

T.C.

MARMARA ÜNİVERSİTESİ

SOSYAL BİLİMLER ENSTİTÜSÜ

İKTİSAT (İNG) ANA BİLİM DALI

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**THE ROLE OF CONSTRUCTION SECTOR IN ECONOMIC
GROWTH OF TURKEY**

Yüksek Lisans Tezi

Hakkı Kutay BOLKOL

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ABSTRACT

THE ROLE OF CONSTRUCTION SECTOR IN ECONOMIC GROWTH OF TURKEY

This thesis empirically investigates the relationship between construction sector and economic growth for Turkey during 2005Q1-2014Q4 period. In the study, there is also an empirical work related with interest rates. It is found that, there is causality relation which runs construction investments (private sector) to real interest rates of residential buildings both in short run and long run but not vice versa. The other result of the study is that, there is bidirectional long run causality between construction production and economic growth. However, in short run there is unidirectional causality running from economic growth (GDP) to construction production. According to IRFs results, construction production affects economic growth positively in long run. On the other side, economic growth affects construction production positively in short run but negatively in long run. Based on empirical results, this study reaches the conclusion that construction sector is significant sector for Turkish economy but the sector should not be overburdened regarding the contribution to economic growth.

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Anahtar Kelimeler: İnşaat Sektörü; İnşaat Üretimi; GSYH; Ekonomik Büyüme; Türkiye; VECM; Granger Nedensellik

ÖZET

TÜRKİYE’NİN İKTİSADİ BÜYÜMESİNDE İNŞAAT SEKTÖRÜNÜN ROLÜ

Bu tez ampirik olarak Türkiye’deki 2005Q1-2014Q4 periyodundaki inşaat sektörü ve ekonomik büyüme arasındaki ilişkiyi inceliyor. Tezde faizlerle ilgili de ampirik bir çalışma mevcut. Çalışmada inşaat yatırımlarından (özel sektör) reel konut kredi faizlerine doğru hem kısa dönemde hem uzun dönemde bir nedensellik ilişkisi olduğu bulunuyor. Ama tersi yönde bir ilişkinin söz konusu olmadığı belirtiliyor. Çalışmanın bir diğer sonucunda da inşaat üretimi ve ekonomik büyüme arasında uzun dönemde çift yönlü bir nedensellik ilişkisi olduğu bulunuyor. Ancak kısa dönemde GSYH’den inşaat üretimine doğru tek yönlü bir nedensellik ilişkisi olduğu belirtiliyor. IRFs sonuçlarına göre inşaat üretiminin uzun dönemde ekonomik büyümeye pozitif bir etki yaptığı vurgulanıyor. Diğer taraftan ekonomik büyümenin inşaat üretimine kısa dönemde pozitif fakat uzun dönemde negatif bir etki yaptığı bulunuyor. Yapılan ampirik çalışmalar sonucunda inşaat sektörünün Türkiye ekonomisi için önemli bir sektör olduğu fakat ekonomik büyümeye katkısı açısından fazla yük bindirilmemesi gerektiği sonucuna ulaşıyor.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
AIC	Advanced Industrialized Country
BK	Baxter-King
BT	Balance of Trade
CBRT	Central Bank of the Republic of Turkey
CCI	Construction Cost Index
CGDFCF	Value of Construction in Total Gross Domestic Fixed Capital Formation
CPI	Consumer Price Index
CVA	Construction Value Added
DEPRINT	Real Interest Rates for Deposits
FD	Corbae-Ouliaris First Difference
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GDPD	Gross Domestic Product Deflator
GCONS	Growth Rate of Construction Sector
GFCF	Gross Fixed Capital Formation
GGDP	Growth Rate of Gross Domestic Product
GNP	Gross National Product
GVCW	Gross Value of Construction Works

HP	Hodrick-Prescott
INTES	Construction Industrialists Employers Union of Turkey
IRFs	Impulse Response Functions
LDC	Less Developed Country
LCONS	Natural Logarithm of Construction Production
LGDP	Natural Logarithm of Gross Domestic Product
LPRCONS	Natural Logarithm of Private Sector Construction Investments
LRIRATE	Natural Logarithm of Real Interest Rates of Residential Loans
M&R	Maintenance and Repair
NI	National Income
NIC	Newly Industrialized Country
PP	Phillips-Perron
RIRATE	Real Interest Rates of Residential Loans
SC	Schwarz Information Criterion
TURKSTAT	Turkish Statistical Institute
US	United States
VAR	Vector Auto Regression
VECM	Vector Error Correction Model

1. INTRODUCTION

Construction sector is one of the significant sectors for Turkish economy. It is also related to many other industries. Furthermore, the stability of construction sector is very important due to more than 200 subsectors it has (Intes, 2015). In order to illustrate this point, construction activities generate demand for raw, semi-processed and processed materials. For this reason, there is strong association between construction and manufacturing sector since manufacturing industry supplies materials and equipment to construction industry (Lean, 2001). Furthermore, since most of the construction projects are done with help of bank loans, construction sector is also closely linked with financial operations (Punwani, 1997). Therefore, it can be said that, construction sector depends on some other sectors or from different point of view, an increase in the volume of construction output may also trigger an increase in volume of the other sectors. That's why the sector plays a significant role in economy.

The sector consists of building and non-building construction activities. The building construction activities consist of residential buildings, hospitals, schools, trade centers, factories etc., while the non-building construction activities consist of infrastructure projects such as roads, bridges, ports, dams, highways, railways, power systems etc. Moreover, the construction sector creates output which is more durable than any other outputs/goods. That's why the outputs of the sector are named as investment goods. It also makes contribution to production of other goods and services, which make the outputs of the sector also create value added.

What's more, Turkey is a developing country and it has some needs and requirements to reach the status of developed country and the construction sector is a labor-intensive sector which makes great contribution to the employment in the country. Sector employs both skilled and unskilled workers. That's why the construction sector plays significant role in reducing the level

of unemployment. However, it is better to state that especially unskilled workers in construction sector are mainly temporary workers because the construction activities are generally project-based works.

Furthermore, the sector plays important role in socio-economic development by providing infrastructure, sanctuaries, schools, hospitals, cultural centers, and libraries etc.

On the other side, the construction sector is highly dependent to economic conditions. It is known as the first and the most affected sector by economic crisis. The reason for this is that, in the period of economic downturn or crisis, the demand of residential buildings and private sector construction investments decreases significantly. Consequently, it can be stated that during periods of rapid economic expansion, the construction sector grows faster than the other sectors, but during periods of stagnation, it is the first to suffer, at least in short run.

The purpose of this thesis is to investigate the role of construction sector in economic growth of Turkey by giving some descriptive statistics and doing some empirical works.

This study differs from the other studies existing in literature in two respects; the first difference is that the other studies, especially the studies based on Turkey, do not include interest rate although it is very important in construction sector. Interest rates are related with mainly the private sector construction investments. That's why this thesis includes empirical part which is about the relationship between private sector construction investments and real interest rates of residential loans.

Second difference and contribution of this study is that there is an empirical part which is about the relationship between construction production and GDP. Other studies, especially the studies based on Turkey, existing in the literature generally separate sector as private-public or

building-non-building when making empirical analysis between construction sector and GDP. However, this study sums building and non-building construction production to identify the total role of this sector in economic growth.

Furthermore, there has been an increasing trend in the construction activities recently. Therefore, this study may give some information about the current position of construction sector in Turkish economy since it includes descriptive statistics and empirical analyzes about last 10 years (2005Q1-2014Q4).

The thesis is organized as follows; Chapter 2 gives review on literature while Chapter 3 provides some descriptive statistics on the role of construction sector in Turkish economy. In subsections of this chapter give information about the contribution of construction sector to GDP and employment. Moreover, private and public sector construction investments and the role of construction sector in current account deficit are also mentioned in the subsections of Chapter 3. Chapter 4 and 5 give empirical results about relationship between private sector construction investments and interest rates of residential loans, and relationship between construction production and GDP, respectively. Finally, Chapter 6 provides some recommendations and makes the conclusion.

2. LITERATURE REVIEW

There are numerous studies that examine the relationship between construction sector and economic growth. With these studies, the role of construction sector in economic growth may also be determined. But there is no certain conclusion about this issue. Every study includes its own specific results. At first step one may think that, the situation may vary from country to country. However, in literature it varies even for the same country because of the techniques that are used in studies.

In literature which is related with the construction sector as well as the economic growth and development, there are pioneer studies such as Turin (1978) and more recent one, Bon (1992). Turin's (1978) study largely includes the developing countries and he founds positively S-shaped relation between the share of construction sector in GDP and per capita GDP. And Turin concludes that the share of construction sector increases as GDP per capita increases. Bon (1992) finds different results than Turin. Bon states that the problem of Turin's study is the dominance of developing countries in his sample and that's why positively S-shaped relation is found. He includes less developed countries, newly-industrialized countries and advanced-industrialized countries to his sample and he finds inverted U-shaped relation which starts with less developed countries and ends with advanced-industrialized countries between the share of construction in Gross National Product (GNP) and GNP per capita. One of the differences is that Turin analyses construction sector with GDP but Bon analyses it with GNP. Bon states that, in less developed countries and newly industrialized countries, the share of construction sector in GNP increase with GNP per capita but after the level of newly-industrialized country status and the road to reach advanced-industrialized country status, the share of construction sector in GNP decreases as GNP per capita increases. That's why he concludes that there is inverted U-shaped relationship between the share of construction sector in GNP and GNP per capita.

There are also many works which examine this topic based on countries. For instance; Mallick and Mahalik (2010) investigates the role of construction sector in India's economic growth. According to their study, dominant influence of capital stock blurred or neutralized the impact of construction sector. However, when capital stock dropped out from the equation, the significance of construction sector in economic growth increases sharply. And this work puts emphasis on the employment that construction sector provides. It is suggested that, when employment of construction sector increases, the output also increases and this provides increase in economic growth. However, it is emphasized that the aforementioned effects are only valid in short-run.

In another study which is also related with India, Tiwari (2011) works on the causal relationship between construction flows and economic growth under static and dynamic framework. In static analysis it is indicated that there is bidirectional causality between construction flows and economic growth, but in dynamic analysis it is found that the construction flows affect economic growth positively in short run while the long run effect is negative. And economic growth affects construction flows negatively in short run while the effect in long run is positive. Consequently, this study suggests that, in short run Indian government can focus on development of construction sector as it increases economic growth. However, in long run Indian government should gradually cut down her budget expenditure on construction.

In literature there are also some studies which investigate this topic for U.S. case which is called as a leading economy in the world. For example Green (1997) examines how changes in residential and non-residential investment predict changes in GDP for U.S. case. In the study it is found that, residential and non-residential investments are cointegrated with GDP, which means that they have long-run relationship. After that, the paper uses Granger Causality method in order to test whether residential and non-residential investments Granger cause GDP and whether GDP Granger causes each of these types of investment. And according to the result, it is found that the residential investment Granger causes GDP and GDP Granger causes non-residential investments. So it can be said that, for this study, the residential investment is exogenous of GDP and policy, which promote an increase in residential investment should be designed since the causality starts with residential investment. However, in the paper it is also stated that the

mentioned result doesn't mean that the residential investment leads to higher permanent levels of GDP every year because high levels of residential investment cannot be sustained. Furthermore, Green (1997) also indicates that, tax laws may cause a reduction in the residential investment. And this can trigger some divergence in short-run.

