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EDUCATION EXPENDITURE INDEX, FINANCIAL DEPTH INDEX AND ECONOMIC GROWTH CAUSALITY ANALYSIS: CASE OF NORTH CYPRUS

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Abstract

In the literature, it is very common to find academic works related to the education sector expenditures and the Gross Domestic Product (GDP) growth also with the financial sector development and the GDP. However, it is not very common to find academic works that are focusing on education expenditures, financial depth and GDP growth relationship all at the same time. From that respect, the main aim of this particular study is to reveal the causality relationship between expenditures on education with finance sector depth and economic growth in North Cyprus. At the same time, surveys in the literature tried to explain the relationships with a one or two indicator. Same models with unique data sets may have different results for each country. Under all these facts in our study both education sector expenditures and financial development indicators were discussed separately. Findings of the study proves to us that in North Cyprus there are both long and short term relationships amongst human capital development through education, financial development and the Gross Domestic Product (GDP) growth.

Keywords: Education Expenditure Index, Financial Depth Index, Gross Domestic Product, Factor Dimension, Vector Error Correction Model, Granger Causality, Impulse Response, Variance Decomposition.

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Theoretical Background: Human Factor Role over Economic Growth

Starting point of endogenous growth model is mainly based on the academic works of Lucas (1988) and Romer (1994). Endogenous growth models explain the economic growth with internal dynamics of the economy itself and that's the main differentiation of the model from the exogenous growth models. 'New Growth Theory' concentrates mainly on labor and physical capital and hold technology as an endogenous variable (Arnold, 2011). Theoreticians who are trying to explain endogenous growth can be grouped under two categories. For the first category of researchers, population growth and human capital accumulation accepted as the leading factor for economic growth (Schultz, 1961; Becker, 1964; Denison, 1979; Lucas, 1988; Barro, 2001; Cohen & Soto, 2007). For the second category of researchers it is believed that technological progress managed by market actors would be the leading factor, contrary to the belief of neo-classical economists who accept technology as an endogenous variable instead of accepting it as an exogenous variable (Solow, 1956; Arrow, 1962; Romer, 1990; Mankiw, Romer, & Weil, 1992; Aghion & Howitt, 1998). Endogenous growth model theorists expanding the definition of capital believes that besides the physical capital, knowledge and qualification of human capital became important variables for economic growth. Academicians argue that, at endogenous growth models, physical capital has positive impact over human capital. Increases at physical capital, causes an increase in human capital as well. At the same time they argue that, there is a tight relationship between technological progress, and physical and human capital. Human capital prepares necessary conditions for technological infrastructure, research and development studies (Solow, 1956; Arrow, 1962; Romer, 1990; Mankiw, Romer, & Weil, 1992; Aghion & Howitt, 1998; Shi, He, Wang, Fan, & Guo, 2016).

Human Capital is accepted by most academicians as the main milestone for the economic growth. Also, it is accepted that accumulation of the skills and knowledge of the human resources are main source of economic growth differentials. Mankiw, Romer and Weil (1992), is first study that put human capital variable into Solow exogenous growth model. Lucas and Romer are the main two endogenous growth model theorists that explain the model based on human capital variable (Romer, 1994; Romer, 1990; Romer, 1986; Lucas, 1988). According to them, main reason under the economic growth is accepted as a human capital investment, instead of physical investments together with the technological investments. At the same time, sources that continue research and development activities are major determinants of the economic growth.

Theoretical Background: Finance Sector Role over Economic Growth

On the other side, finance sector have intermediation role between people, companies and finance institutions within the economy. Robinson (1952) argues that, financial development follows economic growth. This is Robinson's "Business Venture shows the way, finance follows" can be summed up with the words. According to him as real sector of the economy expands; their demand to the financial services also expand and causes financial services to develop. Finance sector is a channel between the borrower and the lender of financial instruments. Financial system is spreading the investors' savings to different investment areas and lowering their risk factors. A well organized, liberalized and developed financial sector is critically important because of its role in the economy. Developed financial sector means efficiency at resource allocation mechanisms for the reel sector (Gregorio & Guidotti, 1995; Levine, 1997; Khan & Senhadji, 2000; Miskhin, 2004; Bloch & Tang, 2004; Levine, 2005; Demirguc-Kunt & Ross, 2008). Levine (2005) supports that bank, insurance companies and other financial institutions and stock markets, bond markets, derivative markets and other financial markets have strong effect over poverty reduction through economic development and stability.

