

# Reevaluating Greece Growth Potential. An econometric Approach

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## Abstract

Econometric evidence from Public Investments in goods such as schooling illustrate a controversy. Especially when compared to similar studies in other parts of the world. Two decades back, results proved that investing in public schooling was highly imprinted onto the country's economic growth rate. More recent data prove otherwise and challenge this hypothesis for the part that concerns the statutory provision. At the same time, the large enough available talent pool is itself a strength which can attract investment opportunities by receiving a proper, smart and robust pricing, not to mention the training.

Finally, we cast doubt on the notion that a strict financial adjustment program can induce sustainable development and boost economic growth. We introduce the idea that the Greek potential has to be reevaluated and discuss about calibrating the channels of knowledge transmission to the needs of the market and the trends for the future.

*Keywords: Government expenditures in education, Economic Growth, Time-series, Nonparametric.*

*JEL Codes: C14, C 22, C58, O38, O15, H52, C32.*

## 1. Introduction

Data at hand show major improvements in schooling and education provision across developing countries the past decades, as most of it emphasized on the role of human capital as a driver for economic growth. The unjustifiable amount of schooling received by each student though, and the “graduation” rally did not bring the desired effect. Accumulation of degrees is not regarded as a skill. Recent research projects have brought out the value of cognitive skills in economic growth. Cognition instead of mere school attainment is straightforward related with individual earnings. Back in time, when baby boomers were entering the market, degrees mattered a lot and created a high demand. Today, things got a lot different. With so many graduates and just by looking at the ads on the newspaper, one easily tells that employers go beyond the degree and ask for a lot more credentials from potential employees, to prove efficiency and professional capacity.

This reported lack of skills provides some explanation on why this desired effect of human capital on economic growth was not finally accomplished through schooling at all. Expansion of school enrollment and attainment caused a major crippling of the market in some cases. Many hard market skills vanished, as marks of social inferiority, while other softer skills came to take their place. The vision of a “service economy” haunted income per capita, and total economic growth. At the same time the critique on who dares to be an entrepreneur and who can cope with the market, remains

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unchallenged up to this day, even though entrepreneurship is declining.

## 2. Where does Greece stand in the developed world?

As many scholars have cited, the issue of education having a causal effect on the economic growth of the country is mainly a problem scrutinized by emerging economies like the BCIM and such. Developed economies have never had any doubt about their leading role in convergence.

Analyzing the results of this study we dare to say that the Greek Economy stands somewhere in the middle. Nor has it ever neglected the effect of education on its own economic growth responding with quantitative investments on infrastructure ( building new schools, hiring additional personnel etc), neither has it ever occupied itself only with qualitative issues such as time in classroom, teaching subjects, restrictions from entering (apart from HE and according to the Constitution)etc.

So, researchers, in developing countries (Mostafizur, Liu, 2012, Qazi et al, 2013) explore the education vs growth relationship, while in developed countries they explore other relationships like education for well-being, education for self-awareness, education for philosophy, education for cohesion, education against drop-outs etc, revealing a lot about the situation at hand in their respective country. No researcher has he or she ever wondered if education brings growth in the US or GB etc, because this thing is self-evident. Education provision is also a large division with a great market share in terms of labor and capital, that brings economic growth in itself and its counterparts if done properly, and the business sector that integrates progress and technological change in its textbooks promoting personal economic growth in any functioning economy and competition.

## 3. Data description and preliminary diagnostics

The dataset involves annual student enrollments for all educational levels, namely, preschool, elementary, secondary and tertiary, public expenditures as derived from the government's budget for education, and annual GDP per capita. The initial observations refer to the period 09/1960-61 to 09/2014 -15(start of school year), the period is covered by the 55 observations that were used for all variables. In order to catch most of the variance, the data had been processed using **cubic spline interpolation (Matlab)**, and the final sample followed a quarterly frequency providing 216 observations.

### 3.1 Preliminary diagnostics

Table 1 contains the summary statistics for each variable, for the whole period under review.

They include also the parameters of mean, median, standard deviation, skewness, kurtosis and the Jarque-Bera test, and its P-value.

None of the means is statistically different from zero, except slightly for higher education.