In another study examining for the case of U.S., Coulson and Kim (2000) study the relationship between residential investment, non-residential investment and GDP. They take four variables as a component of GDP. These are residential investment, non-residential investment, consumption and government spending. It can be said that there are five variables in their analysis and they try to investigate causal relationship between these variables by using Granger Causality Method. It is found that, there are no cointegration relation between the variables. That's why the study includes only short run relationship with VAR (Vector Auto Regression) Method. In VAR model, it is found that non-residential investment has negative impact on the residential investment. Coulson and Kim (2000) explains this situation with crowding out effect. By Granger Causality Method, it is found that, non-residential and residential investment are Granger caused by every component of GDP while government spending seems to be autonomous. Coulson and Kim (2000) use partial correlation method to see the causal ordering and they find that there can be two options if government spending is got out of the model. These direction of causalities are like consumption to residential investment, residential investment to non-residential investment and non-residential investment to residential investment and residential investment to consumption. For making estimation, the study uses variance decompositions and impulse response functions. These functions are applied to two different direction of causalities mentioned above. In the first case, consumption is dominant and it affects residential investment almost 200 percent while the residential investment has much greater effect on non-residential investment. In addition, it is found that the effect of non-residential investment to GDP is negative and the second case, in which the first causer is non-residential investment and second causer is residential investment, is stated as a better model since it minimizes the effect of consumption and expand the role of non-residential investment. With this model, non-residential investment's effect on GDP becomes positive but still small like in first case. Variance Decomposition Method indicates similar results either. Consequently, Coulson

and Kim (2000) state that the impact of residential investment on GDP is more powerful than the non-residential investment.

In more recent works related with the U.S., Ewing and Wang (2005) study on an application of generalized impulse response analysis for housing starts. In their paper, they deal with how housing responds to sudden changes or shocks in macroeconomic factors by using generalized impulse response analysis. It is highlighted that the monetary policy may also affect the housing starts since when the price level increases and goods and services become more expensive so that the price of complementary goods such as furniture and, appliances etc. increase and this triggers a decrease in new housing starts or vice versa. Empirically, generalized impulse response function is used in this study because it allows meaningful interpretation of initial impact of endogenous variables. The paper takes industrial production, federal funds rate, CPI (consumer price index), corporate default risk premium and single housing starts as variables. And it is found that the unexpected rise in aggregate price levels and positive Federal Reserve shock causes decrease in housing starts while positive output shock and unexpected increase in aggregate risk in economy cause an increase in housing starts. Consequently, it can be said that the paper emphasizes on the endogeneity that exists among housing market and macroeconomic activity.

Ramachandra et al. (2013) study the direction of causal relationship between construction and the national economy of Sri Lanka. In contrast to the other studies, they use a set of variables. For construction sector, they use three variables (CVA¹, CGDFCF² and CCI³) while they also use three variables (GDP⁴, GDPD⁵, BT⁶) for national economy. And Granger Causality Test is used to find the causality between these variables. According to the result, all indicators except CGDFCF and GDPD, indicates that the national economy Granger causes construction sector and not vice versa. Moreover, in the document, it is also stated that during periods of rapid economic

¹ Construction Value Added

² The Value of Construction in Total Gross Domestic Fixed Capital Formation

³ Construction Cost Index

⁴ Gross Domestic Product

⁵ Gross Domestic Product Deflator

⁶ Balance of Trade

expansion, the construction sector grows faster than the other sectors, however, during periods of stagnation, it is the first to suffer.

Jackman (2010) investigates the relationship between residential construction and economic growth for Barbados. Empirically, the study suggests that there is bidirectional causality between economic growth and residential construction. At the end, the study emphasizes that too much investment on housing could damage economic stability since construction materials are imported at a rate of 60%. Furthermore, too much import triggers an increase in current account deficit and this could be a bad situation for Barbados. Consequently, the work recommends that the policy makers should carefully ration the amount allocated to housing.

Chang and Nieh (2004) study the causal link between construction activity and economic growth in Taiwan. It is found that, there is cointegration between construction activity and economic growth. According to the work, there is unidirectional causality that makes construction activities effect economic growth both in short run and long run. And it is said that the aforementioned result is consistent both with Neoclassical and Keynesian view, since the economic growth is determined by exogenous factors.

Lopes et al. (2011) work on the long-run relationship between construction sector and the national economy in Cape Verde. They put emphasis on the relationship between construction sector and transportation because transportation facilities depend on construction activities. Paper states that trade, co-operation and technology transfer can be provided with transportation that's why the importance of construction sector increases indirectly when the significance of transportation is taken into consideration. Furthermore, they mention the role of construction sector after the periods of war. In empirical analysis, Granger Causality Method is used in this study. Gross Domestic Product and Gross Value Added in Construction are taken as variables. It is found that these variables are integrated of the same order and they examine long-run relationship between these variables. Consequently, it is found that the causality runs from GDP to Construction sector and not vice versa. Paper explains that the aforementioned situation by

stating that the volume of construction output tends to increase with the increase in GDP before the countries get AIC (Advanced Industrialized Country) status.

Anaman and Amponsah (2007) state the causality between construction industry growth and economic growth in Ghana. In empirical analysis, they include political stability as dummy variable since Ghana experienced some military coups in some periods. And the study complains the lack of interest to construction sector although it is the 3rd largest sector in Ghana. Empirically, there is no cointegration found between construction production, economic growth and political stability. Therefore, short run analysis is investigated and it is found that the political stability and construction production affect GDP in positive way. Moreover, the political stability affects the construction production in positive way. At the end, the study puts the emphasis on the importance of construction sector for economic growth but it is also stated that there may be some problems related to funding and negotiations.

Khan (2008) examines the role of construction sector in economic growth for Pakistan economy and it is said that construction sector is the most neglected sector in Pakistan although it is the driver of economic growth in developing countries. In empirical analysis, it is found that there is cointegration relationship between construction sector and economic growth. According to findings of the study, causality runs from construction to economic growth which indicates that there is forward linkage.

Choy et al. (2011) examines the property investment, construction and economic growth for Malaysia. The study investigates causal relationship and it is found that the construction activities affect GDP positively and GDP affects property investment⁷ positively too while these causalities are unidirectional. The work concludes that the construction activities are important for economic growth because Malaysia is a developing country.

⁷ Property investment is a source of capital accumulation.

Alhowaish (2013) works on the causality between construction sector and economic growth of Saudi Arabia. He includes the oil revenues into the model because Saudi Arabia is an oil-rich country. The study emphasizes on employment generation of construction sector and its contributions to the national income. This work empirically finds that there is cointegration between economic growth and construction industry. And there is one more cointegration that is between oil revenues and construction industry. When it comes to causality, economic growth and construction have bidirectional causality in long run. Moreover, there is unidirectional causality, which runs oil revenues to construction industry, between oil revenues and construction industry. However, it is found that there is no long run relationship between economic growth and oil revenues. But there is a relationship in short run and it runs oil revenues to economic growth. Consequently, the study suggest that the government should intervene the market for the sake of economic growth.

Tse and Ganesan (1997) study the causal relationship between construction flows and GDP for Hong Kong economy. The purpose of this work is to examine specific lead-lag relationship between construction flow and GDP and it is found that there is unidirectional relationship that runs GDP to construction flow in short run. According to the analysis, demand for construction work is not autonomous, however it is determined by GDP. This results suggest that GDP is more volatile than construction flows since GDP affects the construction flows. And it is contrary to the general view which states that construction is more volatile than GDP. The reason of this is that when there is a decrease in GDP, income decreases and this affects credit supply conditions. And when the credit supply decreases, the construction activities decreases too. As a result, the work recommends that the government should affect the output to influence construction activity.

In another study which is made for Hong Kong Yiu et al. (2004) examines a longitudinal analysis on the relationship between construction output and GDP. They use real growth rate of construction output and real growth rate of GDP as variables. Granger Causality Method is used to analyze the causal relationship between these variables. And it is found that the increase in real growth rate of GDP Granger causes a decrease in real growth rate of construction output. The paper concludes that the aforementioned result agrees with the proposition that the construction

industry is relatively inefficient in productivity improvement and capital investment accumulation results in a marginally diminishing growth rate of construction output. Consequently, this study shows that the growth rate of GDP leads growth rate of construction output and they are negatively related.

For Hong Kong case, there is also a study made by Tan et al. (2012) about building maintenance market named 'A Causal Relationship between Building Maintenance Market and GDP'. It can be beneficial since in large cities that has significant urban development like Hong Kong, there are number of aged buildings. Some new buildings constructed in replacement of old buildings but some of them just need maintenance. Therefore, it can be thought as a part of construction demand. For this reason, analyzing relationship between building maintenance market and GDP may also make some contribution to the relationship between construction sector and economic growth. In their study, Tan et al. (2012) state that the investment on building maintenance is almost 50 percent of total turnover of the construction industry, which gives us the reason why analyzing is very significant for it. Granger Causality Method is used to examine the causal relationship between building maintenance market and GDP. It is found that, GDP Granger causes the building maintenance market and not vice versa. The paper concludes that building maintenance market will keep growing with economic development.

In another work which is related with Hong Kong, since construction sector generates significant amount of employment and employment issue is also very important for economic growth and development, Chiang et al. (2015) include employment (in the services and construction sectors) to the model as a variable while investigating causal relationship between construction activities and GDP in order to see whether or not it plays an intervening role on the causal relationship between construction activities and economic growth. In the analysis, construction activities include buildings, structures and facilities. Buildings are also divided into four categories, namely, residential, commercial, industrial and storage, and services buildings. Structure and facilities are also divided into four categories as transport, other utilities and plants, environment, and sports and recreation facilities. Furthermore, GDP, Total Labor and Gross Value of Construction Works (GVCW) are also included in the model as aggregate variables.

Granger Causality Method is used to identify causal relationship. The results indicate that there is bi-directional causal relationship between construction works and GDP. And construction works not only Granger cause construction employment but also that of services employment. Moreover, according to the results, growth of employment in construction industry also leads the growth of construction works. Consequently, there is bi-directional causal relationship between employment and GDP. Also for all types of structure and facilities, and building investments there are bi-directional causal relationships with GDP. At the end, Chiang et al. (2015) state that, construction industry plays a significant role in Hong Kong economy and the results obtained from this study may inform policy makers in determining long term public policies.

