning and Chan (2005) enumerate the efficiency that they see as belonging to tertiary education and which, in part, coincide with the ones enumerated by Krueger and Lindahl (2001), more specifically: applying higher taxes to incomes; the increase of the number of savings and investments; creating a more entrepreneurial and civic society; improving the health level of a nation; the contribution in the growth rate of the population; the technological improvement and political consolidation.

Resembling to the opinion of Bloom, Canning and Chan (2005) is the opinion of Musibau and Rasak (2005), who support the role of education (primary, secondary, tertiary) in the economic growth by improving the health, by reducing the fertility rate and by the contribution in the political stability. On the other hand, Temple (2001) reckons that education is viewed by economists (both theorists and practitioners) as having rather little efficiency (few benefits).

A recent study entitled *"Putting Higher Education to Work"* of the World Bank (2012) emphasizes the role of tertiary education in producing efficiency, in consolidating the nation and in improving the socializing level.

Psacharopoulos and Patrinos (2004) made an upgrade and a completion of previous studies regarding the values of the efficiency of education investments, quantifying

social and private efficiency in education worldwide and according to geographical areas, according to education levels (primary, secondary, tertiary), as well as according to women and men. They realized that depending on the assessment method used, there are small differences in the education efficiency values that they obtained: thus, by applying a method of assessing the instrumental variables, based on the information regarding the situation of the family, the values got by Psacharopoulos and Patrinos (2004) are higher than the specifications made by Becker and Chiswick (1966) and Mincer (1974), by applying the method of the smallest squares.
The values of the education investments efficiency obtained by Psacharopoulos and Patrinos (2004), that we are going to use in the empirical analysis, are in accordance with the data in table 2.1, being higher, once the level of the studies graduated from increases:

Table no. 2.1. Privat and social returns of education, %

Region	Social			Private		
	Primary	**Secondary**	**Tertiary**	**Primary**	**Secondary**	**Tertiary**
Asia*	16,2	11,1	11,0	20,0	15,8	18,2
Europe, Middle East, N Africa*	15,6	9,7	9,9	***13,8***	***13,6***	***18,8***
Latin America, Carribean	17,4	12,9	12,3	26,6	17,0	19,5
OCDE	8,5	9,4	8,5	13,4	11,3	11,6
S Africa-Sahara	25,4	18,4	11,3	37,6	24,6	27,8
World	18,9	13,1	10,8	26,6	17,0	19,0

*Non-OCDE
Source: Psacharopoulos and Patrinos, 2004, p. 4

These assessments were reviewed 1973 to 2004, and they were different according to countries, including in what concerns the year of the elementary data considered in the calculation of the efficiency, the data from the table reflecting an average for those particular country groups.
Andren, Earle and Sapatoru (2004) made an analysis of the impact of education, measured by the school years, over the monthly revenues in Romania, for the period 1950-2000. Starting from the standard equation of the revenues of Mincer (1974) and using statistical data provided by the National Institute for Statistics, Andren, Earle and Sapatoru (2004) calculated the following efficiency of the education investment (for all of the three cycles of education) (table 2.2).
The period 1990-2000 seen as a period of transition from a communist system, to a market economy, brought major changes in the education system and an international opening to education. The analysis results indicate that right in the

first year after 1990 the efficiency of the education investments practically doubled, as compared to the years before the reform.

Table no. 2.2. Returns of education in Romania, %

Y	1960	1965	1970	1975	1980	1985	1990	1995	2000
%	4,7	4,6	3,9	4,2	4,3	3,4	**6,4**	**6,7**	**8,5**

Source: Andren, Earle and Sapatoru, 2004, p. 35

The authors offer a few possible explanations of these results, among which: an increase in the demand for more educated labor force; an improvement of the education quality; the international opening of the economy, by the pressure on the differential of knowledge of the labor force, in order to take it to the level of the neighboring countries; the possibilities of entrepreneurial development etc. (Andren, Earle andSapatoru, 2004, p. 16).

3. Methodology

In the models applied to Romania, the general form of the equation is one of semi-long type:

$$log(rgdpch) = \beta_0 + \beta_1 log(fbcf) + \beta_2 log(s_h) - \beta_3(n+g+\delta) + \varepsilon_t$$

The dependent variable is the GDP per inhabitant (*rgdpch)*, and the dependent variables are the physical capital per inhabitant (*fbcf)*, the demographic variable regarding the active population ($n+g+\delta$ – where $g+\delta=0,05$ and represents the rate of growth of the technological progress and the depreciation rate of the capital), and the human capital which was calculated in several ways, according to the average of the school years, efficiency and labor force, and $\beta_0$is the constant,β represents the coefficients of the model and ε represents the residuals of the factors which were not included in the model.