Role of Human Development and Financial Depth over Economic Growth

General agreement of the economists on economic growth theory expresses that; there must be efficiency and effectiveness at allocating the scarce resources. Financial development is one side of such a kind of resources allocation and education is the flip side of it. Better education, schooling, learning through experience and training helps to accumulate effective human capital (Arrow, 1962). Well educated human capital means knowledgeable society about the efficiency in resource utilization. Efficient use of resources means healthier transfers of the sources through better financial intermediaries and through better financial instruments from savers to the borrowers. It was proven that education expenditures have better human capital and, direct and statistically significant relationship with economic growth. Also, it was proven that better and a developed financial market has a positive and statistically significant relationship with economic growth. Recent research done by Hakeem (2010) has found that capital, both human and physical, are important twofold for growth of Sub-Saharan Africa. However, as a result of long lasting underdevelopment at finance sector in the

region financial development is lowered. Besides that, researchers found that, there is a strong relationship between finance and human capital on growth. Evans *et al.* (2000), have argued that, both money and human capital makes a significant contribution to growth. Evans, Green and Murinde (2000) speculates that the precise impact of human capital and financial development on growth may perhaps depend in part on the quality of the input as much as on any single measure of its quantity. Evans, Green and Murinde (2000) suggest a positive relationship between money and human capital by interacting to the two in a growth equation, and they suggest that this provides evidence for complementarity between financial depth and human capital. They conclude that, a developed financial system is an essential complement to a human resource or labor development in the growth process.

Data and Methodology

Data

Data set covers the annual data from 1977-2012 periods of education sector indicators, financial depth indicators and GDP. Variables that are given at Table-1 and Table-2 are primary variables for analyzing education sector and financial depth of finance sector respectively. GDP is the dependent variable for the analyses.

Table 1. *Education Sector Primary Data Set*

Variable
Enrollment Ratio (ER)
Total Education Expenditure To GDP (TEE/GDP)
Total Education Expenditure To Student (TEE/ST)
Total Teacher To Total Student (TE/ST)
Total School To Total Student (SC/ST)
Total Teacher To Total School (TE/SC)

Sources: North Cyprus Ministry of Education, 2013

Table 2. *Finance Sector Primary Data Set*

Variable
Money Supply (M2)/GDP
Private Credit To Total Credit (PC/TC)
Total Credit To GDP (TC/GDP)
Total Credit To Deposit (TC/DE)
Deposit To GDP (DE/GDP)

Sources. *North Cyprus State Planning Organization, 2013; Central Bank of North Cyprus, 2013.*

Method

By using Eviews 7 and SPSS 20 package software, we deduct variables that have the same dimension and can be used within the education index and financial depth index. By that way we determine the components of our indexes.

Factor Dimension Process of the Variables

For the factor dimension process of education and financial depth indicators we use SPSS 20 package software (SPSS, 2007), (Durmus, Yurtkoru, & Cinko , 2013). First of all, we use Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test. According to the KMO test result, each variable must be between 0 and 1 and it must be minimum 0.6 in order to be factor. At the same time Bartlett's Test of Sphericity (BTS) test result must be below 0.05 critical values to be significant and to be a factor (Pallant, 2005). Both KMO and BTS test results are satisfying those criterions, meaning that education indicators variables and financial depth indicators variables are suitable for the factor analysis (Beaumont, 2012; Landau & Everitt, 2004).

Determination of the Education Sector and Finance Sector Index Components

In order to determine the variables which generate components of each test variables, Initial Eigen values must be greater than 1. According to the test results, those variables that do not satisfy necessary conditions to be a part of any component is removed from the analysis and analysis is run again till the results satisfy necessary conditions (SPSS, 2007), (Durmus, Yurtkoru, & Cinko, 2013; Pallant, 2005).

Reliability Test Statistics

In order to decide reliability of the variables we use Cronbach's Alpha statistic (Beaumont, 2012), (Landau & Everitt, 2004). According to the test results we decide the variables that can be taken out from the test. After first run TE/SC and TE/ST variables excluded from the analysis and after the second test ER variable also excluded from the analysis. Final Cronbach's Alpha score is sufficient for the reliability. For the education index, Total Education Expenditure to GDP Ratio and Total Education Expenditure to Student Ratio are remaining final variables for indexing (Pallant, 2005; Beaumont, 2012; Landau & Everitt, 2004). For the financial depth index, Total Deposit to GDP Ratio, Money Supply (M2) to GDP Ratio and Total Credit Volume to GDP Ratio are remaining final three variables for indexing (Pallant, 2005; Beaumont, 2012; Landau & Everitt, 2004).