There are also some works which touch on the linkages of construction output. For example, Lean (2001) examines linkages between construction and other sectors in Singapore empirically. He puts emphasis on the contribution of construction industry to the socio economic development process. And his main aim is to show linkages between construction and other sectors since construction industry is related with many other industries. In empirical analysis, eight variables are used. These are; GDP, manufacturing, utility, construction, commerce, transport and communications, finance and business services, and other services. Granger Causality Method is used to determine whether a change in construction output causes other outputs within the Singapore economy. According to the results, the construction leads other services such as utility, finance and business services, and commerce sectors by one, two, four and five quarters, respectively. And it also leads the manufacturing and transport and communication sectors by six quarters and GDP by two years. Statistical results also show that, there are multiple links among variables which makes causality system a little bit complex. In other words, many of the causal relationship between variables or sectors are bi-directional which implies mutual dependence among sectors in economic environment. Lean (2001) concludes that, this study may help policy makers and investors because construction sector is highly regulated industry in Singapore and the results of this study may show the way to investors by giving prior knowledge about the general business performance in the near future.

Hongyu et al. (2002) investigate the interaction between housing investment and economic growth in China. It is stated that, economic growth that highly dependent on housing may damage the economic condition. Empirically, the analysis uses the variables; housing investment, non-housing investment and economic growth. It is found that, housing investment has a stronger short run effect on economic growth than non-housing investments. Moreover, it is determined that the housing investment has a long run effect on economic growth while the economic growth has a long run effect on both housing and non-housing investment. Furthermore, it is stated that the housing investment is a significant factor for short term fluctuations of economic growth because of its positive relationship to economic growth.

There are also some studies which include other investments as variables when testing the relation between construction investment and GDP. For example, Siqi and Hongyu (2004) study the interaction among construction investments, other investments and GDP for the case of China. The paper mentions fast increase in construction investment and government encouragement to construction, which stimulates the growth of national economy. Furthermore, it is also stated that the investment growth cannot be sustained without the support of national economy. On the other hand, the study also refers that the economic growth which is heavily dependent on investment (especially construction investment) causes some problems for the stability of general economy. Therefore, this work recommends that policy makers should be careful while encouraging investments for the sake of economic growth. In empirical side of this study, it is found that there is cointegration between GDP and construction investment. But other investment is not cointegrated with both GDP and construction investment. For making causality analysis, this work uses Granger Causality Method with both Vector Error Correction Model (VECM) and Vector Auto Regressive Model (VAR) since some variables are cointegrated but some are not. And paper reports that there is bidirectional short run causality between construction investment and GDP. But there is unidirectional short run causality between other investments and GDP that runs only GDP to the other investments. It is also stated that GDP affects both construction investments and other investments in long run. From these empirical results, Siqi and Hongyu (2004) concludes that the construction investment has a leading role when comparing with the other investments, since it is short term causer of economic growth.

The paper includes another variable as a dummy into the system called policy because of China's government investment oriented policy after the year of 1998. And after this dummy variable is included to the analysis, the new result states that the construction investment has stronger effect on GDP and becomes a long run causer of GDP. Lastly, Siqi and Hongyu (2004) divide construction sector into two as residential and non-residential investment. And they report that both of these variables are cointegrated with GDP. And residential investment Granger causes GDP in short run while non-residential investment does not.

In literature there are also many works related with housing and economic growth and development. Because housing is a very significant part of construction process, these works are also very important for our analysis. Generally most of the studies try to answer the question whether the housing should be a part of the economic growth and development strategies or not? Arku (2006) also tries to answer some other questions in his work like; must housing improvement wait until high economic growth stage, how much priority should be given to housing in less developed countries which have limited resources and what are the distinctive features of housing investments comparing with other economic investments? While Arku (2006) explains the significance of housing investments, he puts the emphasis on high capital-output ratio that housing investments generate. He also mentions the contribution of housing investments to employment and saving process. By giving some past studies and events as example, Arku (2006) concludes that, housing investments are one of the most important part of economic growth strategies also for less developed and developing countries.

Ofori (2007) states the need of construction activities for developing countries. He put emphasis on creation of employment through construction sector. This study recommends that, developing countries should give major importance to construction sector since it makes contribution to national socio-economic development by building infrastructure and productive facilities. This work also gives importance to the cultural issues because most of the projects are done by foreign companies in developing countries. Project constraints, equity problems and technological problems in developing countries are also stated in the study.

Lopes et al. (2002) work on investment in construction and economic growth in developing countries. In the analysis, Sub-Saharan countries are investigated. The study finds that, there is a direct relationship between construction output and GDP but it is valid only when the economy is in downturn. It is suggested that the construction output will grow faster than GDP at the first stages. When certain level⁸ achieved and countries are in the period of sustainable economic growth and development, the construction output increases, generally, at the same rate with GDP. Consequently, the study emphasizes that the construction sector is a major contributor to the economic growth process and development.

There are also some studies investigating Turkish case, for instance, the study written by Bon et al. (1999) examines the relationship between construction sector and other sectors by giving input-output⁹ tables. This work analyzes the period of 1973-1990 and it targets to examine the construction sector's role in Turkish economy. The result obtained by input-output table states that the share of construction sector in Gross National Product (GNP) and National Income (NI) tends to increase. And this shows that Turkey can be placed at transition point between less developed countries (LDC) and newly-industrialized countries (NIC). Of course, this comment is made according to the data obtained between 1973 and 1990. The study suggests that Turkey has a NIC status by looking backward linkage indicators and output multipliers. Furthermore, construction sector has the highest backward linkage indicator among all sectors since it needs input from other sectors especially from manufacturing sector. That's why, Bon et al. (1999) conclude that the construction sector has an intense pull effect and it can be used as an instrument to increase overall output in economy.

There is also a more recent study written by Gundes (2011) which explores the behavior of Turkish construction sector and its relationship to investment, income and other sectors in the economy by using the input output tables belong to the period between 1969 and 2006. In input-output tables there are nine sectors, namely, agriculture, mining, food processing, manufacturing,

⁸ Construction/GDP = 4-5%

⁹ Input-output analysis is based on the idea that commodities are needed in the current production of other commodities (Bon et al., 1999).

trade, transport, services, utilities and construction. And also GDP, Construction Industry and Gross Fixed Capital Formation (GFCF) are added into the model as variables. Gundes (2011) states that the construction industry accounted for more than half of GFCF until 1995. But after 1989, the share has begun to decline continuously and it has dropped to 36% in 2006. Furthermore, in the paper, it is stated that the share in construction sector in National Income (NI) is approximately half the GNP share for the study period. The author explains this situation as a not-surprising event because construction produces mainly for final demand and the only proportion of intermediate good produced by construction activity belongs to M&R (Maintenance and Repair) subsector. When it comes to backward linkages, there is high backward linkage ratio which runs construction to manufacturing sector according to the empirical works in the paper. And in general, the backward linkage ratio is higher than the forward linkage ratio for construction industry. However, Gundes (2011) states that the increase in the ratio of forward linkage in recent years may suggest significant policy implications to both policy makers and construction firms. Consequently, this paper put the emphasis on unequal distribution of construction sector linkages across industry groups (Mainly manufacturing for backward linkages and mainly services for forward linkages). Therefore, the leading role of construction sector is called as 'controversial issue' in this work.

In another work which is related with Turkey, Ozkan et al. (2012) examines causal relationship between construction investment policy and economic growth. The study shows the importance of construction sector by putting the emphasis on construction sector's direct relation with 200 different sectors. This work divides construction sector into three as public construction investment, private construction investment and infrastructure investment. It is found that, there is cointegration between public construction investment and economic growth. There is also cointegration between infrastructure investment and economic growth. But there is no cointegration between private construction investment and economic growth. In causality analysis, it is found that there is bidirectional relationship between both infrastructure investment and economic growth, and public construction investment and economic growth. Consequently, this study suggests that the public construction investment positively affects economic growth in

long run. That's why Ozkan et al. (2012) recommends that the government should give importance to this issue.

In a more recent work, Kaya et al. (2013) examines the role of construction sector in economic growth for Turkey case. In this study, construction investment is divided into two categories as public construction investment and private construction investment. The determinant for economic growth is GDP for this study. In order to investigate this relationship, Granger Causality is used. And it is found that the causality runs public sector construction investments to GDP and GDP to private sector construction investments. In other words, public sector construction investments affect GDP and GDP affects private sector construction investments. Consequently, the study suggests that the construction sector is very significant for sustainable economic growth.

In literature there are also some researchers who believe that the construction is not an industry. For instance; Groak (1994) examines whether the construction is an industry or not. And he thinks that the construction was assimilated to various forms of manufacturing industry. That's why, according to him, it is better to say that construction is a sum of projects rather than a discrete industry. He also introduce the idea of demand chain¹⁰ in his paper. It is suggested that one should be examined construction activity as project based. But when it comes to the relation between construction sector and economic growth or some other issues related with macro economy, it is impossible to think construction as project based sector.

¹⁰ Demand chain is a part of value chain that have subtitles which are called; marketing, sales, service.

3. DESCRIPTIVE STATISTICS ON THE ROLE OF CONSTRUCTION SECTOR IN TURKISH ECONOMY

The role of construction sector in economy can be analyzed by looking its contribution to GDP and employment. Also it may be beneficial to separate construction sector into two as public and private sector construction investments. In addition, it is important to look whether the sector affects current account deficit or not¹¹.

Construction sector is also related with many other sectors such as manufacturing, services etc. Therefore, the sector has many backward and forward linkages. To define this, there is a need of input output tables. However, the newest table was announced in 2002 by TURKSTAT (Turkish Statistical Institute). That's why, this study does not include the descriptive statistics about the ratio of backward and forward linkages of construction sector.

Furthermore, M&R (maintenance and repair) is very important part of construction sector but because of the lack of data about this issue, this work does not separate the M&R part from construction sector.

¹¹ There are also many other options to determine the role of construction sector in economy but since the aim of this thesis is to analyze sector based on economic growth and there is limited available data related with construction sector, this section includes only limited descriptive statistics. In other words, descriptive statistics that are used in this section give some prior knowledge for subsequent empirical analyzes.

3.1 Contribution of Construction Sector to GDP

One should better benefit from some descriptive statistics to see the contribution. Table 3.1 shows the share of construction sector in GDP with constant prices of 1998. According to the table, it can be said that the share has approximately been 5-6% in the last 10 years. The share is almost significant but it is generally thought that, because construction sector is related with many other sectors, the share becomes much more when backward and forward linkages are taken into consideration. Especially, in literature there is a big consensus of the relation of the construction sector with manufacturing sector. For instance, Lean (2001) states that construction activities generate demand for raw, semi-processed and processed materials and manufacturing industry supplies materials and equipment to construction industry. That's why, there is strong association between construction and manufacturing sector. And it is better to state that, manufacturing industry is one of the biggest industry in Turkish economy. For this reason, the role of construction sector becomes more significant indirectly with linkages.