The assessment of the human capital according to the mincerian specification was done according to the average of the school years, the efficiency of education and the labor force stock. For the average of the school years we used the age group over 15 years and, respectively, the age group over 25, and for the stock of the population the two groups used are the one comprised between 15-64 years of age, and respectively, 25-64. For the education efficiency the values were calculated by us – *Models 2, 3, 6 and 7* – as well as taken from the study done by Psacharopoulos and Patrinos (2004) - *Model 1* - and Andren, Earle and Sapatoru (2004) – *Models 4,5,8 and 9*.

The models were processed in the statistic program Stata 11.0. The restriction regarding the presence of the homoscedasticity was confirmed by the fact that the

values obtained are different from zero for the Breusch-Pagan test. All models were validated by the point of view of autocorrelation of 1st order which we made the Durbin-Watson test for (the values obtained are close to value 2, indicating the lack of autocorrelation); equally, the absence of the multicollinearity at the level of the exogenous variables was verified by generating the correlation matrix.
F test indicates values which are significant from a statistical point of view for all models, thus the explicative variables are relevant when analysed as a whole in the relation with the dependent variable, and test *t*, by the attached values of *p*, indicates the individual relevance of the explicative variables, the only variable which also has values above 0.05 is the growth rate of the active population.

4. Models developed based on the human capital calculated according to the mincerian specification, of the active population and of the physical capital

For Romania (the period 1960-2010, every five years), we calculated the human capital variable in accordance with the mincerian specification.
In *Model 1*, in order to assess the human capital, we employed the values of the education investments efficiency calculated by Psacharopoulos and Patrinos (2004), the average of the school years of the population aged over 15 and the stock of the population aged 25 to 64. The coefficient sign of the human capital shows a favorable influence upon the growth rate, at a level of 0.1%, thus with a growth of 1% of the human capital the increase of the GDP per inhabitant will be of 0.35%. The magnitude of the human capital influence emphasizes its importance in the process of economic growth.
The physical capital per worker has the coefficient with the plus sign, but has a statistical significance of just 5%. The increase effect over the GDP per inhabitant is 0.37% at an increase of 1%.
For the coefficient of the population increase variable the sign is the expected one (minus), but because the statistical significance is low the growth effect of the GDP per inhabitant is a less relevant one.
The value of R^2 is close to value 1, this way the variation of the dependent variable (the GDP per inhabitant) is explained in proportion of 97% through the variation of the physical capital per worker, of the human capital and of the increase rate of the active population.
In *Model 2*, human capital was approximated depending on the education investment efficiency calculated by us according to the minimum and average wages, to the stock of people aged 25-64 and of the average number of school years of the population over 25 years of age. The coefficient has the plus sign showing a positive effect on the increase of the GDP per inhabitant, but because the statistical significance is just at the level of 5%, the robustness of the result is

reduced (with an increase of 1% it leads to an increase of 0.16% of the GDP per inhabitant).

Table no. 4.1. The estimation results based models of human capital expressed by Mincer specification, the case of Romania (1)

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se
logfbcf	0.372* (0.09)	0.463* (0.16)	0.253** (0.12)	0.292 (0.21)	0.242 (0.18)
$logedu_{RO\eta medie}$	0.437*** (0.15)				
Popactiva	-0.136 (0.44)	0.054 (0.77)	-0.105 (0.59)	-0.486 (1.12)	-1.349 (0.95)
$logedu_{RO\eta calc25-64/25+}$		0.160* (0.04)			
$logedu_{RO\eta calc15-64/15+}$			0.223** (0.04)		
$logedu_{RO\eta activ25-64/15+}$				0.161* (0.04)	
$logedu_{RO\eta activ15-64/15+}$					0.238* (0.04)
Constanta	-0.202 (0.99)	1.750 (1.58)	0.276 (1.30)	3.464 (2.04)	2.922 (1.68)
R-squared	0.975	0.924	0.955	0.960	0.973
F	65.221	20.379	35.349	23.716	35.368
N observations	9.000	9.000	9.000	7.000	7.000

* p<0.05, ** p<0.01, *** p<0.001
Note: Standard errors are in parentheses.
Source: Working in the software Stata 11.0

The rate of investments has a significant positive effect, but just at the level of 5%. The increase of the GDP per inhabitant by 0.46% occurs when the investments rate increases by 1%.

