Forecasting of Construction Growth and Investment in Turkey

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Abstract: The construction sector is regarded as a significant factor influencing economic policies in developing countries like Turkey. Construction investments play an important role in short term economic growth whereas infrastructure investments are vital in long term growth. Developing countries utilize their construction sectors as regulators. In this study, forecasting of construction growth and construction investment was analyzed in Turkey. ARIMA models were used in this study for forecasting of Construction growth and construction investments. It has been seen that, the variables taken at hand is explained at an important rate with their own delayed variables.

Introduction

Construction industry and investment is an important determinant in developing economies. Developing countries utilize their construction sectors as regulators. These investments affected by the government policies as governments usually regulate the economy (Wigren and Wilhelmsson, 2007; Easterly and Rebelo,1999; Canning et al., 1994; Sanchez-Robles 1998). That is, they tend to lessen construction projects and cut off funds fostering this sector when the economy enters a very rapid growth pace and refresh the sector when the economy suffers from demand shortage and the unemployment rate increases. The construction sector relate to activities of capital investments in construction. Construction products are a function of investments made in other sectors. This sector has undertaken a key role in transition from economic stagnation to growth in terms of the inputs it utilizes and employment it creates, its contribution to the national revenue, its role in creating new employment fields and opportunities and its relation with other industries Öcal et al. (2007).

Construction sector investments have been classified as Building+Residential (Government), Building+Residential (private) investment and infrastructure. Except from Building+Residential (private) these sectors investments have effects of Gross Domestic Product (GDP). There is a clear cointegration between "GDP-infrastructure investments" and "GDP-building+residental (government) investments". It has been concluded that the long term relation in infrastructure investments are not affected by economic shocks in the short run; however building and residential (government) investments are affected by short term shocks (Ozkan and Ozkan, 2009). Because of this, the estimates of construction investments take place an important place at the economies in economical crisis. When it is reviewed that one of the important reasons of the economical crisis boomed in year 2008 is the mortgage financial system, its importance increases once more.

In this study, forecasting of Construction growth and construction investment was analyzed in Turkey. ARIMA models are used in this study for forecasting of Construction growth and construction investments. Construction growth and investment data (1987-2007 June periods) used in this study.

Data and Economic Model

Data collection

In this study makes use of construction growth items. This items are Infrastructure Investment, Building+residental (government), Building+residental (private) investments monthly data. Data have been collected from statistics of Central Bank of Republic of Turkey. Construction growth, infrastructure, building and residential (government), building and residential (private) refers to current prices and 1987:01-2007:01

period level expenditure data. Values are given in New Turkish Lira. In the analysis stage, logarithmic values pertaining to series were used and series have been cleared off seasonal effects as well as the trend effect.

Series' stationary structures have been analyzed via Augmented Dickey Fuller (ADF) unit root test. ARIMA test has been employed in order to forecast.

Unit Root Test

The unit root test is executed by way of the following formulation.

$$\Delta Y_t = a + \rho Y_{t-1} + \delta T + \sum_{i=1}^{n} b_{1i} \Delta Y_{t-i} + \varepsilon_t$$

$i= 1,2,\ldots,n$ (1)

$\Delta Yt=Yt-Yt-i,$ (2)

α, is a drift term, and T is the time trend with the null hypothesis, n is the number of lags necessary to obtain white noise and ε is the error term. Note that failing to reject Ho implies the time series is non-stationary.

$Ho: \rho=0, \quad H1: \rho\neq 0,$ (3)

Arima Models

ARIMA models are, in theory, the most general class of models for forecasting a time series which can be stationarized by transformations such as differencing and logging. In fact, the easiest way to think of ARIMA models is as fine-tuned versions of random-walk and random-trend models: the fine-tuning consists of adding lags of the differenced series and/or lags of the forecast errors to the prediction equation, as needed to remove any last traces of autocorrelation from the forecast errors.