Table 3.1: Share of Construction Sector in GDP with Constant Prices of 1998

Year	GDP (million TL)	Construction Sector (million TL)	Share of Construction Sector in GDP
2005	90 500	5 250	5.8%
2006	96 738	6 221	6.4%
2007	101 225	6 574	6.5%
2008	101 922	6 041	5.9%
2009	97 003	5 067	5.2%
2010	105 886	5 996	5.7%
2011	115 175	6 688	5.8%
2012	117 625	6 726	5.7%
2013	122 556	7 221	5.9%
2014	126 070	7 379	5.8%

Source: TURKSTAT (Turkish Statistical Institute)

In order to better understand the relationship between construction sector and GDP, Table 3.2 shows the growth rates of GDP and construction sector with constant prices of 1998. From the table, it can be seen that, when there is a decrease in growth rate of GDP, construction sector growth rate declines more than GDP with a multiplier effect. Similarly, when there is an increase in growth rate of GDP, construction sector growth rate increases more than GDP. According to these information, one can state that, construction sector is highly affected by the condition of general economy, at least in the short-run. And generally, this effect is seen in the same year. Therefore, it can be said that the effect comes true within 4 quarters. In order to understand the situation better, Figure 3.1 shows the relationship graphically based on the same data given in Table 3.2 and it is obvious that the fluctuation in growth rate of construction sector is much bigger than the fluctuations in growth rate of GDP and they are in similar trend, which means that their relation is positive.

Table 3.2: Growth Rates of GDP and Construction Sector with Constant Prices of 1998

Year	Growth Rate of GDP	Growth Rate of Construction Sector
2005	8.4%	9.3%
2006	6.9%	18.5%
2007	4.7%	5.7%
2008	0.7%	-8.1%
2009	-4.8%	-16.1%
2010	9.2%	18.3%
2011	8.8%	11.5%
2012	2.1%	0.6%
2013	4.2%	7.4%
2014	2.9%	2.2%

Source: TURKSTAT (Turkish Statistical Institute)

Figure 3.1: Growth Rate of GDP (GGDP) and Growth Rate of Construction Sector (GCONS)



Source: Authors' calculation based on the data from TURKSTAT (Turkish Statistical Institute)

3.2 Contribution of Construction Sector to Employment

Construction sector is one of the four main sectors that contribute employment with industry, agriculture and services sector.

What's more, construction sector generates employment not only for itself but also for other sectors indirectly because almost every sector need some construction works to survive.

Furthermore, construction sector is a labor-intensive sector and labor cost is cheaper in Turkey than in Europe. That's why its contribution to employment is very significant. Moreover, the

sector employs both skilled and mostly unskilled workers. Table 3.3 shows educational status of employees in construction sector. According to table, it can be stated that the share of unskilled workers is very important in construction industry.

Table 3.3: Ratios of employees according to their educational status in construction sector

Educational Status	Ratios
Illiterate	1.85%
Literate without schooling	4.69%
Primary School	41.70%
Elementary Education	15.92%
Junior High School	10.38%
High School	8.38%
Vocational High School	8.12%
Higher Education	8.96%

Source: INTES, Report of Construction Sector, April 2015

Table 3.4 shows the share of construction sector in employment. From the table, it can be seen that there has been an increasing trend in construction employment in the last 10 years. When unrecorded workers are also taken into consideration, probably the share of construction sector in employment will increase because there is a significant problem related with unrecorded workers in construction sector. The reason of this problem may be that the construction sector mainly consists of unskilled, seasonal and project-based workers.

Furthermore, the construction sector is very significant for employment process because in recent years with rural-urban migration, agriculture employment has decreased. And agriculture employment consists of mainly unskilled workers like construction sector. Therefore, sector can

absorb the unemployment caused by migration by employing workers which formerly worked in agriculture sector.

Table 3.4: The Share of Construction Sector in Employment

Years	Construction Employment (%)
2005	5.6%
2006	6.0%
2007	6.1%
2008	6.0%
2009	6.3%
2010	6.6%
2011	7.2%
2012	7.2%
2013	7.2%
2014	7.4%

Source: TURKSTAT (Turkish Statistical Institute)

3.3 Private and Public Sector Construction Investments

In Turkey construction investments can be classified as public and private sector construction investments. Generally, public sector construction investments include roads, railways, dams, ports, subways etc. and private sector construction investments consist of mainly residential buildings.

Table 3.5 shows the share of public and private sector construction investments in GDP with constant prices of 1998. According to the table, private sector construction investments have more share in GDP than public sector construction investments. That's why the private sector has major role in construction sector. Because private sector construction investments consist of mainly residential buildings, it can be stated that, construction of residential buildings are main engine for growth of construction sector.

Table 3.5: Share of Public and Private Sector Construction Investments in GDP with Constant Prices of 1998

Year	GDP	Public Sector Construction Investments	Private Sector Construction Investments	Share of Public Sector Construction Investments in GDP	Share of Private Sector Construction Investments in GDP
2005	90 499 731	2 248 034	6 492 518	2.5%	7.2%
2006	96 738 320	2 481 508	7 812 047	2.6%	8.1%
2007	101 254 625	2 594 217	8 296 877	2.6%	8.2%
2008	101 921 730	2 869 324	7 269 820	2.8%	7.1%
2009	97 003 114	2 965 845	5 680 409	3.1%	5.9%
2010	105 885 644	3 532 810	6 685 076	3.3%	6.3%
2011	115 174 724	3 499 063	7 799 724	3.0%	6.8%
2012	117 625 021	3 596 802	7 791 925	3.1%	6.6%
2013	122 556 461	4 684 189	7 739 191	3.8%	6.3%
2014	126 069 789	4 179 330	8 467 831	3.3%	6.7%

Source: TURKSTAT (Turkish Statistical Institute)

3.4 The Role of Construction Sector in Current Account Deficit

Construction sector output is non-tradable. Therefore, it cannot generate export. On the other side, in order to look at the dependence of construction sector to import, one needs to look at the input output tables to see the share of direct imported inputs in the value of total production of construction sector. Turkish Development Bank (2008) reports that, according to input output tables for the year 1998 and 2002, 93% of the construction productions were done with domestic inputs. This result shows that the construction sector does not depend on imports.

Consequently, it can be stated that the sector cannot generate any export volume but it also does not depend on import. However, it may help to reduce current account deficit because when construction demand and production increase, it may take the share of other sectors which mostly depend on imports like; automobile sector. Furthermore, an increase in construction investments may also take the share of technological investments which are also mostly depend on imports.

Lastly, it is also better to say that for further research related with the relationship between construction sector and current account deficit, the help of some descriptive statistics can be taken like; the share of real estate investments in FDI. However, this thesis does not include this because it leaves out of the limits of this thesis.

4. EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN PRIVATE SECTOR CONSTRUCTION INVESTMENTS AND INTEREST RATES OF RESIDENTIAL LOANS

4.1 Pre-Analysis

It is better to mention the role of interest rate in construction sector. Because, like every investment instrument, construction investments are also related with the interest rates. Furthermore, rate of interest is important for not only constructor but also for people who wants to be a home owner. To illustrate this point according to TURKSTAT, there are 1 165 381 sales of residential buildings in 2014 and 389 689 of them were made with residential loans (mortgage) and the percentage of sales with residential loans are in increasing trend. This statistics shows the rising role of banks and interest rates in construction sector.

This chapter empirically tries to examine the relationship between private sector construction investments and interest rates of residential loans (See Appendix B1 for the Share of Residential Loans in Consumer Loans).

4.2 Methods and Data

In this chapter, causal relationship between private sector construction investments and real interest rates of residential buildings is analyzed.

For this empirical work, E-views 8 econometric software is used. It is time series work for the period 2005Q1-2014Q4. 10 years quarterly data is used which means that the analysis consists of 40 observations.

The variables are; private sector construction investments and the real interest rates of residential loans and they expressed in natural logarithms in order to allow the estimated coefficients to be considered as the elasticity of relevant variables. Moreover, if the change in a variable is relatively small, the difference of the logarithms of the variable is approximately equal the growth rate. And it is generally convenient to use growth rates for economic relationships. Therefore, natural logarithmic version of variables are used.

For this study, the following abbreviations are used; LPRCONS for natural logarithm of private sector construction investments, LRIRATE for natural logarithm of real interest rates of residential loans.

The data of private sector construction investments were taken from TURKSTAT (Turkish Statistical Institute) and the data of interest rates of residential loans were taken from CBRT (Central Bank of the Republic of Turkey). The data of private sector construction investments are based on constant prices of 1998 and it is already seasonally adjusted in TURKSTAT. Interest rates of residential loans are transformed into quarterly data by taking average because it was weekly data in CBRT and they are also transformed into real terms with Fisher equation (See Appendix B2 for the Trend of Nominal Interest Rates of Residential Loans).

Fisher equation states that (Cooper and John, 2012, p. 812):

$$[4.1] \quad (1 + \text{nominal interest rate}) = (1 + \text{real interest rate}) (1 + \text{inflation})$$

Inflation data were also taken from TURKSTAT and CPI (%) is used according to same period of previous year.

By rearranging the equation and leaving the real interest rate alone:

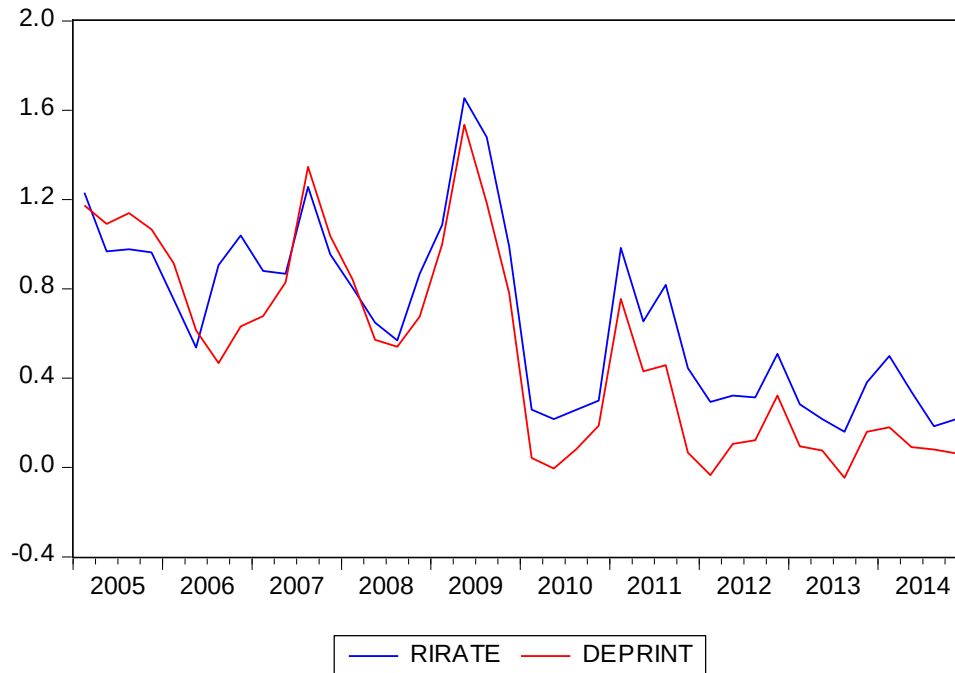
$$[4.2] \text{ real interest rate} = (1 + \text{nominal interest rate}) / (1 + \text{inflation}) - 1$$

According to this formula, interest rates of residential loans are transformed into real terms.

It is also beneficial to state that interest rates of residential loans are selected for this study since this work is about construction sector. However, generally it can be said that all types of interest rates are in a parallel trend in economy. Figure 4.1 shows this situation graphically by giving real interest rates of residential loans as “RIRATE” and real interest rates for deposits up to 1 year as “DEPRINT”. The data of interest rates for deposits up to one year is also taken from CBRT and converted into real terms with same method as it is done for interest rates of residential loan.

