Bidirectional Causality Analysis for Education Expenditures Index, Financial Development Index and Economic Growth: Case of North Cyprus

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Abstract: The main aim of this study is to reveal the causality relationship between education expenditures index with finance sector development index and economic growth in North Cyprus. After producing indexes, Vector Error Correction Model (VECM), Granger Causality Analysis, Impulse Responses and Variance Decompositions are run to check the short and long term relationships. Findings show us that there are both long and short term bidirectional relationships amongst education expenditure index and financial development index with the Gross Domestic Product (GDP) growth in North Cyprus.

Keywords: Education Expenditure Index; Financial Development Index; Gross Domestic Product; Vector Error Correction Model; Granger Causality; Impulse Response; Variance Decomposition.

INTRODUCTION

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. Starting point of endogenous growth model is mainly based on the academic works of Lucas [1] and Romer M.P [2]. 'New Growth Theory' concentrates mainly on labor and physical capital and holds technology as an endogenous variable [3]. 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 [4-8]. 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 [9-13]. Endogenous growth model theorists expanding the definition of capital believe 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 [9-13].

On the other side, finance sector has intermediation role between people, companies and finance institutions within the economy. Robinson [14] 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. Schumpeter [15] argues that, financial intermediations like banks are very important institutions for technological innovations and growth. According to him, banks collect savings, evaluate investment projects, manage the managers of firms and collect detailed information about the companies with low costs. Financial intermediates direct available sources to efficient fields which plays an important role for the economy. Hicks [16] Argues that financial development has been played an important role over the England industrialization process by facilitating the capitalization of the huge projects. McKinnon [17,18] deal with the complementary issues of the financial development and focused on the linkage between internally financed investment and the deposit rate. On the other side Shaw [19] deals with the financial deepening and focused on the importance of financial deepening and external financing. Levine [20] 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. Demirgüç-Kunt and Ross [21] found that well-functioning developed financial systems have positive role over long run economic growth, and those countries' economies grow faster.

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 [10]. 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. Question is that, what kinds of relationships exist between education expenditures and financial development and as a result with economic growth, is a subject of discussion. From that respect, particular study tries to analyze the following hypothesis;

Hypothesis-1:
Is there a relationship between human capital development through education expenditures and financial development in North Cyprus? What's the direction of the relationship if it exists?

Hypothesis-2:
Can human capital development cause an economic growth for an island economy like North Cyprus?

Hypothesis-3:
Can financial developments cause an economic growth for island economies like North Cyprus?

Hypothesis-4:
Is there a positive correlation between economic growth and human capital development?

Hypothesis-5:
Is there a positive correlation between economic growth and financial development?

Hypothesis-6:
Is there a positive correlation between human capital development through education, financial development and economic growth in North Cyprus?

METHODOLOGY

Data set covers the annual data from 1977-2012 periods of education sector indicators, financial development indicators as an independent variables and GDP as a dependent variable. Education sector primary data set variables are 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) and Total Teacher to Total School (TE/SC). Finance Sector Primary Data Set variables are 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). Our dependent variable GDP data set is based on 1977 prices [22-24]. By using SPSS 20 package software, we take variables that have the same dimension and can be used within the education expenditure index and financial development index. By such means we determine the components of our indexes. For the factor dimension process of education expenditure and financial development indicators we use Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test. At the same time Bartlett's Test of Sphericity (BTS) is also used. According to the KMO test result, each variable must be between the values of 0 and 1 and it must be minimum 0.6 in order to be a factor. At the same time Bartlett's Test of Sphericity (BTS) test result must be below the critical value of 0.05 to be significant and to be a factor. Both KMO and BTS test results are satisfying necessary criterions, meaning that education indicators variables and financial development indicators variables are suitable for the factor analysis. 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 part of any component is removed from the analysis, which is repeated till the results, satisfy necessary conditions. According to the Scree Plot graph after second breaking point there is a fix trend at the slope of the line which means that optimum number of factor is two. According to the Component Matrix and Rotated Component Matrix results Factor-1 consists of TE/SC, TE/ST and ER. Factor-2 consists of TEE/GDP and TEE/ST. According to the component plot in rotated space, the SC/ST variable is taken out and the test is repeated. Results show that the two components' Initial Eigenvalues are higher than 1. First factor explains 53.836% of the total variance and the second factor explains 37.884% of the total variance. Total cumulative variance is 91.720% [25-29]. Finally, in order to decide the reliability of the variables, we use Cronbach's Alpha statistic. According to the test results we decide the variables that can be taken out from the test. After the first run TE/SC and TE/ST variables are excluded from the analysis and after the second test the