The coefficient of the increase rate of the active population has the minus sign indicating an increase of 5% of the GDP per inhabitant when this modifies by one unit, but because the statistical significance is low, this reduces the magnitude of the effect on the GDP per inhabitant.

The variation of the GDP per inhabitant is explained as much as 92% by the variation of the human capital, of the physical capital per worker and of the active population, because R^2 has the value of 0.92.

In the specification of *Model 3* human capital was assessed according to the efficiency calculated by us, for the people aged between 25-64 years and of the

average of the school years of the population over 15 years old. The results indicate the plus sign for the human capital coefficient and a statistical significance of 1%. As compared to *Model 2* the coefficient value is bigger; consequently its influence on the increase rate is 0.22% at an increase of 1%.

For the physical capital per worker the plus sign of the coefficient shows the positive effect that it has on the GDP per inhabitant. The variable is statistically significant at the level of 1%; hence with an increase of the physical capital per worker of 1% it may lead to an increase of the physical capital per inhabitant of 0.52%.

The expected sign of the active population increase rate coefficient is minus, because with a decrease of the population, the value of the GDP per inhabitant will be higher, but because the variable has no significant statistical relevance, this reduces the magnitude of the created effect.

Another study which calculates the efficiency of the investment in education is the one made by Andren, Earle and Sapatoru (2004). In our study we took over these values of the efficiency with the aim of assessing the human capital in the specification of *Model 4* (the average of the school years of the population over 15, the stock of the active population aged 25 to 64. For this assessment of the human capital, the sign of the coefficient is the expected one (plus), but from the point of view of the statistical significance, the latter is just at 5%. The increase of the GDP per inhabitant may be influenced by the human capital by 0.16% at its increase by 1%.

Unlike the other three models, where physical capital had a significant statistical relevance, in this model, the statistical relevance is low, but the influence on the increase rate is a positive one, because the sign of the coefficient is plus.

The increase of the population number has a positive influence on the GDP per inhabitant, but as the statistical significance is a low one, this influence is a less significant one.

The value of R2 is very big, so the correlation between the variables is very strong, 96% of the variation of the GDP per inhabitant is explained by the variation of the human capital, of the physical capital and of the active population.

In *Model 5*, human capital is approximated according to the stock of the active population (15-64 years), the average of the school years (the population over 15 years) and the efficiency of the education investment (Andren, Earle and Sapatoru (2004)), consequently the results obtained are comparable to the ones obtained in *Model 4*. The human capital coefficient has the plus sign, leading to an increase effect on the GDP per inhabitant, thus by an increase of 1% the influence of the human capital on the increase rate is of 0.24%, but it is verified at a level of statistical relevance of just 5% (this value is higher than the one obtained in *Model 4*).

In table 4.2 one can see the values obtained for the coefficients of the human capital assessed according to the mincerian specification, for Romania 1960 to 2010 (every five years).

In *Model 6*, the human capital variable is assessed according to the efficiency calculated by us, based on the population stock aged between 15-64 years and on the average number of school years graduated from by the population over 25 years old. By the plus sign of the coefficient a positive influence of the human capital on the GDP per inhabitant is indicated, at a statistical level of just 5%, and by the value of the coefficient an increase of the GDP/capita by 0.15% is indicated when human capital increases by 1%.

The physical capital per worker has the coefficient with the plus sign; thus it leads to an increase of the GDP per inhabitant by 0.46%, when it increases by 1%. The variable has a statistical relevance of just 5%.

Table no. 4.2. The estimation results based models of human capital Expressed by Mincer specification, the case of Romania (2)

	Model 6 b/se	Model 7 b/se	Model 8 b/se	Model 9 b/se
logfbcf	0.462* (0.16)	0.519** (0.12)	0.294 (0.21)	0.247 (0.18)
$logedu_{RO\eta medie}$	0.155* (0.04)			
Popactiva	0.054 (0.76)	-0.099 (0.59)	-0.485 (1.12)	-1.306 (0.95)
$logedu_{RO\eta calc25-64/25+}$		0.213* (0.04)		
$logedu_{RO\eta calc15-64/15+}$			0.155** (0.03)	
$logedu_{RO\eta activ25-64/15+}$				0.226* (0.04)
Constanta	-1.845 (1.55)	0.472 (1.28)	3.536 (2.03)	3.053 (1.68)
R-squared	0.926	0.955	0.960	0.972
F	20.895	35.667	23.732	35.334
N observations	9.000	9.000	7.000	7.000

* p<0.05, ** p<0.01, *** p<0.001
Note: Standard errors are in parentheses.
Source: Working in the software Stata 11.0

The demographical variable of the model (the increase rate of the active population) does not have the expected sign, nor does it have a significant statistical relevance, hence the effect on the increase rate is a less relevant one.