Furthermore, other variable is the private sector construction investments because, as it is mentioned in the previous chapter, private sector has more share than public sector in construction industry. Moreover, using public sector construction investments in the analysis which investigate the relationship between construction investments and interest rates, would not be informative. What’s more, private sector construction investments consist of mainly residential buildings and the analysis also uses real interest rates of residential loans as another variable. That’s why, private sector construction investments selected for the analysis.

Figure 4.1: Real Interest Rates for Residential Loans (RIRATE) and Deposits (DEPRINT)



Source: Authors' calculation based on the data from CBRT (Central Bank of the Republic of Turkey)

Granger Causality Method is used for exploring the causal relationship between private sector construction investments and real interest rate of residential loans.

But at first it should be analyzed whether the variables are difference stationary or trend stationary. If they are not trend stationary, this means that they are difference stationary. And if they are non-stationary in their levels, they become stationary by taking difference.

For unit root test, PP (Phillips-Perron) Unit Root Test used for this analysis because it is popular in financial time series and in this study one of the variable is interest rate. Furthermore, one of the advantages of PP Unit Root Tests against another popular test called ADF (Augmented Dickey-Fuller) Unit Root Tests is that the PP tests are robust in the general forms of

Heteroscedasticity in error term. Another advantage is that the user does not have to specify a lag length for the test regression (Zivot and Wang, 2006, p. 127).

After that cointegration analysis should be done for the variables that are integrated of the same order. For cointegration analysis Johansen Cointegration Test is used. If there is cointegration which mean that, there is long run relationship between variables, VECM (Vector Error Correction Model) should be used in order to analyze the causality between variables. And because our variables are cointegrated, VECM technique is used in this study.

Ivanov and Kilian (2005) suggest that, if sample size is smaller than 120, Shwarz Information Criterion (SC) is more accurate for quarterly models. That's why Shwarz Information Criterion is used in order to select ideal lag length.

At the end, it is important to check diagnostic tests (Normality Tests, Serial Correlation Tests, and Heteroscedasticity Tests) to see whether the model is well behaved or not.

4.3 Empirical Results

Firstly, it is better to state that variables are not stationary in their levels. That's why, it is examined that whether the variables are trend stationary or not. Because if they are trend stationary and one applies differencing method to trend stationary variables, over differencing problem occurs. For testing trend stationary, 3 different filter method is used. These are Hodrick-Prescott (HP), Baxter-King (BK) and Corbae-Ouliaris First Difference (FD) filters. 3 methods are used to be sure whether the variables are trend stationary or not. After de-trending the variables, PP Unit Root Test is used to test whether they are trend stationary or not.

Table 4.1 indicates that, according to all 3 methods of de-trending, null hypothesis, which says that unit root exists, is accepted because all the probability values are bigger than 5% criteria. That means the variables are not trend stationary. So it can be said that they are difference stationary.

Table 4.1: Testing Trend Stationary

			PP Unit Root Test Results	
Variables	Cases	HP Filter	BK Filter	FD Filter
LPRCONS	Intercept	0.9999	0.5030	0.3025
	Trend & Intercept	0.9980	0.6144	0.6083
LRIRATE	Intercept	1.0000	0.3762	0.1073
	Trend & Intercept	0.3069	0.6850	0.3035

Note: Numbers show the probability values.

Table 4.2 shows the order of integration of variables. According to the table, both of the variables are integrated of order 1. That's why cointegration analysis should be done for these variables to see whether there is a long run relationship between these two variables.

Table 4.2: PP Unit Root Test Results¹²

Variables	Cases	Level	1st Difference	Decision
LPRCONS	Intercept	0.2610	0.0371**	I(1)
	Trend & Intercept	0.5529	0.1321	
LRIRATE	Intercept	0.3106	0.0000***	I(1)
	Trend & Intercept	0.2351	0.0000***	

Note: ***, **, * denotes stationary at level %1, %5, and % 10 respectively.

Before testing for cointegration, there is a need to find the optimal lag length. Table 4.3 shows the optimal lag length according to Schwarz Information Criterion (SC). To give information, SC suggests lag with smallest number. And it suggests that optimal lag length for these two variables is 2.

¹² Numbers in table shows the probability values.

Table 4.3: Lag Order Selection Criteria for the Variables LPRCONS and LRIRATE

Lags	1	2	3	4	5	6
Schwarz Information Criterion (SC)	-1.486697	-1.584747*	-1.240520	-1.078551	-0.972095	-0.698079

Note: * shows the optimal lag length for SC

After determining the optimal lag length, table 4.4 shows the result of Johansen Cointegration Test. This test determines the number of cointegrated vectors for any given non-stationary variables for the same order. That's why this test must be applied to level forms of the variables. To explain the procedure it is better to state that the sign of “*” suggests the optimal data trend according to Schwarz Information Criterion. So test result states that, model should be linear and test type should be intercept and trend. Table 4.4 also shows that there is 1 cointegrated equation for both trace and max-eigen statistics for the case of linear intercept and trend. Consequently, it can be stated that the private sector construction investments and real interest rates of residential loans have long run relationship because they are cointegrated.

Table 4.4: Result of Johansen Cointegration Test for the Variables LPRCONS and LRIRATE

Data Trend	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	0	0	0	1	2
Max-Eig	0	0	0	1	2

According to Schwarz Information Criteria

0	-1.612254	-1.612254	-1.424286	-1.424286	-1.230625
1	-1.403957	-1.354593	-1.263335	-1.763401*	-1.666438
2	-1.013606	-1.039585	-1.039585	-1.489066	-1.489066

Because there is cointegration relationship between two variables, Vector Error Correction Model (VECM) should be applied to check causality. And table 4.5 shows the result of VEC Granger Causality. According to table, there is unidirectional causality which states that the private sector construction investments Granger cause real interest rates of residential loans.

Table 4.5: VEC Granger Causality Results

Null Hypothesis	Test Statistics	Probability Value	Result
LRIRATE Does Not Granger Cause LPRCONS	Chi-sq = 0.362654	0.8342	Accepted
LPRCONS Does Not Granger Cause LRIRATE	Chi-sq = 11.34268	0.0034	Rejected

Note: If the probability value is more than 5% that means null hypothesis must be accepted or vice versa.

To check whether this VEC model is well-behaved or not, there is a need to test diagnostic tests. Table 4.6 shows that, the null hypothesis which states that there is no Heteroscedasticity, is accepted because the probability value of VEC Residual Heteroscedasticity Test is bigger than 5% for both with and without cross terms. Moreover, null hypothesis which states that, there is no serial correlation, is also accepted since the probability of VEC Residual Serial Correlation LM Test is bigger than 5%. Furthermore, the null hypothesis which states that, errors are normally distributed, is accepted according to Jarque Bera VEC Residual Normality Test because the probability value is more than 5%. These results show that the model is well behaved and open to meaningful comments.

Table 4.6: Diagnostic Tests for VEC Model

Test	Test Statistics	Probability Value
VEC Residual Heteroscedasticity Test (without cross terms)	Chi-square = 35.65628	0.2195
VEC Residual Heteroscedasticity Test (with cross terms)	Chi-square = 67.36768	0.2397
VEC Residual Normality Test (Jarque Bera)	Jarque-Bera = 0.825740	0.9350
VEC Residual Serial Correlation LM Test (lags 1 to 12)	LM = 1.652455 LM = 3.206611 LM = 2.197993 LM = 1.861283 LM = 2.342042 LM = 3.595682 LM = 5.355024 LM = 5.796100 LM = 7.285334 LM = 2.856417 LM = 1.057380 LM = 6.458814	0.7993 0.5239 0.6994 0.7613 0.6731 0.4635 0.2528 0.2149 0.1216 0.5821 0.9010 0.1674

Note: If the probability value is more than 5% that means null hypothesis must be accepted.

Because Granger Causality gives the result of Wald Tests, the result gives us short run information. However, it is found that the private sector construction investments and real interest rates of residential loans are cointegrated which means that they have long run relationship. In order to look at the long run causality between these variables, it is needed to investigate the

model with 2 different ways by changing dependent variables. In other words, there is a need to look at both a model which dependent variable is private sector construction investments and a model which dependent variable is real interest rates of residential loans.

4.3.1 A Model Which Dependent Variable is Private Sector Construction Investments

Table 4.7 gives the VECM results for the dependent variable of private sector construction investments to see whether a change in real interest rates of residential loans causes a change in private sector construction investments. To check long run causality, there is a need to look at coefficient values and probability value of cointegrated equation. A negative and significant value of cointegrated equation (CointEq (-1)) indicates that, in the next period, any disturbance in corresponding dependent variable will get corrected by the amount of coefficient value (Tiwari, 2011). Consequently, a negative coefficient value of cointegrated equation will give the speed of adjustment towards equilibrium. So for long run causality, coefficient value should be negative and probability value should be significant. However, according to table 4.7 probability value of cointegrated equation is more than 5%, which means that it is not significant that's why it can be said that there is no long run causality running from real interest rate of residential loans to private sector construction investments. Furthermore, table 4.7 shows that the model has low R-squared and non-significant F-statistics Probability Value according to 5% criteria.

Table 4.7: VEC Model which Dependent Variable is LPRCONS

Independent Variables	Coefficient	Probability Value
CointEq(-1)	0.000676	0.9386
D(LRIRATE(-1))	0.009598	0.6382
D(LRIRATE(-2))	-0.004587	0.8344
R-squared	0.280971	
Adjusted R-squared	0.164999	
F-statistic	2.422742	
Probability (F-statistic)	0.057712	

Note: The criteria for significance level is 5% (Prob.>0.05 = not significant or vice versa)

Wald Test should be applied to check the short run causality. Table 4.8 shows the same result as VEC Granger Causality, which means that the null hypothesis stating there is no causality is accepted. In other words, there is no short run causality running from real interest rates of residential loans to private sector construction investments like the long run.

Table 4.8: Wald Test for Short Run Causality (LRIRATE to LPRCONS)

Test Statistics	Probability Value
Chi-Square = 0.362654	0.8342

Note: Probability Value which is bigger than 5% states the acceptance of null hypothesis.

Although R-square of the model is low, it can be regarded as significant according to 10% level of significance. But there is need to test also diagnostic tests to check whether the model is well-behaved or not. According to Table 4.9, null hypotheses, which states that there is no Heteroscedasticity and Serial Correlation, are accepted because probability values of Breusch-

Pagan-Godfrey Heteroscedasticity Test and Serial Correlation LM Test is more than 5%. Moreover, the null hypothesis, which states that errors are normally distributed, is also accepted since the probability value of Jarque-Bera Normality test is more than 5%. Consequently, it can be said that the model is well-behaved.

Table 4.9: Diagnostic Tests for VEC Model which Dependent Variable is LPRCONS

Test	Probability Value
Heteroscedasticity Test (Breusch-Pagan-Godfrey)	0.8236
Histogram – Normality Test (Jarque-Bera)	0.978960
Serial Correlation LM Test	0.8732

Note: If the probability value is more than 5% that means null hypothesis must be accepted or vice versa.

