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Abstract

This paper purpose is to examine the regime shift of public sector and private sector investments on economic growth in North Cyprus using with the Markov Switching Regression technique for the period from the first quarter of the year 1982 to the last quarter of the year of 2015. Both sector investments having a causal effect on the economic growth at the concerned period and method provide the necessary evidence for the regime shifts. Two-regime (growth path/recession path) model has been estimated to analyse the Markov-switching model, Markov transition probabilities, constant expected durations, and smoothed regime probabilities.

JEL classifications: C1, H3.

Keywords: Public Sector; Private Sector; Economic Growth; Crises; Markov Switching.

1. Introduction

The most important factor that affecting the economic growth in a country, without any hesitation is the investments. Although, with the existing study such as Tursoy and Faisal (2017), the connection of savings and investments are investigated in North Cyprus and found that there is important connection within two components, but both public and private sectors investments effects on the growth of the economy were not adequately investigated with literature. This is creating the motivation for this paper to investigate the joint effects of both sectors on economic progress. The North Cyprus economy representing the characteristics of small island economy and public sector had been the most important sector during the many years. North Cyprus had been negotiated with Turkey for many years to develop their economy with the economic programs. For an instant, lately to provide a better environment to eliminate the effects of the global turmoil which is started after the year 2007 in North Cyprus, economic programs employed to targeting the fiscal discipline into the Public Sector. These programs were the "efficiency of the Public sector and the improvements in the private sector's competition power" (2010-2012), and "to passing through the sustainable economy" (2013-2015). These economic programs aimed were to loosening the share of the Public sector into the economy, to disciplining the public sector' expenditures, to review the tax income that is not limiting the developments of the real or private sector, and others to supporting the improvements to create an environment for having a more competitive and real/private sector dominated sustainable economy in North Cyprus. These improvements into the economy showed better results for North Cyprus; for example, the domestic income was

cover to the 96,5% of the domestic expenditure at the year 2016. Before the economic programs just only the 72% of the domestic spending was comprised of the income (2009).

There are some studies such as Ntembe et al. (2017) analysed the public investment effects on economic growth in Cameroon recently. The estimated model by the ARDL approach provides evidence for the cointegration between real GDP, and public and private investments as well as labor force. Also, there are studies to investigate the economic relationship with regime switching, for instant, Fong and See (2002) examined the temporal behaviour of the volatility of daily returns on crude oil futures using a generalised regime switching model. They found that regime shifts are clearly present in the data and which in the highly volatile state, a finding which is consistent with previous empirical research on the theory of storage Fama and French (1988). The economic growth modelling and forecasting for North Cyprus also investigated by Türsoy (2013).

2. Methodology

2.1.Data

This paper is covering quarterly data for the period spam 1982Q1 to 2015Q4. The data was obtained from the State Planning Organization of North Cyprus as a yearly data and with the quadratic match-sum method; the data converted from yearly basis to quarterly basis. Transforming the data from yearly to quarterly adjust and solve the problems related to seasonal variation. The private represents the private investments, and public represents public investments as a share of GDP, and growth rate represented by real growth rate and one-year missing data for the year 2001 was produced by the linear interpolation method.

2.2. Empirical Model

Linear regression models are the primary method to investigate the economic relation in econometric analysis. However, some events need to be investigated with nonlinear modelling in econometrics like the macroeconomic relationships that related to regime shifts. Switching regression models which are linear regression models with nonlinearities araised from a discrete change in regime. Switching models are studied in economics by significant papers such as Goldfeld and Quandt (1973), Maddala (1986), Hamilton (1996), Frühwirth-Schnatter (2004), Sim et al. (2008) and Kim et al. (2008).