The value of R^2 indicates a strong correlation of the variables; it is this way that 93% of the GDP variation per inhabitant can be explained according to the variation of the human capital, of the physical capital per worker and of the increase rate of the active population.

Another way of assessing the human capital on the mincerian specification is the one applied in *Model 7*, where the human capital was approximated according to the efficiency calculated by us, based on the population stock between 15-64 years of age and on the average of the school years of the population over 15. The sign obtained for the human capital coefficient is plus, positively influencing the increase rate, the statistical significance being at 1%. Therefore, with an increase of 1% of the human capital, the increase effect on the GDP is by 0.21%.

The investments rate expressed by the physical capital per worker has the coefficient with the plus sign and a significant statistical relevance at 1%. The value of the influence on the GDP/capita is of 0.52% when it increases by 1%.

Similarly to the other models developed according to the mincerian specification, for the increase rate of the active population the results obtained indicate a low statistical relevance, therefore the effect on the GDP/capita is a lower one.

The value of R^2 is higher and it indicates a correlation relationship at the level of the variables, thus 95% of the GDP variation per inhabitant is explained by the variation of the independent variables of the model.

In *Model 8*, human capital is assessed according to the values of the education investment efficiency calculated by Andren, Earle and Sapatoru (2004), to the average of the school years of the population over 25 years of age and to the stock of the population comprised between 25-64 years old. The results obtained indicate for the human capital coefficient the expected (plus) sign, thus with an increase of 1% the influence on the GDP per inhabitant is at 0.16%. The statistical relevance of the variable is of just 5%.

For the physical capital per worker the statistical significance is low, thus the effect on the increase rate is a less relevant, but positive one, because the coefficient has the plus sign. Similar results were obtained also for the increase rate of the active population, so the effect of this variable too on the GDP/capita is a positive one.

The value of R^2 indicates a strong correlation between the variables of the model, the variation of the GDP per inhabitant being explained as much as 95% by the variation of the physical capital per worker, of the human capital and of the increase rate of the active population.

Also, in *Model 9*, human capital was calculated according to the values of the education investment efficiency calculated by Andren, Earle and Sapatoru (2004), according to the average of the school years of the population over 25 and to the stock of the population between 15-64 years of age. The results obtained for the variable of the human capital indicates an increase effect on the GDP per

inhabitant; thus with an increase of 1% of the human capital, it leads to an increase of 0.24% of the GDP per inhabitant. From the point of view of the statistical relevance, the latter is just at 5%.
The coefficient of the physical capital per worker has the plus sign, but because the statistical relevance is low, the effect of the physical capital on the increase rate is not a significant one. And for the variable of the increase rate of the active population the results show a positive effect on the GDP/capita.
The value of R^2 indicates the existence of the correlation between the variables of the model, therefore the variation of the GDP per inhabitant may be explained to the extent of 97% by the variation of the explicative variable of the model.

Discussions

The study is based on and consolidates the results of other relevant studies in which most of the identified variables were considered and integrated into comprehensive models of quantitative and qualitative analysis. Our results mostly validate the role of education in the economic growth process. But, the database which the empirical analysis was built on was limited to quantitative expressions and only for Romania, not for all the EU countries.

Conclusion

The variables calculated according to the mincerian specification were inserted in the specification of the model only in Romania's case (the reason is the lack of the availability of the data). According to the data used in assessing the human capital (the efficiency of the investment in education, the average of the number of study years, the stock of the active population according to age group), the magnitude of its influence on the increase rate is higher or lower; however, this assessment of the human capital confirms the existence of a positive relation between human capital and economic growth as well.
All these results show the special importance of the human capital on economic growth, and conclude on the confirmation of the causal relation education-growth.
Complex aspects surprised theme, from conceptualization to implementation, and lead to possible technical deviations or general understanding of such analysis. A minus can be considered and the actual situation related to relatively low availability of comparable data for the countries analysed. However, validation of models successfully counterbalances this data limitation, successfully validating causal relationship analysed.
These conclusive results on the relationship between human capital and growth of GDP per capita open new opportunities and challenges for the continuation and deepening of research, especially through the construction of composite indices

that can reflect better the reality of the education system, specially reporting to the quality education and the return on investment in education.
At the same time, we can develop and analyze new growth regression specifications that could be improved and that can include a larger number of countries in research and potential inclusion of new variables influence.

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