4.3.2 A Model Which Dependent Variable is Real Interest Rates of Residential Loans

It is needed to investigate model which dependent variable is real interest rates of residential loans in order to check long run causality running from private sector construction investments to real interest rates of residential loans.

According to Table 4.10, there is long-run causality running from private sector construction investment to real interest rate of residential loans because the coefficient value of cointegrated equation is negative and its probability value is significant. In other words, in the next period, any disturbance in corresponding dependent variable will get corrected by the amount of approximately 37%. Also R-square of the model is approximately %60, which is relatively high

and the probability f-statistics is significant according to 5% criteria. And from the table, it can be seen that the private sector construction investments have negative effect on real interest rates of residential loans because the probability of private sector construction investment with one lag period is significant and its coefficient value is negative.

Table 4.10: VEC Model which Dependent Variable is LRIRATE

Independent Variables	Coefficient	Probability Value
CointEq(-1)	-0.371898	0.0000
D(LPRCONS(-1))	-3.538336	0.0087
D(LPRCONS(-2))	-0.448929	0.7443
R-squared	0.603570	
Adjusted R-squared	0.539630	
F-statistic	9.439579	
Probability (F-statistic)	0.000015	

To look at the short run causality, Wald Test should be applied. It gives the same result as VEC Granger Causality because Granger Causality method also uses the procedure of Wald Test. And according to table 4.11, there is also short run causality running from private sector construction investments to real interest rates of residential loans because the probability value is less than 5%, meaning that the null hypothesis stating there is no short run causality, is rejected.

Table 4.11: Wald Test for Short Run Causality (LPRCONS to LRIRATE)

Test Statistics	Probability
Chi-Square = 11.34268	0.0034

Note: Probability Value which is smaller than 5% states the rejection of null hypothesis.

Lastly, Diagnostic Tests are checked to be sure about the robustness of the model. And according to both Breusch-Pagan-Godfrey Heteroscedasticity Test and Serial Correlation LM Test, the null hypothesizes, stating that there is no Heteroscedasticity and Serial Correlation, are accepted because the probabilities of both tests are more than 5%. Moreover, the probability of Jarque-Bera Normality Test is bigger than 5%, meaning that the null hypothesis which states that the errors are normally distributed, is accepted. In other words, there is no problem related with Heteroscedasticity, Serial Correlation and Normality which means that the model is well behaved and one can make meaningful interpretation of the model.

Table 4.12: Diagnostic Tests for VEC Model which Dependent Variable is LRIRATE

Test	Probability Value
Heteroscedasticity Test (Breusch-Pagan-Godfrey)	0.1547
Histogram – Normality Test (Jarque-Bera)	0.638889
Serial Correlation LM Test	0.1602

Note: If the probability value is more than 5% that means null hypothesis must be accepted or vice versa.

4.4 Conclusions and Recommendations

According to empirical results, there is cointegration between private sector construction investments and real interest rates of residential loans, which means that they have long run relationship. Therefore, VECM was constructed to identify the causality between variables. And results show that there is causality running from private sector construction investments to real interest rates of residential loans both in short run and long run but not vice versa. And based on the empirical results, it can also be stated that, private sector construction investments negatively affect real interest rates of residential loans.

In the light of the empirical results, it can be commented that banks might have noticed an increase in construction investments and demand, then they might have reduced the level of interest rates to encourage people to use residential loans because residential loans might have been seen more profitable to banks since it is long term and less risky loan.

Moreover, based on the results, it can be stated that a change in construction investments may be due to demand of investors and people who wants to be a home owner, because interest rates do not affect construction investments. The reason for this may be that there is an urban renewal project in recent years, especially for large and earthquake zone cities like Istanbul and government uses some subsidies to encourage investors to attend this project. This subsidies may have been seem profitable to investors and they could persuade home owners to rebuild their buildings. Furthermore, in large and old cities like Istanbul, there are a lot of old buildings and home owners may want to rebuild their buildings with the help of urban renewal project because of the danger of the earthquake.

Furthermore, according to empirical results showing that interest rates do not affect construction investment, a government strategy based on lowering interest rates in order to increase construction production and investments seems to be useless. The reason for this may be

that the construction investments affect interest rates via affecting banks decisions because the interest rates do not affect construction investments as it is mentioned above.

Consequently, it can be stated that changing the level of interest rates in order to affect construction investments is inefficient because construction activities (production, investment) are generally based on needs and requirements. So, according to these needs and requirements, financial institutions may change the level of interest rates.

5. EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN CONSTRUCTION PRODUCTION AND GDP

5.1 Pre-Analysis

The aim of this chapter is to determine the role of construction sector in economic growth of Turkey.

In literature, there are a lot of studies related with the relationship between construction sector and GDP. It is very significant issue since construction sector is one of the main sector in economy. Furthermore, production side of the economy is very important for GDP. Therefore, the relationship between Construction Production and GDP is analyzed in this chapter.

5.2 Methods and Data

In this chapter, causal relationship between Construction Production and GDP is analyzed.

Other procedures are the same as empirical analysis explained in the previous chapter. Our sample size is also the same (2005Q1-2014Q4). The only difference is that our variables are Construction Production and GDP for this time.

For this study, the following abbreviations are used; LGDP for natural logarithm of Gross Domestic Product, LCONS for natural logarithm of Construction Production.

The data were taken from TURKSTAT and the variable Construction Production consists of building¹³ and non-building¹⁴ construction production. Because the data of Construction Production are in index form with based year of 2010 and already seasonally adjusted in TURKSTAT, GDP is also transformed into index form based on the year 2010 and it gets seasonally adjusted by using E-Views X-13 procedure.

All the testing procedures are same as the analysis which is done in previous chapter, however, in addition, the method of impulse-response functions (IRFs) is used to make an estimation in this chapter because an impulse response function measures the time profile of the effect of shocks/innovations at a given point in time on the expected future values of variables in dynamic system (Pesaran and Shin, 1998). In other words, it allows for meaningful interpretation of initial impact of endogenous variables to shocks/innovations to any of the other variables (Ewing and Wang, 2005).

5.3 Empirical Results

Because the procedure is the same as the empirical analysis in previous chapter, it is not explained in detailed way.

Firstly, it is better to state that variables are not stationary in their levels. That's why it is examined whether the variables are trend stationary or not. Table 5.1 shows the test of trend stationary and according to all 3 methods of de-trending, null hypothesis, which says there is unit root, is accepted since all the probability values are more than 5%. This means that the variables are not trend stationary. So it can be said that they are difference stationary.

¹³ Building construction production includes residential buildings, hospitals, schools, trade centers, factories etc.

¹⁴ Non-building construction production is mainly related with infrastructure projects and it includes roads, bridges, ports, dams, highways, railways, power systems etc.

Table 5.1: Testing Trend Stationary

			PP Unit Root Test Results	
Variables	Cases	HP Filter	BK Filter	FD Filter
LGDP	Intercept	0.9701	0.4598	0.2021
	Trend & Intercept	0.8316	0.7523	0.4876
LCONS	Intercept	1.0000	0.4560	0.2947
	Trend & Intercept	0.9978	0.6114	0.5992

Note: Numbers show the probability values.

So, Table 5.2 shows that LGDP and LCONS are integrated of order 1 when differencing method is used. That's why cointegration analysis should be done for these variables to see whether there is long run relationship between these two variables.

Table 5.2: PP Unit Root Test Results¹⁵

Variables	Cases	Level	1st Difference	Decision
LGDP	Intercept	0.7987	0.0035***	I(1)
	Trend & Intercept	0.3635	0.0161**	
LCONS	Intercept	0.5433	0.0423**	I(1)
	Trend & Intercept	0.6380	0.1448	

Note: ***, **, * denotes stationary at level %1, %5, and % 10 respectively.

Before doing cointegration analysis, it is needed to test the optimal lag length for this model. Table 5.3 shows that the optimal lag length is 2 according to Schwarz Information Criterion.

¹⁵ Numbers in table shows the probability values.

Table 5.3: Lag Order Selection Criteria for the Variables LGDP and LCONS

Lags	1	2	3	4	5	6
Schwarz Information Criterion (SC)	-8.269871	-9.018842*	-8.749907	-8.853824	-8.746017	-8.486428

Note: * shows the optimal lag length for SC

After determining the optimal lag length, Table 5.4 gives the cointegration results for the variables; LGDP and LCONS. And according to the results, there is one cointegrated equation for the case of linear intercept and trend which Schwarz Information Criterion recommends. In other words, it can be stated that there is long run relationship between GDP and Construction Production. That's why VECM should be constructed.

Table 5.4: Result of Johansen Cointegration Test for the Variables LGDP and LCONS

Data Trend	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	1	0	1	2
Max-Eig	1	1	0	1	2

According to Schwarz Information Criteria

0	-8.703632	-8.703632	-8.913768	-8.913768	-8.726787
1	-8.746661	-8.669936	-8.700510	-9.113276*	-9.022757
2	-8.365082	-8.319937	-8.319937	-8.782307	-8.782307

Table 5.5 shows the VECM Granger Causality result to determine the causality between GDP and Construction Production.

Table 5.5: VEC Granger Causality Results

Null Hypothesis	Test Statistics	Probability Value	Result
LGDP Does Not Granger Cause LCONS	Chi-sq = 14.46308	0.0007	Rejected
LCONS Does Not Granger Cause LGDP	Chi-sq = 3.387644	0.1838	Accepted

Note: If the probability value is less than 5%, it means that null hypothesis must be rejected or vice versa.

According to the results, GDP Granger causes Construction Production but Construction Production does not Granger Cause GDP. But this test gives short-run analysis since it is based on Wald Tests.

After that, there is need to check whether this VEC Model is well-behaved because, in addition to Granger Causality Test, VECM of IRFs (impulse-response function) will be used. To check whether the model is well-behaved, Table 5.6 gives the results of diagnostic tests. And the null hypothesizes, stating that there is no Heteroscedasticity and Serial Correlation, are accepted. Moreover, the null hypothesis, stating that the errors are normally distributed, is also accepted. Consequently, it can be said that the model is well-behaved and one can make meaningful interpretation with this model.

To examine the long run causality, it is needed to investigate the model in two parts by changing the dependent variable¹⁶.

¹⁶ In first model, the dependent variable is LCONS and in the second model, it is LGDP.

Table 5.6: Diagnostic Tests for VEC Model

Test	Test Statistics	Probability Value
VEC Residual Heteroscedasticity Test (without cross terms)	Chi-square = 26.44801	0.6521
VEC Residual Heteroscedasticity Test (with cross terms)	Chi-square = 61.66736	0.4162
VEC Residual Normality Test (Jarque Bera)	Jarque-Bera = 1.128186	0.8898
VEC Residual Serial Correlation LM Test (lags 1 to 12)	LM = 2.266338	0.6869
	LM = 2.125283	0.7127
	LM = 2.479686	0.6483
	LM = 1.671008	0.7960
	LM = 0.857013	0.9306
	LM = 1.243687	0.8709
	LM = 0.807026	0.9375
	LM = 4.754932	0.3134
	LM = 4.769289	0.3118
	LM = 4.076702	0.3957
	LM = 9.217560	0.0559
	LM = 2.137080	0.7106

Note: If the probability value is more than 5% that means null hypothesis must be accepted or vice versa.