**Table 1. Preliminary statistics 1960 Q1-2014 Q4**

	<b>GDP</b>	<b>EDEX</b>	<b>P</b>	<b>E</b>	<b>S</b>	<b>H</b>
<b>Mean</b>	6726.597	2.29E+09	124841.1	803855.5	601127.3	110921.9
<b>Std. Dev.</b>	7499.131	2.83E+09	36694.62	132151.0	135145.1	40385.66
<b>Skewness</b>	0.722508	0.943046	-1.071234	-0.227574	-1.015759	0.079490
<b>Kurtosis</b>	1.952771	2.413356	2.825591	1.301999	2.676085	2.215645
<b>Jarque-Bera</b>	28.66284	35.11342	41.58530	27.81331	38.08791	5.764387
<b>P-value</b>	0.000001	0.000000	0.000000	0.000001	0.000000	0.056012

## 4. Methodology

This section analyses the definitions of the linear and non linear Granger causality. The first paragraph presents a brief overview of the traditional linear approach as it has been used to report for the presence of linear Granger causality in previous studies. The second part of this section is dedicated to the more elaborate statistical technique developed first by Baek and Brock (1992), modified later on by Hiemstra and Jones (1994), obviously improved by Diks and Panchenko (2006) and backed up by the Diks and Wolski (2012) extension to the method of non linear testing.

### 4.1 Linear Granger causality test

Uni directional and bidirectional causality tests are conducted following Granger methodological patterns. This procedure is essentially a test of the predictive ability of time series models. The condition that is being satisfied is whether the lagged values of a time series X predict, or not, the future values of a time series Y, and viceversa, in the Granger sense

According to the VAR model being used, X is said to cause Y if the coefficient is not zero in the following equation:

$$(1) Y_t = \alpha_0 + \sum_{i=1}^l \beta_i X_{t-i} + \sum_{j=1}^l \delta_j Y_{t-j} + \varepsilon_t$$

$$(2) X_t = b_0 + \sum_{i=1}^l \pi_i Y_{t-i} + \sum_{j=1}^l c_j X_{t-j} + \mu_t$$

### 4.2 Non linear Granger causality test

As said, “traditional parametric tests for Granger non causality within linear autoregressive model classes have reached a mature status, and have become part of the standard toolbox for economists”. The weakness of the linear approach to causality testing is their inability to detect the existence of certain no linear relations, mainly due to its construction. The non linear method was first proposed by Baek and Brock (1992). The first modification on this method was applied by Hiemstra and Jones (1994). Their model, later on, was found to be producing spurious results as it had the tendency to over reject the null hypothesis. Diks and Panchenko (2005) suggested a new

nonparametric statistical software alternative to the HJ test. Namely Diks and Panchenko(2005) introduced a new nonparametric test for Granger non causality, such that avoids the over rejection rates of the frequently used test proposed by Hiemstra and Jones (1994). The real problem is that if the null hypothesis is true then the HJ test can severely over reject. This new DP test does not suffer from this serious limitation mainly due to its global nature, ignoring the possible variation in conditional distributions that maybe present under the null hypothesis. The new test statistic, letting the bandwidth  $e$  tend to zero at appropriate rates, with increasing the sample size, which we will refer to again at a later stage, automatically takes into account such variation under the null hypothesis while obtaining an asymptotically correct size.

It is very important to remove the source of the bias, and guarantee less size distortion as one main reason reported why HJ is inconsistent is that the assumptions made by it do not hold in general

They made **available 2 C codes referring to the asymmetric and bootstrapped non linear tests respectively.**

In order to test for non linear Granger causality one first has to remove the linear dependencies. One classic step one has to follow is: Applying a VAR model to all time series of the variables in order to obtain the estimated residuals to test for non linear causality. After estimating the VAR residuals, and according to the method that is being followed the BEKK framework provides us with another suitable model from the GARCH family that serves our forecasting interests.

So, the VAR model can be written as follows:

$$(3) \quad R_{i,t} = \sum_{j=1}^6 \delta_{ij} R_{j,t-1} + \varepsilon_{i,t} \quad \text{for } i, j = 1, 2, 3, 4, 5, 6$$

The Garch model that is applied can be written as follows:

$$(4) \quad \log \sigma_t^2 = \omega + \sum_{k=1}^q \beta_k g(Z_t - k) + \sum_{k=1}^p \alpha_k \log \sigma_{t-k}^2$$

By removing all linear predictive power, all remaining predictive power of any residual series on another can be regarded non linear predictive power.

#### 4.2.1 Bandwidth selection

The DP test is consistent if we let the bandwidth depend on the sample size as follows,

$$(5) \quad e_n = Cn^{-b}$$

For any positive constant  $C$  and  $b \in \left(\frac{1}{4}, \frac{1}{3}\right)$ . The only value that  $b$  can take is  $\frac{2}{7}$ . In this case ,

$$(6) \quad e_n = C^* n^{-\frac{2}{7}}$$

With

$$(6) \quad C^* = \left( \frac{18.3q_2}{4(E[S(W)])^2} \right)^{\frac{1}{7}}$$

The optimal choices for  $C$  and  $b$  rely heavily on the data generating process.

#### 4.2.2 Data sharpening (DS) as a bias reduction method

Diks and Wolski (2012), following the modification of the HJ test, confronted the issue of the large kernel estimator bias concerning the DP test which promotes inconsistency in the multivariate setting.