The basic model for the switching regression start to suppose the random variable of $y_t$follows the process that depends on the value of an unobserved discrete state variable s_t.its assumed that there are *M* possible regimes, and its defined as to be the regime *m* in period *t* when $s_t = m$, for $m = 1, \ldots, M$. The switching model assumes that there is a different models regarding to the each regime shift. With the below equation, given regressors are X_t and Z_t, the conditional mean of y_t in regime m is assumed to be in linear form:

$$\mu_t(m) = X_t'\beta_m + Z_t'\gamma$$

Where β_m and γ are k_X and k_Z vectors of coefficents and its noted that, in the above equation, the β_m coefficients for $X_t$is indexed by regime; the the coefficient of γassociate with the $Z_t$which is the regime invariant.

2.3.Empirical Results

In the empirical results section, the Markov switching regression and long-run co-integration equations results will be analysed. In the first analyses, two regimes (expansion and recession) will be analysed and lately to understand the signs and coefficients for the long-run relationship will be investigated by using the long-run cointegration equations (FMOLS, DOLS, CCR).

Time series analyses usually start with the unit root analyses for the time series. To understand the unique order of the integration for the series, Perron – Vogelsang unit root test with one endogenous structural break has been employed and represented in Table 1.

Table 1. Perron–Vogelsang test with one Endogenous Structural Break

Variables	**Perron–Vogelsang test with one Endogenous Structural Break**				
	AO -model *t*-Statistics	TB1	IO-model *t*-Statistics	TB1	Result
Real Growth	-3.500 (5)	2008Q3	-3.304 (8)	2005Q4	*I*(0)
LnPRIVATE	-3.165 (8)	2004Q4	-4.108 (9)	2003Q1	*I*(0)
LnPUBLIC	-3.750** (5)	2010Q1	-3.932 (5)	2008Q3	*I*(0)
First Difference					
DReal Growth	-3.842** (1)	1991Q3	-5.590** (7)	1991Q4	*I*(1)
DLnPRIVATE	-4.956** (7)	1996Q3	-5.894** (7)	1996Q1	*I*(1)
DLnPUBLIC	-5.783** (4)	1995Q3	-6.086** (4)	1995Q4	*I*(1)

Note: ** represents the significance at 5% level.

To understand the order of integration of the series, Perron and Vogelsang (1992) unit root test applied with one structural break. The results from the unit root tests confirmed that all the variables are non-stationary at the level and with the first difference all become to stationary. Also, the break dates are shown in Table 1. After the unique order of integration analyses allow us to proceed to further investigation with the series. To analyse the regime shift in series for two kinds of period which are expansion path and recession path, Markov SwithchingRegresion analyses applied to determine the shifts. Figure 1 represents the two possible regime shift with a graph for representing the two shifting periods. Approximately, the crises/recession paths that were happened in North Cyprus in real can be observed from the figure 1, that are the crises times at the beginning of the 1990s and 2000s, and also the global crises which are started at the year 2007. The recession path observed with the orange line and the expansion paths are seen with the blue lines. All these findings from Markov Switching regression are matched with the real time of the expansion and recession periods in North Cyprus. All these periods are represented with the below figure.