5.3.1 A Model Which Dependent Variable is Construction Production

Table 5.7 shows the VECM results of the model which dependent variable is Construction Production. According to table, there is long run causality running from GDP to Construction Production because the coefficient value of cointegrated equation is negative and its probability value is significant. In other words, in the next period any disturbance in the corresponding the variable of Construction Production will get corrected by the amount of approximately 58%. Furthermore, R-square of the model is also descriptive and probability f-statistics of the model is significant. Therefore, it can be said that, one can make meaningful interpretation with this model.

Table 5.7: VEC Model which Dependent Variable is LCONS

Independent Variables	Coefficient	Probability Value
CointEq(-1)	-0.581965	0.0288
D(LGDP(-1))	0.766944	0.0006
D(LGDP(-2))	0.292565	0.2740
R-squared	0.715877	
Adjusted R-squared	0.670051	
F-statistic	15.62154	
Probability (F-statistic)	0.000000	

Note: The criteria for significance level is 5% (Prob. < 0.05 = significant or vice versa)

To check short-run causality, there is a need to look Wald Tests but because it is mentioned earlier that Wald Test gives the same result as VECM Granger Causality, by looking it, it can be said that there is also short run causality running from GDP to Construction Production (See Table 5.5). Also one can understand from the table that, GDP with one period lag affects

Construction Production positively by the amount of 76% because its probability value is significant.

To examine whether the model is well-behaved or not, diagnostic tests should be done. According to Table 5.8, the null hypotheses of there is no Heteroscedasticity and Serial Correlation, are accepted. Also the null hypothesis of the errors are normally distributed, is also accepted. Consequently, it can be said that the model is well-behaved and opened to meaningful interpretation.

Table 5.8: Diagnostic Tests for VEC Model which Dependent Variable is LCONS

Test	Probability Value
Heteroscedasticity Test (Breusch-Pagan-Godfrey)	0.0736
Histogram – Normality Test (Jarque-Bera)	0.835078
Serial Correlation LM Test	0.6321

Note: If the probability value is more than 5% that means null hypothesis must be accepted or vice versa.

5.3.2 A Model Which Dependent Variable is GDP

Especially, the main aim of this thesis is to look this model because it can give the result of the role of the construction sector in GDP. Table 5.9 gives the results of VEC Model which dependent variable is GDP. According to results, there is long-run causality running from Construction Production to GDP because the coefficient value of cointegrated equation is

negative and its probability value is significant. It can be said that, in the next period any disturbance in the corresponding GDP will get corrected by the amount of approximately 98%.

Table 5.9: VEC Model which Dependent Variable is LGDP

Independent Variables	Coefficient	Probability Value
CointEq(-1)	-0.980036	0.0000
D(LCONS(-1))	-0.198575	0.1501
D(LCONS(-2))	-0.045979	0.6383
R-squared	0.563423	
Adjusted R-squared	0.493008	
F-statistic	8.001402	
Probability (F-statistic)	0.000062	

Note: The criteria for significance level is 5% (Prob. < 0.05 = significant or vice versa)

It is mentioned earlier that, there is no short run causality running from Construction Production to GDP (See Table 5.5). Table 5.9 also shows that, Construction Production does not affect GDP with one and two period lag because their probability values are insignificant. However, it can be stated that, Construction Production is long term causer of GDP. Furthermore, R-square of the model is approximately 56% which is not bad and probability f-statistics of the model is significant which is desirable.

After the construction of the model, there is also a need to investigate whether the model is well-behaved or not. Table 5.10 shows the results of diagnostic tests. According to results, the null hypothesizes which states that, there is no Heteroscedasticity and Serial Correlation, are accepted. Also the null hypothesis which states that, the errors are normally distributed, is

accepted. Finally, it can be said that, the model is well behaved and one make an interpretation on it.

Table 5.10: Diagnostic Tests for VEC Model which Dependent Variable is LGDP

Test	Probability Value
Heteroscedasticity Test (Breusch-Pagan-Godfrey)	0.9851
Histogram – Normality Test (Jarque-Bera)	0.671952
Serial Correlation LM Test	0.4553

Note: If the probability value is more than 5% that means null hypothesis must be accepted or vice versa.

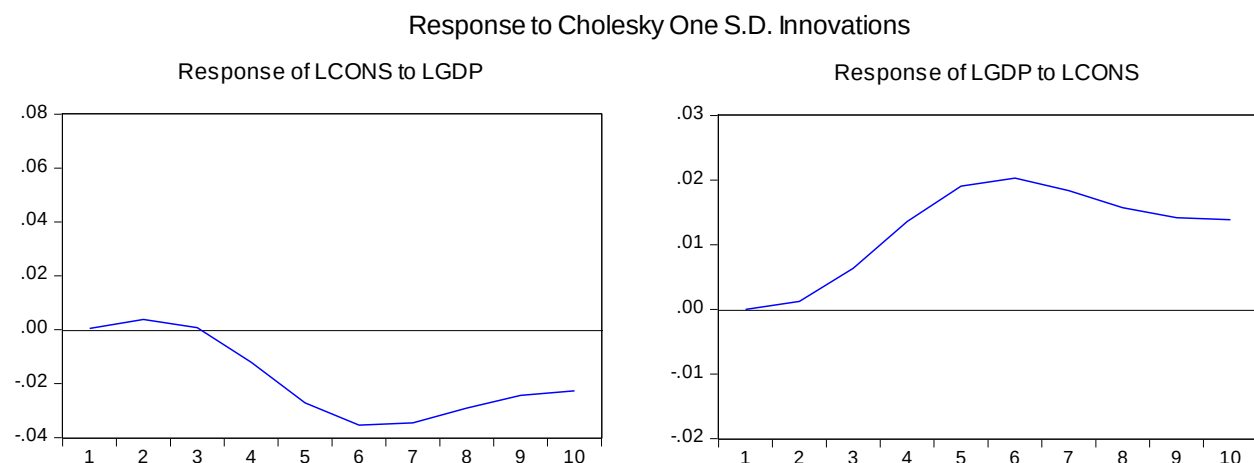
5.4 Estimation

Previously, it is stated that, there is bi-directional long run causality between Construction Production and GDP. However in short run, only GDP Granger causes Construction Production, but not vice versa. In this section, it is analyzed that, how one variable will respond to shock/innovation in another variable by using VECM Impulse-Response Functions (IRFs). Therefore, with this dynamic analyzes, estimation is made. Furthermore, IRFs can also show the sign of short run and long run relationship between variables. What's more, the role of construction sector in GDP which is the main aim of this thesis, can be seen by the help of IRFs.

Figure 5.1 shows that, Construction Production affects GDP positively both in short-run¹⁷ and long-run¹⁸ (See Figure 5.1, Response of LGDP to LCONS). But previously, it is found that, there is no short run causality running from Construction Production to GDP that's why, by the help of the figure one can only comment that Construction Production affects GDP positively in long run.

Figure 5.1 also shows that, GDP affects Construction Production positively in short run but negatively in long run (See Figure 5.1, Response of LCONS to LGDP).

Figure 5.1: Impulse Response Functions (IRFs)



Source: Authors' Calculation

¹⁷ In short run analysis, period 3 is taken as a base.

¹⁸ In long run analysis, period 10 is taken as a base.

5.5 Conclusions and Recommendations

According to Causality results, there is bi-directional long run causality between Construction Production and GDP but there is unidirectional short run causality which runs GDP to Construction Production.

Furthermore, IRFs (Response of LGDP to LCONS) show that the Construction Production affects GDP positively in long run. The reason for this may be that the Construction Sector needs some time to make profit because there is production process and sector uses many inputs to make an output. However, according to results, a government strategy based on increasing construction production to promote short run economic growth is not meaningful because in short run Construction Production does not Granger cause GDP. There is positively related long run causality running from Construction Production to GDP but there may be some saturation point because construction production mainly based on needs and requirements.

On the other side, according to IRFs (Response of LCONS to LGDP), GDP affects Construction Production positively in short run but negatively in long run and there may be many reasons for this. Firstly, it may be because the construction production might reach saturation point after a period of time.

Secondly, if GDP increases permanently in long run, other investment instruments like technological and other financial investments may take the share of Construction Sector.

Lastly, this situation is parallel to one of the pioneer studies in the literature, written by Bon (1992). In that study, it is found that the share of construction sector in GNP increase with GNP per capita in less developed countries and newly industrialized countries but after the level of newly industrialized country status and the road to reach advanced industrialized country status, share of construction sector in GNP decreases when GNP per capita increases (See Figure 5.2).

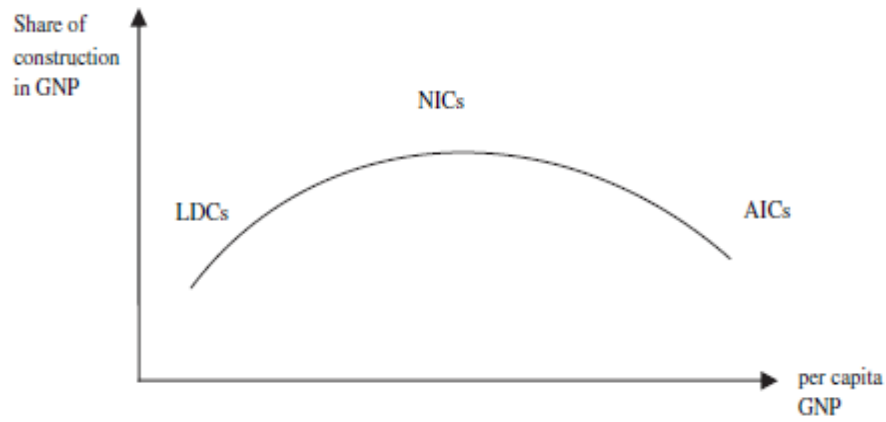
This situation may also be valid for Turkish economy. In other words, Turkish economy may be in a transition point between newly industrialized countries and advanced industrialized countries. That's why, according to IRFs result, if GDP increases permanently in long run, an increase in GDP may cause decrease in Construction Production. Figure 5.3 shows the trend of the index and logarithmic version of GDP. And according to the figure, it can be stated that GDP is in an increasing trend. This result is consistent with the conclusion stating; IRFs result indicates that an increase in GDP will decrease the Construction Production if this trend continues in the same way in long run.

Consequently, it can be concluded that the Construction Production affects GDP positively in long run. However, an increasing trend in Construction Production (See Figure 5.4) seems not to be permanent as GDP continuing to increase in long run. From a different point of view, after some saturation point, the Construction Production cannot be sufficient alone for contributing to economic growth which means that economy needs other investments like technological investments to reach advanced industrialized country status.

Furthermore, by looking at Figure 5.4, it can be stated that the Construction Sector is highly affected by economic condition because the production of sector decreases sharply in crises (2008 Global Financial Crises, See Figure 5.4). Therefore, economic growth strategy mainly based on the growth of Construction Sector is a little bit controversial issue.