A common approach for modeling unvaried time series is the autoregressive (AR) model:

$Y_t = \alpha_o + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots + \alpha_n Y_{t-n} + u_t$ (4)

Another common approach for modeling unvaried time series models is the moving average (MA) model:

$Y_t = \alpha_o + \alpha_1 u_t - \alpha_2 u_{t-1} - \ldots - \alpha_n u_{t-n}$ (5)

Where Y_t is the time series, a_o is the mean of the series, u_{t-i} are white noise, and α1……. α n are the parameters of the model. The value of n is called the order of the MA model.

Box and Jenkins detailed an approach that combines the moving average and the autoregressive approaches in the book (Box, Jenkins, and Reinsel, 1994). Box and Jenkins was in developing a systematic methodology for identifying and estimating models that could incorporate both approaches. This makes Box-Jenkins models a powerful class of models. The most general Box-Jenkins model includes difference operators, autoregressive terms, moving average terms, seasonal difference operators, seasonal autoregressive terms, and seasonal moving average terms. This stage is founded on the study of autocorrelation and partial autocorrelation (Box, Jenkins, and Reinsel, 1994; Dobre and AnaMaria, 2008)

The Box-Jenkins ARMA model is a combination of the AR and MA models as follows:

$Y_t = a_o + a_1 Y_{t-1} + a_2 Y_{t-2} + \ldots + a_n Y_{t-n} + u_t + b_1 u_{t-1} + \ldots + b_p u_{t-p}$ (6)

Forecasting Result and Discussion

Unit Root Test Results

Forecasting of construction growth and investment are analyzed in Macro-economic time series are generally characterized by unit root of the stochastic process which reveals the relevant datum. Generalized ADF unit roots tests were employed in this study to determine time series characteristics of data. The fixed term model with trend was used in ADF unit root test. The results of ADF unit root test on series are presented in [Table 1].

Table 1: Unit root test results

	Level		Difference	
	ADF	Lag	ADF	Lag
Construction Growth	-0.34	3	-8.44	3
Private (Build.+Res.)	-0.90	1	-6.91	6
Public (Build.+Res.)	-0.631	4	-14.1	2
Infrastruture	-1.19	6	-11.6	2

Note: Numbers in lag column represent lag numbers determined according to the Schwartz criteria. McKinnon critical values for fixed term ADF model with trend are as follows: -3.46for %1, -2.87 for %5, -2.57 for %10.

According to ADF test results, Construction Growth, Private (Build.+Res.), Public (Build.+Res.) and Infrastruture investment series are not stationary [I(1)]. Series were differentiated of order one to become stationary. Graphics of series in non-stationary and stationary status are presented in [Figure 1, 2, 3 and 4].