ER variable is also excluded from the analysis. The final Cronbach's Alpha score is sufficient for the reliability. As for the education index, Total Education Expenditure to GDP Ratio and Total Education Expenditure to Student Ratio remain as the final variables for indexing [27-29]. To determine the finance sector index components we follow the same procedure as discussed above. According to the Scree Plot graph, after the second breaking point there is a fix trend at the slope of the line which means that the optimum number of factor is two. According to the Component Matrix and Rotated Component Matrix results Factor-1 consists of M2/GDP, DE/GDP and TC/GDP. Factor-2 consists of TC/DE and PC/TC. According to the component plot in rotated space PC/TC and TC/DE variables are taken out and tests are repeated. Results show that the remaining factor-2 component's initial Eigenvalue is higher than 1 which explains the 79.125% of the total variance. Finally, in order to decide the reliability of the variables we use Cronbach's Alpha statistic. According to the test results we decide the variables that can be taken out from the test. Remaining component Cronbach's Alpha score is sufficient for the reliability. For the financial development index, Total Deposit to GDP Ratio, Money Supply (M2) to GDP Ratio and Total Credit Volume to GDP Ratio are the remaining final three variables for indexing [27-29]. After obtaining the variables according to their dimensions, we calculate the index values for each of them. According to the results for the preparation of the education expenditure index, Teacher to Student and Total Education Expenditure to GDP are the remaining two variables to put in education index final data set. At the same time, according to the results for the preparation of the financial development index, M2 to GDP, Deposit to GDP and Total Credit to GDP are the remaining three variables to be put in the financial development index final data set. We use EViews 7 package software to analyze the Vector Error Correction Model (VECM). In order to run the VECM, the first condition is that the data set must be integrated of the same order and must have a unit root. The second condition is for the variables to be co-integrated [30]. We run the unit root tests to check for the degree of integration for both education and financial development indicators. The Phillips Peron test is used for stationary test and results are significant at 5% level. Unit root test results shows that the logarithmic form of whole variables become stationary after first difference, meaning that they integrated of fist order, I(1) [31]. In order to run the VECM, we have to decide on the optimum Lag Length. According to the VAR Lag Order Selection Criteria the optimum lag length is selected as three. Stability condition of the model can be tested with both the AR Table and the AR Graph. Both AR Table and AR Graph show that the model is stable [32]. We run VEC Residual Serial Correlation LM Test for

checking the existence of the serial correlation in our model. VEC Residual Serial Correlation LM Test shows that there is no serial correlation in the model [33]. We run VEC Residual Normality Tests for testing normality of our model. VEC Residual Normality Tests' results show that residuals are normally distributed[34]. We run VEC Residual Heteroskedasticity Test to check the existence of Heteroskedasticity. VEC Residual Heteroskedasticity Test shows that there is no Heteroskedasticity in our model [35]. We run Johansen Cointegration Test to check the cointegration in our model. Johansen Cointegration Test' Results shows that according to both Trace Test and Max-eigenvalue there are 3 cointegration equations at 5% level. This means that GDP, Financial Development and Education expenditure have a long run relationship. Later, we run VECM to acquire and check the long run and short run equations. 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. After the causality test in order to check the effect of shocks on variance in the long run we use the impulse response analysis over the variables. Finally, to get information about the contribution of any variable in our model to other variables we use Variance Decomposition.