The intuition behind DS is to disturb the original dataset by a sharpening function  $\psi_\rho(\cdot)$  so as to obtain the desirable properties of the estimator, where  $\rho$  is the order of bias reduction. Their innovation lies within concentrating points where they are already dense and thin them where they are already sparse. The sharpening function as given above, depends on the order of bias reduction. DS allows for very high levels of bias reduction, together with the universality of the Granger causality testing method that is worldwide acknowledged for its practical purposes. DS also does not affect directly the kernel estimator function, meaning that the properties of the MSE of the test statistics remain untouched. DS is also a very straightforward and easy application, even in a multivariate setting. This method of kernel bias reduction ensures, above other methods, a clear-cut asymptotic theory for the statistics of the test.

Given the lower bias, the test does not have to include a wide range of points in order to estimate similar properties, while at the same time it guarantees “asymptotic normality of the sharpened test statistics under smaller bandwidth values” (Diks & Wolski, 2012)

### 5. Empirical results

This study investigated the causal relationship between economic growth and public education for the Greek economy for the period 1960-2015. Employing a bivariate VAR, stationarity and cointegration were tested and indicated that economic growth, education expenditures and education enrollments are integrated of order one, and that no long run relationship exists between these time series. The so different outcomes led us to investigate extensively the non linear properties of these time series, as the results from the linear Granger tests could not be relied upon, not solely.

The results from the nonlinear testing demonstrate no serious causation among time series. This does not imply that schooling is worthless, as Hanushek (2013) agrees with this finding. What is being said however is that only the part where skills are created has an impact on economic growth. The part of schooling that cannot produce cognitive skills constitutes “excess baggage” on each student, and a major restraint on the growth policies applied.

### 6. Discussion

One common mistake that most previous human capital & labor studies did was that when they tried to find a measure for human capital, they all agreed upon school attainment. And as it was expected years of school attainment went “viral” among researchers. Mincer, the father of “Mincerian equations”, provided a misleading direction towards suggesting that years of schooling was a major indicator of the amount of

human capital a person owned, while his earnings functions became the warhorse of many research projects later on. So schooling became synonymous of intelligence and excellence.

One argument here is that there is not one optimum measure for human capital, rather a multivariate function. The human body is a very complex mechanism, and its well known that it elements need more than schooling in order to perform. Many international agencies like the World Bank focus on health and nutrition provision as means of developing human capital, while other researchers gave prominence to more direct routes such as health towards learning. Our line of research brings out the issue of “enough income” for all, mainly because the deprivation of income is a deprivation of life. And as seen from the results school attainment is not an indicator of economic growth. Enrollment rates cannot translate as success, but on the contrary, taking into account the tremendous lack of skills then the procedure itself raises issues of illiteracy. The importance of degree attainment created a frenzy demand that was covered even through several “unorthodox procedures” towards finding a job.

## **Conclusion**

The first assumption that is derived from the econometric analysis is that “long” schooling is not a predictor of economic growth anymore.

Greece is a developed country in terms of infrastructure, technological change, major reforms and adjustments in both public and private sector etc, with a low GDP.

Obligatory years of schooling went from 6 to 9 in 1985, in an attempt to support the advancement of human capital, as this was the trend at that time. In the minds of people this was translated as education would be from then on the solution to a variety of financial and social problems.

30 years after this reform, things are rather vague. This can be attributed to 2 major reasons:

a) Years of schooling became the center of attention, confronted as the opportunity cost for superior social and job titles targeting higher levels of income as well. This trend was supported partly from the political supervisors but also on a private basis from those families who opted for “a better future” for their off springs no matter what the cost. So a vicious cycle had started. The pressure that was applied in that direction did not lay further issues of what was taught at school and where this knowledge could be applied in the market.

In tertiary education things have gotten out of hand the previous years with the well established “barrier” entrance exams, with demand rising high. It became a matter of pride. High school diploma was further downgraded. The cost “for a better future” forced people into spending at least one fourth of their entire lives, and more than half of their active workforce life in classrooms, on the orthological expectation of financial and social “settlement”. They say that in the developed part of the world families have not had schooling as a priority choice for the capable and competent young members of their families, as they were the only ones who could assist in the upbringing of the others guarantying food and shelter for the whole family. In Greece the trend was turned upside-down. Progressive members of the Greek community disconnected their bright

children from worrying about food and shelter, directing them towards higher goals, at it was believed.