Model Output

Long run equilibrium equation of our model is given below;

$\ln(GDP)_t = -9.065 - 0.034 \ln(EDU_t) - 0.060 \ln(FIN_t)$

Short run equilibrium equation of our model is given below;

$\Delta\ln(GDP_{t-3}) = 0.053 - 0.033 \Delta\ln(EDU)_{t-3} - 0.107 \Delta\ln(FIN)_{t-3} - 0.209 \, e_{t-1}$

$\Delta\ln(EDU_{t-3}) = -0.372 + 1.774 \Delta\ln(GDP)_{t-3} + 0.744 \Delta\ln(FIN)_{t-3} + 0.391 \, e_{t-1}$

$\Delta\ln(FIN_{t-3}) = -0.011 + 0.238 \Delta\ln(GDP)_{t-3} + 0.016 \Delta\ln(EDU)_{t-3} + 0.703 \, e_{t-1}$

Cointegration test results show us that according to the trace test statistics and the maximum Eigen Value test statistics there are at least 3 cointegration equations in our model, which means that there is a long run relationship between our dependent variable and independent variables. So we run Vector Error Correction Model (VECM) to get and check the long run and short run equations (Watson & Teelucksingh, 2002). After getting cointegration equations from our model we run the granger causality test to check the direction of the relationship between variables in our VECM (Gujarati, 2004).

Granger Causality Analysis

Granger causality results of VECM model regressions summary are given at *Table 3*.

Table 3. Granger Causality Test Results of VECM

| H$_o$	Obs	F Statistics	Probability	Test Result
FIN does not Granger Cause GDP	33	3.75414	0.0230	Reject**
GDP does not Granger Cause FIN	33	5.44521	0.0048	Reject*
EDU does not Granger Cause GDP	33	3.30947	0.0357	Reject**
GDP does not Granger Cause EDU	33	2.52985	0.0792	Reject***
EDU does not Granger Cause FIN	33	1.60911	0.2114	Accept
FIN does not Granger Cause EDU	33	7.94403	0.0006	Reject*

* Indicates 1% level, ** Indicates 5% level and *** Indicates 10% level, (Gujarati & Porter, 2009)

According to *Table 3* we can conclude that there is a bidirectional relationship among Financial Depth and GDP and among Education and GDP, and there is a unidirectional causal relationship between Financial Depth and Education. Finally there is no relationship associated with Education and Financial Depth. Results of the VECM show us that the coefficient of the speed of adjustment is negative and significant at 10% level, which implies that 20.90% of the distribution in the

short-run will be corrected each year. In other words, mechanism will come to the equilibrium in 4.78 years.

Impulse Response for VAR Model

Horizontal axis shows the term, annually, and vertical axis shows the size of the responses. Graphs show us that responses are in line within the standard error bands which mean that they are statistically significant. Complete results are given in *Graph 1* (Gujarati & Porter, 2009; Adkins, 2014).
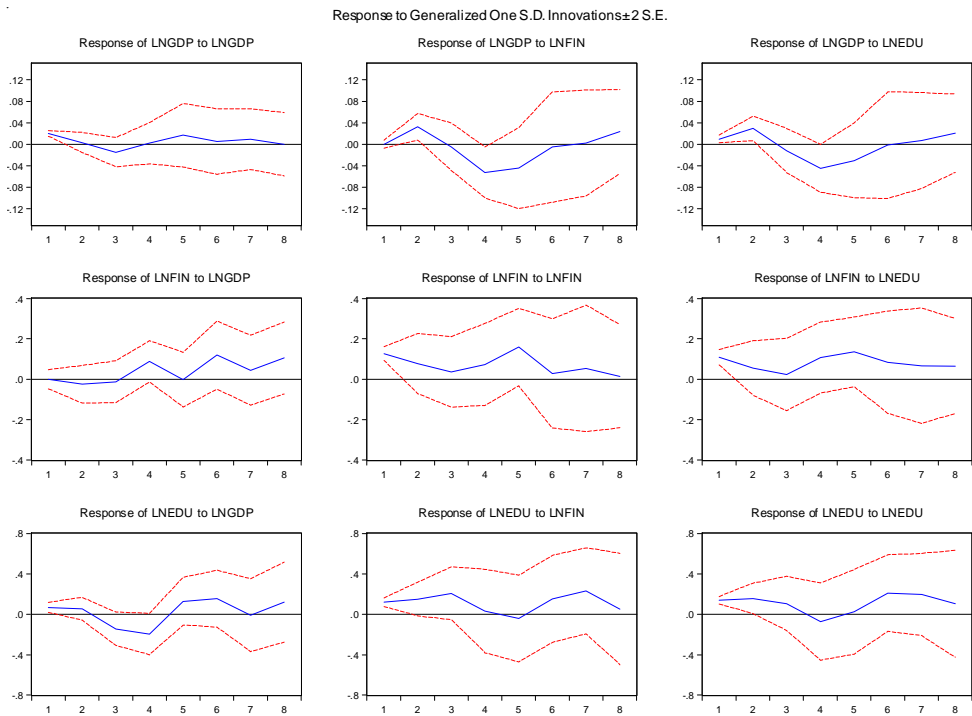
Graph-1. *Impulse Response Graphs, Eviews Outputs*