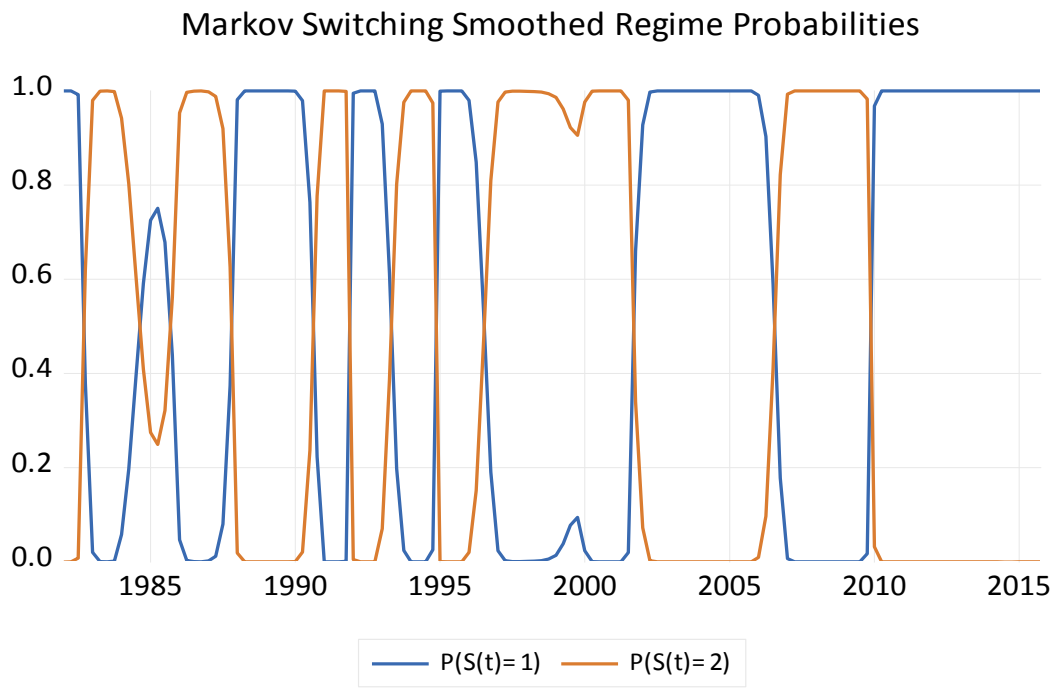

Figure 1. Regime probabilities for possible regime shifts.

In table 2, both public and private investments are significant in regime 1 which is representing the growth time of the economy. With the results, in the economic growth path, public investments are more affecting the economy than the private investment. The coefficient of public sector investment is doubled regarding to the private sector investment. Meanwhile, in the regime 2 which is representing the crises or recession path, both sector having significant effect on the economy. Although not like the expansion path, in the recession/crises time, private sector investments are effects on more to the economic recession. Of course, also public sector investment is significant and having effect also on the crises.

Table 2. Markov Switching Regression Results

Variable	**Coeficient**	**Z-Statistic**
Regime 1		
logPublic	4.1343	9.8688***
logPrivate	2.1980	3.6586***
constant	25.2928	8.7321***
Regime 2		
logPublic	1.9240	9.8689***
logPrivate	2.4619	4.4373***
constant	18.9030	7.8430***
Log(sigma)(common)	-0.3599	-5.3418***
Transition Matrix Parameters		
P11-C	2.1626	4.1326***
P21-C	-2.4986	-5.4044***

Note: *** represents the significance at 1% level.

Tablo 3. Transition summary: Constant Markov transition probabilities and expected durations

Constant transition probabilities: P(i,k) = P(s(t) = k | s(t-1) = i) (row = i / column = j)		
	1	**2**
1	**0.8968**	**0.1032**
2	**0.0759**	**0.9240**
	Constant expected durations:	
	1	**2**
	9.6934	**13.1661**

Table 3. represent the result from Markov switching model with constant transition probabilities. Note that there is considerable state dependence in the transition probabilities with a relatively higher probability of remaining in the origin regime (0.8968 for the high output state/expansion path, 0.9240 for the low output state/recession path). The duration of the first regime (expansion path) is approximately 9.69 quarter and the second regime (recession path) is approximately 13.17 quarter.

Conclusion

The investment into the economy is the most crucial subject for the economic growth. With this paper, it can be concluded that both sector (public/private) affecting two possible regimes such as economic growth and crises times. All the findings are supporting the view that both sectors are having a significant share on the economy of North Cyprus. Although with the economic programs to improve the private sector in North Cyprus's economy, still public sector having more share in economic growth part againts to the private sector in the economy. On the other situation that is recession time, private sector promoting more severe situation than the public sector. Finally, based on the finding from the analysis, results showing that growth time is passing approximately slightly more than 2 years and crises time are passing more than three years.

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