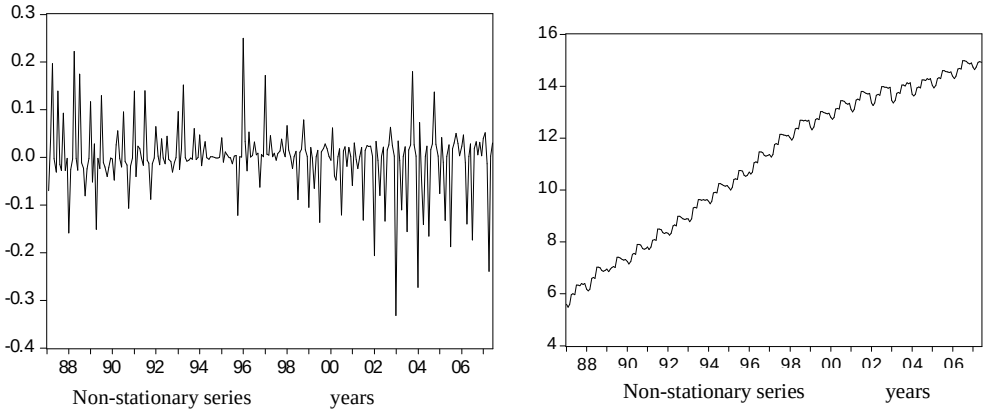

Figure1: Infrastructure investment

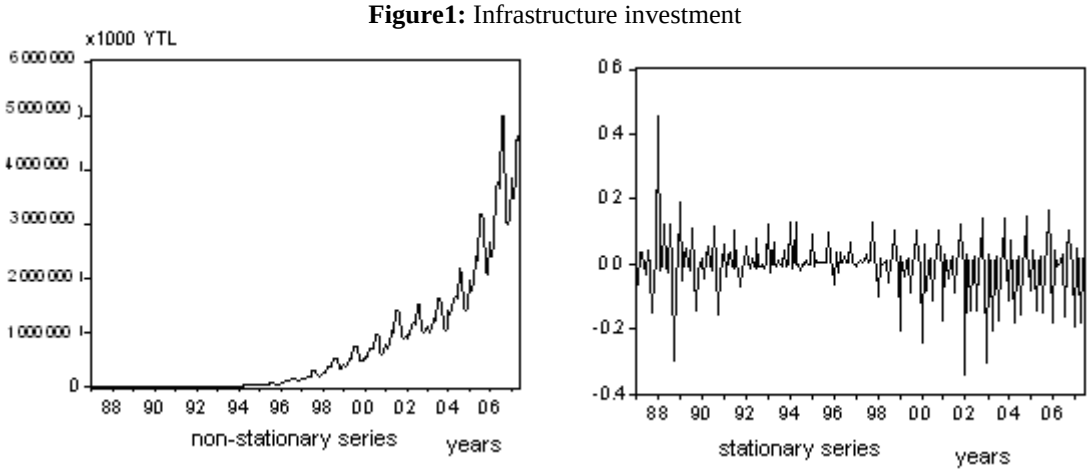

Figure 2: Private (Build.+Res.) investment

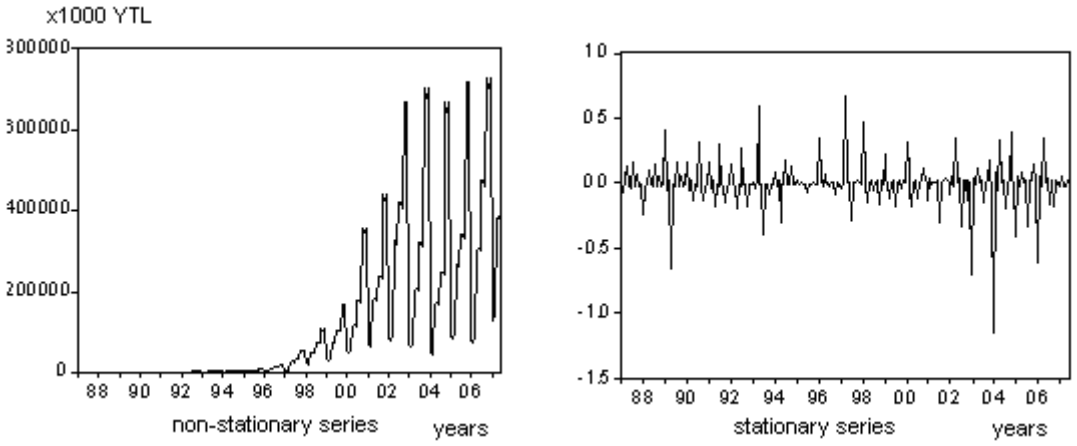

Figure 3: Public (Build.+Res.) investment

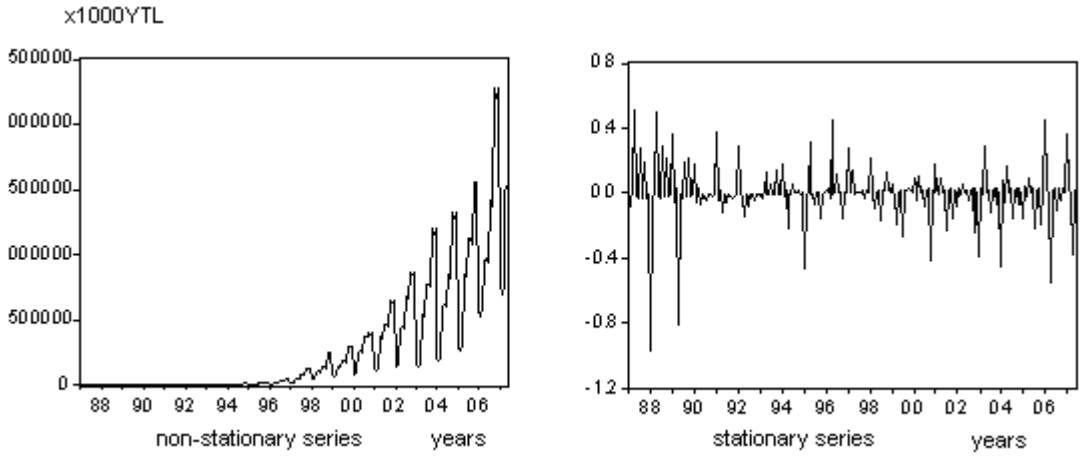

Figure 4: Infrastructure investment

ARIMA Test Results

[Table 2] show ARIMA model results for Construction Growth, Private (Build.+Res.), Public (Build.+Res.) and infrastructure investments.

Table 2: ARIMA Model Regression Results

Coefficients	Construction Growth	Private (Build.+Res.)	Public (Build.+Res.)	Infrastruture
b_0	-0.003 (0.65)	-0.01 (0.39)	-0.006 (0.72)	-0.001 (0.85)
AR(3)	-	0.11 (0.00)	0.52 (0.00)	-0.50 (0.00)
AR(9)	-	-0.11 (0.00)	-	-
AR(12)	0.58 (0.00)	0.79 (0.00)	0.34 (0.00)	-0.32 (0.00)
MA(3)	-0.38 (0.00)	-	-1.01 (0.00)	0.21 (0.00)
MA(6)	0.38 (0.00)	-	0.26 (0.00)	-0.21 (0.00)
MA(9)	-0.19 (0.00)	-	-	-
MA(12)	0.35 (0.00)	-	-	0.75 (0.00)

Special Statistics

Coefficients	Construction Growth	Private (Build.+Res.)	Public (Build.+Res.)	Infrastruture
R^2	0.50	0.71	0.32	0.36
DW	2.08	2.09	2.05	2.09
$F_{prob.}$	0.00	0.00	0.00	0.00
LM Test	0.41 (0.66)	0.31 (0.72)	0.09 (0.91)	0.13 (0.87)
ARCH Test	4.25 (0.04)	1.68 (0.19)	1.25 (0.26)	1.46 (0.22)

Models of estimates have been constructed for Construction Growth, Private (Build.+Res.), Public (Build.+Res.) and infrastructure investments. When the results are examined, it is seen in the construction growth variables' forecasting models that it is usually the most explanatory variable the value of the variable

which explains best the period to be estimated related to its period of one year ago. Besides this, it is seen that the periods which are retarded from the period to be estimated of 3,6 and 9 months are also effective.

When it is looked at the general construction growth results, R^2 values are calculated as 0.50, 0.71, 0.32 and 0.36 in order. These results express that general construction growth is explained at the rate of R^2 with its own retarded values. For the reason that Turkish economy does not have a completely stable structure, as the economical variables are affected from other external effects, only its retarded variables and explanation rate are at the values to be taken into consideration.

Conclusion

In the studies at where the relationship between economical growth and construction growth is examined, the existence of a strong mutual relationship is emphasized. It is clearly seen in the studies that construction growth is used as a regulator especially at countries which are developing. The assumption that the crisis experienced in the world is sourced by the mortgage financial crisis and that the exit from the crisis shall be with the normalization which shall be attained at the construction sector carries a quality to validate these studies. For this reason, in our study, an estimate model of the construction growth has been constructed. .

In our study, the Construction growth, private (Build.+Res.), Public (Build.+Res.) and infrastructure investments estimate models of year 1987-2006 has been constructed. For this purpose, in our study, it is looked at the stagnancy structures of the series with ADF unit root test and ARIMA estimate model has been constructed. It is reached to the conclusion that the rate of explaining the data of which their estimate models have been constructed with their own variables is not very high and this result from the structure of the Turkish economy which is not completely stable and that it is affected from many other external factors.

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