- According to the response of GDP to one standard deviation of a shock in GDP, own shock, is positive until the end of the year two, and it is negative after that year till year four and is significantly positive after year four to year eight.

- According to the response of GDP to one standard deviation of a shock in Financial Depth is positive during the first three years but it is negative after year three to year six and after that trend turns to positive till year eight.

- According to the response of GDP to one standard deviation of a shock in Education index is positive during the initial two years then it becomes negative till year five and it is significantly positive from there on.

- According to the response of Financial Depth to one standard deviation shock in GDP is negative during the first three years but it becomes significantly positive from there on.

- According to the response of Financial Depth to one standard deviation shock in Financial Depth, own shock, is significantly positive during the whole eight year period.

- According to the response of Financial Depth to one standard deviation of a shock in Education Index is significantly positive during the whole eight year period.

- According the response of Education Index to one standard deviation of a shock in GDP is positive in the initial two years; it becomes negative after that till year four and positive from there on.

- According to the response of Education Index to one standard deviation of a shock in Financial Depth is significantly positive for the whole eight year period except the year five.

- According to the response of Education Index to one standard of a deviation shock in Education Index, own shock, is positive at first four year period, it becomes negative for year four to year five and it becomes positive again till the end of the eight year period.

Variance Decomposition for VAR Model

Variance Decomposition of VAR model gives us information about the contribution or explanation of any variable of our model to other variables in percentage. It gives us an idea about the most effective independent variable to the dependent variable in the given VAR model (Greene, 2002; Adkins, 2014). The results of analyses are given in the tables below.

Table 4. *Variance Decomposition of GDP*

Period	S.E.	GDP	FIN	EDU
1	0.038361	100.0000	0.000000	0.000000
2	0.064630	77.78640	6.974445	15.23915
3	0.075459	67.41463	5.134782	27.45059
4	0.083434	57.54222	4.422695	38.03509
5	0.087588	52.21731	4.081443	43.70125
6	0.089201	51.55048	5.013748	43.43577
7	0.089582	51.34871	5.243398	43.40790
8	0.090335	50.49688	5.161975	44.34115

According to *Table 4*, the contribution of GDP to GDP variability ranges from 50% to 100%. In the first year all the variability of the GDP was explained by itself. In following years the effect of GDP diminishes annually and eventually reaches 50% in year eight. The contribution of Financial Depth variability to GDP ranges between 0% and 7%. In first year it doesn't have any effect on GDP, however starting from year two it contributes 7% and averages at 5% contribution level. The contribution of Education to GDP variability ranges 0% to 45% throughout the 8 year time-frame. At first year it doesn't have any effect on GDP, however starting from year two it finds 15% contribution and gradually increases its contribution level as high as 45%. As a result effects over GDP are explained in part with itself having a decreasing trend and in part with the effect of EDU having an increasing g trend. Finally for the GDP in coming years EDU has the highest forecasting error terms variance together with the GDP itself and followed by FIN in third rank.

Table 5. *Variance Decomposition of Financial Depth Index*

Period	S.E.	GDP	FIN	EDU
1	0.134997	7.981530	92.01847	0.000000
2	0.165579	11.94999	82.60877	5.441248
3	0.222303	7.440409	88.43261	4.126984
4	0.296054	4.526611	85.44385	10.02953
5	0.374109	3.755282	81.34410	14.90062
6	0.462826	4.016063	74.96831	21.01562
7	0.562755	4.449935	68.39004	27.16003
8	0.659219	4.734506	62.26048	33.00502

According to *Table 5*, the contribution of Financial Depth to Financial Depth variability ranges between 62% and 93%. At first year 92% of the variability of the FIN was explained by itself and the remaining 8% with the GDP. Following years' effects of FIN diminishes each year and eventually reaches 62% in year eight. The contribution of GDP to Financial Depth variability ranges 3% to 12%. At first year it has 8% effect on FIN and reached 12% at second year. Reached 8% at year three and reached average 4% after year three till year eight. Contribution of Education to Financial Depth variability ranges between 0% and 33% throughout the 8 year time-frame. At first year it doesn't have any effect on FIN, it has 6% in year two and 4% in year three. Starting from year four, it increases its contribution from 10% to 33%. As a result, half of the effect over GDP can be explained with itself with a decreasing trend and with the effect of EDU with an increasing trend. Finally for the GDP in the coming years EDU has the highest forecasting error terms variance together with the GDP itself and after that FIN holds the third rank.