FINDINGS

Granger Causality test is done in order to check the direction of the relationship between variables in our VECM. Granger causality results of VECM model regressions summary are given in Table-1. According to the results obtained from the test, we can conclude that there is a bidirectional relationship among Financial Development and GDP and among Education and GDP. There is also a unidirectional causal relationship between Financial Development and education. Finally there is no relationship associated with education and financial development. Results of the VECM show that, the coefficient of the speed of adjustment is negative and significant at 10% level. This 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. To check the effect of shocks on variance in the long run we use impulse response over variables. Results are shown in Fig-1 & given in Table-1 and below that, responses are in line within the standard error bands which mean that they are statistically significant. 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 Development 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 Development 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 Development to one standard deviation shock in Financial Development, own shock, is significantly positive during the whole eight year period. According to the response of Financial Development 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 Development 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. Finally, in order to check the contributions of variables we use Variance Decomposition. Variance Decomposition gives us information about the contribution of any variable in our model to other variables. The results of analyses are given in Tables-2, 3 and 4 at below. The contribution of GDP to GDP variability ranges 50% to 100%, the contribution of GDP to Financial Development variability ranges 0% to 7%, and the contribution of GDP to Education variability ranges 0% to 45% throughout the 8 year time-frame. Contribution of Financial Development to Financial Development variability ranges 62% to 93%, the contribution of Financial Development to GDP variability ranges 3% to 12%, and contribution of Financial Development to Education variability ranges 0% to 33% throughout the 8 year time-frame. Contribution of Education to Education variability ranges 35% to 97%, contribution of Education to GDP variability ranges 0.7% and 1.8%, and contribution of Education to Financial Development variability ranges 1.6% and 64% throughout the 8 year time-frame.
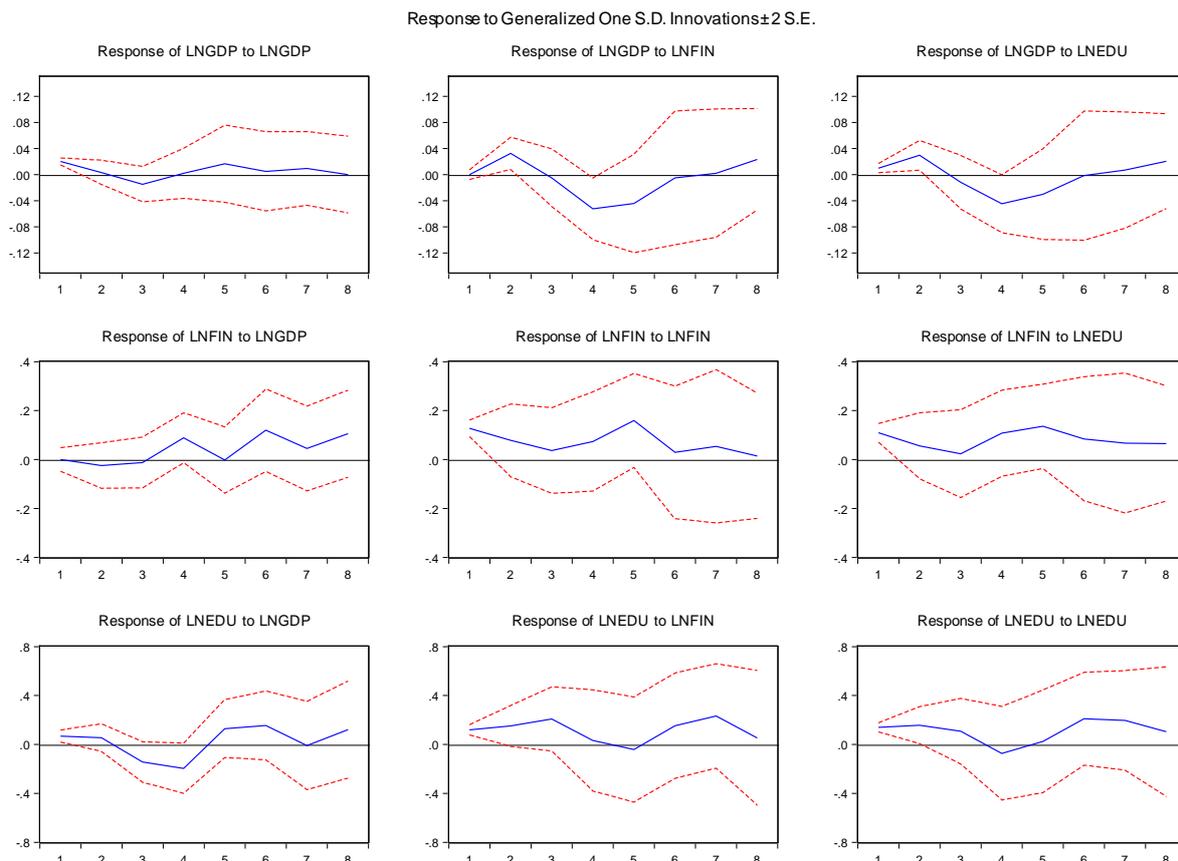
Fig-1: Impulse Response Graphs, Eviews Outputs