Knowledge, cognitive advancement, enlightenment and such are indeed tasks of a higher brain level and supported as such. But all this resulted in a lack of supply of technical and other staff in the market, which was covered through outsourcing with immigrants from neighboring countries. The prime part of the indigenous population, the top tiers, was engaged in schooling abandoning many other important activities like:

Business start-ups, starting a family, contributing in the formation of GDP, giving up on any legal rights by working part-time (no previous experience on the degree), facilitating labor shortage, losing all its comparable competitiveness towards the market, not creating needs neither obligations, postponing everything until further notice.

b) The second possible reason for this loss of predictability of economic growth of education could be attributed to the lack of expectations and alternatives which would enable the possibility of proper exploitation of the existing high quality human capital.

People choose to study for millions of reasons. Especially those coming from the developing part of the world. Some of them study abroad aiming to return home one day and do something for their country.

Greece is indeed a developed country under economic crisis. The motives that lead Greeks to universities might not be as humanitarian as mentioned earlier but the proper use of a specialist can contribute to the well-being of the society at whole. Right now the country experiences a time of large contradictions. High quality graduates of local and foreign universities seek a job able to meet their most basic needs.

Whatever the initial idea 30 years back to raise awareness among people, successful or not, no substantial screening mechanism has been facilitated. Previous research though has introduced the phenomenon of overeducation and mismatch for the Greek market.

Giving the proper employment opportunity to graduates, ideally establishing a proper market for them, going from the economics of supply to the economics of demand, as Philippe Aghion says, might reveal a country that should not be at crisis at all but at a steady growth pace.

No further adjustment program is needed in this case.

Possibly a memorandum of understanding among the members of the society that the trend has changed, would serve just fine.

## **Policy suggestions**

Some scholars and international institutions have started a campaign against the credibility of GDP as a measure for Growth saying that it is outdated and cannot grasp the “technological effect” that has been imposed onto the market and the way business is done nowadays.

If we were to create a new index measuring the level of convergence of an emerging economy, or for any economy in doubt, should we not ignore the causal effect between education and GDP per capita. Of course, it would be a lot easier to continue the seminal work of Mincer provided only that we could monitor the whole labor market day by day, and have a clear picture of who gets paid for what. But even Mincer himself

couldn't open these channels of information, and that was one of the main reasons why his work in 1974 left him aside. People integrate change in their lives and respond by changing lifestyles, tastes, choices and attitudes towards life.

What we suggest is a new "*Economic Convergence sub-Index*", that could consider the adverse causal relationship of education and growth.

The assumption is that whenever schooling stops forecasting growth (zero or negative), aka does not Granger cause economic growth, then economic convergence of the country deepens (positive), picking up the speed of the top tier economies.

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## References

- Alexakis P. and Siriopoulos C. (1999) The International Stock Market Crisis of 1997 and the Dynamic Relationships Between Asian Stock Markets: Linear and Non-linear Granger Causality Tests. *Managerial Finance*, 25 (8), 22-38.
- Asteriou D. and Siriopoulos C. (1997) Can educational expansion function as a "seed" of economic development in developing countries? City University. Department of Economics and Applied Econometric Research Unit. Discussion Paper Series, 68.
- Baek, E., Brock, W., (1992). A general test for Nonlinear Granger causality bivariate model. Working paper, Ames: Iowa State University and Madison: University of Wisconsin.
- Hanushek, E.A., (2013) Economic growth in developing countries: The role of human capital. *Economics of Education Review*, 37(2013), 204-212.
- Rahman, Mostafizur, Peng, Liu, (2012) Long-run effect of education on GDP: An empirical evidence from BCIM countries. *International Research Journal of Finance and Economics*, issue 82, EuroJournals Publishing.
- Qazi, Wasim, Raza, Syed Ali, Jawaid, Syed Tehseen, (2013) Higher education and growth performance of Pakistan: evidence form multivariate framework. Published online, Springer
- Panchenko, Valentyn, Diks, Cees, (2006). A new statistic and practical guidelines for nonparametric Granger causality testing. *Journal of Economic dynamics & control*, vol. 30, Elsevier B.V., 1647-1669
- Panchenko, Valentyn, Diks, Cees, (2005). A note on the Hiemstra-Jones test for Granger non-causality. *Studies in nonlinear dynamics & econometrics*, vol. 9, issues 2, article 4, the Berkeley electronic Press.
- Panchenko, Valentyn, Mougoue, Mbodja, Francis, bill B., (2009). Is there a symmetric nonlinear causal relationship between large and small firms?. *Journal of Empirical Finance*, vol. 17 (2010), 23-38.
- Hiemstra, C., Jones, J. D., (1994) Testing for linear and nonlinear Granger causality in the stock price – volume relation. *Journal of Finance*, vol. 49, no. 5, pp 1639-1664.
- Granger, C., W., J., 1969. Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, vol. 37, no. 3, pp. 424-438.
- Diks, Cees, Wolski, Marcin, (2015) Nonlinear Granger Causality: Guidelines for multivariate analysis. *Journal of applied econometrics*, John Wiley & sons L.t.d.