Table 6. *Variance Decomposition of Education Index*

Period	S.E.	GDP	FIN	EDU
1	0.248896	1.731239	1.682371	96.58639
2	0.305785	1.246019	3.398894	95.35509
3	0.344241	1.499886	22.35882	76.14130
4	0.379985	1.770773	35.59706	62.63216
5	0.447979	1.279378	50.87935	47.84127
6	0.541342	0.877979	60.14867	38.97335
7	0.633069	0.755647	63.08145	36.16290
8	0.748557	1.474383	63.20028	35.32533

According to *Table 6*, contribution of Education to Education variability ranges between 35% and 97%. In the first year 97% of the variability at the EDU was explained by itself and the rest 3% with the GDP and FIN. Following years' effects of EDU diminishes each year and reaches down to 35% in year eight. Contribution of GDP to Education variability ranges between 0.7% and 1.8%. Within the eight year time period, it holds a steady level of 1.5%, contribution. Contribution of Financial Depth to Education variability ranges between 1.6% and 64% throughout the 8 year time-frame. During the first year it has a lower effect of 1.7% on EDU, in year two it reaches 4%, in year three it reaches 22% and continues to increase in the following years eventually reaching 64% in year eight.

Conclusions

In our study we have found out that NC GDP is affected from itself and education sector in the given eight year period. Finance sector effect over the GDP has a strong indicator as well. As it is expected for NC, education sector effect rate over the GDP is increasing throughout the years and this is a positive consequence of the medium and long term investments over the education sector, because education sector has two different channels for encouraging GDP growth. First one is direct expenditures to the education sector, which has an important role with in the NC's GDP, and the second one is investment to the education sector that is train up qualified personnel for other sectors. NC financial sector has its leap after year 2001 especially in the banking sector and starts to have important portion within the GDP. Also, finance sector has been playing an important role in financing the reel sector. Briefly, finance sector has a direct and an indirect positive effect on NC's GDP. Secondly we found out that education sector is affected from itself and also from finance sector in the given eight year time period. Data supporting the explanation of the GDP to education relationship is not much; however it has a continuous effect over the education sector. Deepening the financial sector supports steady growth of the education sector expenditures. Except for one university, all the rest has not completed their infrastructure development. At the same time, the number of new opening universities rises from year to year and number of the students studying in the island also rises. As a result, needs for construction of the infrastructure, like dormitories, classrooms, laboratories, research and development centers etc. raises and thus needs financing. Concurrently, developing the human capital of the schools also needs financing. For that reason effect of the finance sector to the education sector continuously raises within the eight year time period. On the other hand, we believe that as long as the GDP growth is sustained, positive affect over the education sector will rise preside. Since GDP growth is not at the desired level, the effect of it over the education sector stayed limited. Concurrently, we find that financial sector is primarily affected from itself along with the education sector throughout the eight year time period in NC. At the same time, effect level of the GDP over the finance sector is also high enough. Educating qualified pupils who are able to ensure financial depth and better the infant education sector needs for continuous growth, they also can create positive effect over the financial instruments. Because of those listed reasons, education sector affect over the finance sector is steadily rising within the eight year time period. We believe that, until the economic growth reaches a satisfactory level, GDP will have limited effect over the finance sector and if steady economic growth level is achieved, the effect of GDP will lump.

Another reality we observe from our study is that, GDP has less than 10% effect over both education sector and finance sector within the eight year time

period. This means that, finance and education sectors must have higher portion from the GDP through effective reforms. Another remarkable result we derive is that finance sector effect over the education and education sector effect over the finance sector is continuously rising and has significant effect on each other at the end of year eight. This means that, as education sector grows, demand to the financial instruments also grows and those causes financial deeping that is used in developing the education sector.

Briefly, GDP have limited but steady effect over our independent variables throughout the years. Our independent variables, education and financial sectors maintain growth, especially the education sector, having positive effect over the GDP. At the same time, our independent variables effect level on each other is quite strong. We believe that, this is common characteristic of island economies and shows us the importance of the service sectors.

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