Table-1 Granger Causality Test Results of VECM

H₀	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. **Source:** EViews 7 Software Output

Table-2: 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

Source: EViews 7 Software Output

Table-3: Variance Decomposition of Financial Development 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

Source: EViews 7 Software Output

Table-4 Variance Decomposition of Education Expenditure 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

Source: EViews 7 Software Output

CONCLUSION

This study searches the causality relationship between expenditures on education with finance sector development and economic growth. Findings of the study can be summarized as follows: Financial development has association with both GDP growth and education; also GDP growth has association with Financial Development. At the same time GDP growth has association with Education, also Education has association with the GDP growth. However, there is no identifiable association with Education and Financial Development in the short-run. Our model speed of adjustment implies that 20.90% of the disturbance in the short run will be corrected each year and the model comes into balance at year 4.78. Furthermore, all the shocks to the model have positive significances after four years, meaning that GDP, Financial Development and Education have a positive effect on each other after a four year period. Variance Decomposition of GDP shows that in the long-run one standard deviation shock to GDP can contribute to lower the GDP. Shock to the GDP can contribute steady state to Financial Development, and shock to the GDP can significantly increase contribution and cause a fluctuation in Education. Variance Decomposition of Financial Development shows that in the long-run one standard deviation shock to Financial Development can contribute to lower the Financial Development. Shock to the Financial Development can contribute to lower the GDP and shock to the Financial Development can contribute to increase the fluctuation to Education. Variance Decomposition of Education shows that in the long-run one standard deviation shock to Education can contribute to lower the Education. Shock to the Education can contribute steady state to GDP and shock to the Education can contribute to increase the fluctuation to Financial Development. Higher GDP growth has positive impact over both the education sector and the financial sector. It is a well-known and accepted truth that economic growth rate differentiations amongst countries depend on the level

of skill and knowledge accumulation of the human capital. Education is a catalyst over both personnel and community efficiency. Economic effectiveness can be reached through education. Skill and knowledge accumulation of community helps countries to adapt themselves to the innovations much more easily. The financial sector is dynamic and changes very fast. Needs and desires of the finance sector parallel the needs of the well donated human capital for all economic effectiveness. The findings of the study succinctly shows that in North Cyprus there are both long and short term relationships amongst human capital development through education, financial development and the GDP growth. It is certain that the North Cyprus finance and education sectors must be supported by coordinated policies. Each has an effect on each other and stimulates GDP growth. Higher GDP growth has positive impact over both the education and financial sectors. In that respect, future development plans must be formed to smooth and hasten the Education and Finance sectors' ability to increase their role as catalysts over the GDP. 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 centres etc. raise and thus need 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 development 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 has 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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