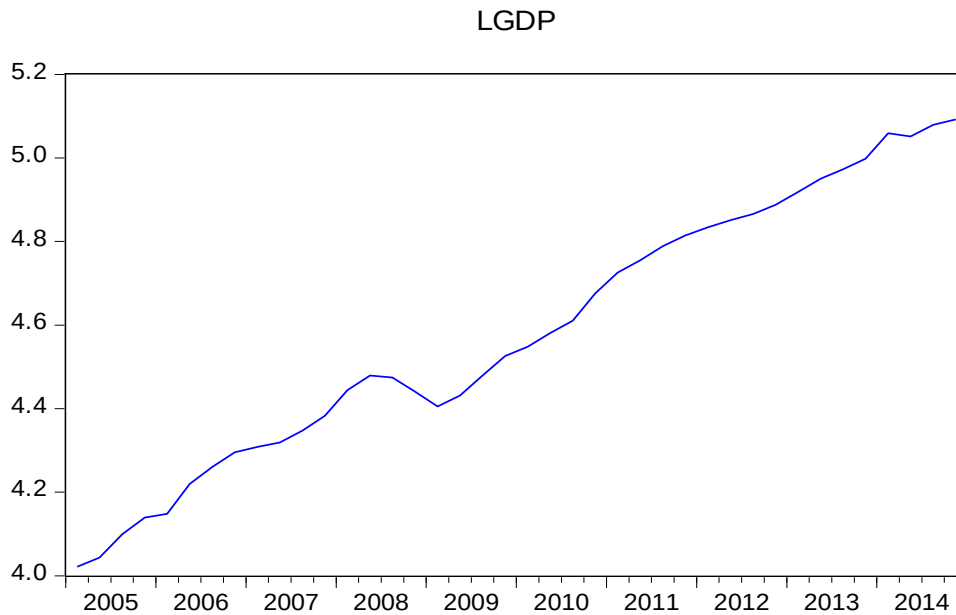
Finally, it is better to state that VECM automatically takes the difference of the variables and the natural logarithm version of the variables is used. Therefore, the comments that were made above are related to the growth rates of variables.

Figure 5.2: Share of Construction Sector in GNP and Per Capita GNP¹⁹



Source: Bon (1992)

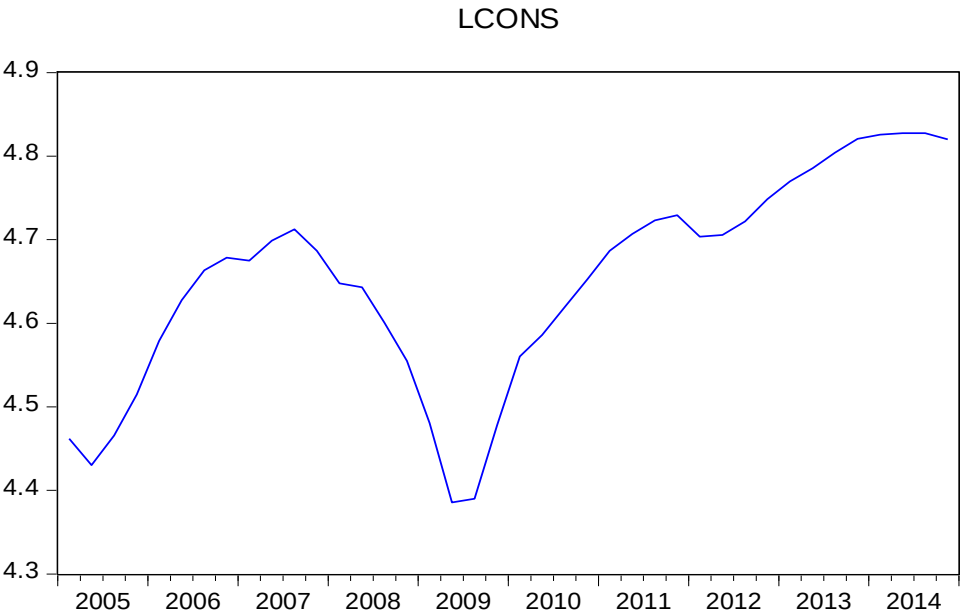
Figure 5.3: Natural Logarithm of GDP Index (LGDP)



Source: Authors' calculation based on the data from TURKSTAT (Turkish Statistical Institute)

¹⁹ LDCs: Less Developed Countries
 NICs: Newly Industrialized Countries
 AICs: Advanced Industrialized Countries

Figure 5.4: Natural Logarithm of Construction Production Index (LCONS)



Source: Authors' calculation based on the data from TURKSTAT (Turkish Statistical Institute)

6. CONCLUSION

This thesis reaches the conclusion that the construction sector is very significant for Turkish economy especially when its contribution to employment is taken into consideration.

Two empirical works were made in order to determine the role of construction sector. And according to these works, some results emerged. Firstly, it is stated that a change in construction investments (private sector) caused a change in interest rates (real interest rates of residential loans) both in short run and long run but not vice versa. Therefore, changing the level of interest rate in order to increase/decrease the level of construction investments is not a good idea. Rather, a change in construction investments causes a change in level of interest rate in negative direction. The reason for this may be as follows; because construction investments are generally based on needs and requirements, recently there may be an increasing demand for construction activities. And banks may have noticed that they decrease the level of interest rates in order to encourage people to use residential loans because they are long term profitable loans for banks.

Secondly, after reaching the conclusion that a change in construction investments causes a change in the level of interest rates, it is needed to look whether it also causes a change in GDP. According to this empirical work, an increase in Construction Production causes an increase in GDP in long run. At first glance, by considering this result, one may think that an economic growth strategy based on a growth of construction sector is plausible. On the other hand, according to the results, an increase in GDP cause an increase in Construction Production in short run but in long run, its effect becomes reverse, meaning that an increase in GDP causes a decrease in Construction Production in long run. The main reason for this is that an economy may have reached to some saturation point by reaching a higher level of welfare. Therefore, other sectors which are based on technology, machinery, financial instruments etc. may take the share

of construction sector in long run if an increase in level of GDP continues in long run so it can be said that the construction production cannot be sufficient alone to contribute to economic growth after some saturation point. On the other side, a government strategy which is based on growth of the construction sector in order to promote an increase in short run economic growth is also not logical because, according to the results, it is stated that a change in Construction Production does not cause decrease/increase in GDP in short run. The reason for this may be that the construction sector is based on long term investments.

Moreover, Construction Sector is highly affected by the economic condition of the country. Therefore, a potential crisis or economic downturn causes a very significant decrease in volume of construction sector immediately that's why making the growth of construction sector the key element of economic growth is a dangerous strategy.

On the other side, the construction sector is related to many subsectors. That's why the stability of the sector is very significant. Consequently, if the sector is not overburdened in the case of the role in economic growth, its contribution is very important for Turkish economy.

Lastly, it is better to mention that the result of the empirical analyzes supports some studies like; Hongyu et al. (2002), Alhowaish (2013), Ozkan et al. (2012) and Tiwari (2011) because they also find a cointegrated relationship and bidirectional long run causality between construction activities and economic growth in their analyzes although they use different variables as components of construction sector. For instance, Hongyu et al (2002) find bidirectional long run causality between GDP and Housing Investments for the case of China. Alhowaish (2013) also finds bidirectional long run causality between economic growth and construction industry for Saudi Arabia. Ozkan et al. (2012) find bidirectional long run causality between public sector construction investments and GDP for Turkey. And lastly, Tiwari (2011) finds bidirectional long run relationship between construction flows and GDP for the case of India.

However, the empirical analyzes of this thesis include limited time period because of the lack of available data related to the construction sector (See Appendix A1 for all data that is used in analyzes). Furthermore, there is no updated input-output table²⁰ to investigate intersectoral relationships. Therefore, the results of this study are not conclusive but informative.

²⁰ Last official input-output table which was announced by TURKSTAT, is based on the data of 2002.

APPENDIX A

A1. Data Used in Empirical Analyzes

DATE	LPRCONS	LRIRATE	LGDP	LCONS
2005Q1	14.24368	0.207639	4.021715	4.461681
2005Q2	14.26809	-0.03196	4.043169	4.430063
2005Q3	14.32176	-0.02285	4.098781	4.465591
2005Q4	14.36169	-0.0376	4.139329	4.51483
2006Q1	14.39987	-0.28464	4.148184	4.578955
2006Q2	14.47224	-0.62196	4.219374	4.627573
2006Q3	14.52667	-0.0984	4.260431	4.663461
2006Q4	14.535	0.037775	4.295135	4.678518
2007Q1	14.53715	-0.12721	4.308216	4.674779
2007Q2	14.54089	-0.1423	4.318963	4.698746
2007Q3	14.54678	0.227991	4.347525	4.712337
2007Q4	14.55545	-0.04601	4.382748	4.686839
2008Q1	14.46841	-0.21743	4.444359	4.647774
2008Q2	14.44816	-0.43362	4.479369	4.643005
2008Q3	14.41338	-0.56291	4.474601	4.600776
2008Q4	14.315	-0.14275	4.440846	4.554976
2009Q1	14.2162	0.082455	4.405097	4.480308
2009Q2	14.14259	0.503173	4.431435	4.385629
2009Q3	14.11881	0.391309	4.479009	4.389971
2009Q4	14.18454	-0.01044	4.525684	4.478195
2010Q1	14.26464	-1.34836	4.547984	4.560132
2010Q2	14.3198	-1.52753	4.580659	4.58597
2010Q3	14.35235	-1.35496	4.610466	4.619385
2010Q4	14.37611	-1.20333	4.675906	4.65232

2011Q1	14.46047	-0.01712	4.72584	4.686796
2011Q2	14.49537	-0.42446	4.755313	4.706967
2011Q3	14.47504	-0.20067	4.788729	4.723235
2011Q4	14.5018	-0.80891	4.814113	4.729307
2012Q1	14.49791	-1.22497	4.834047	4.703709
2012Q2	14.47225	-1.13343	4.85114	4.705773
2012Q3	14.46427	-1.15976	4.865661	4.721935
2012Q4	14.49438	-0.67637	4.887772	4.748633
2013Q1	14.44956	-1.26213	4.918095	4.769913
2013Q2	14.47974	-1.52793	4.950323	4.785559
2013Q3	14.49878	-1.83025	4.972562	4.80401
2013Q4	14.47336	-0.96404	4.997996	4.820749
2014Q1	14.55776	-0.69409	5.058952	4.825758
2014Q2	14.58923	-1.08356	5.051317	4.827405
2014Q3	14.59277	-1.68688	5.07918	4.827513
2014Q4	14.52051	-1.52615	5.092015	4.820074

APPENDIX B

B1. Share of Residential Loans in Consumer Loans (The Amount that is Used, Million TL)

Year	Vehicle Loans	Residential Loans	Personal Loans	Others	Total	Share of Residential Loans
2005	6 836	12 967	15 233	4 348	39 384	33%
2006	5 373	15 604	19 975	652	41 604	37%
2007	5 178	15 535	27 538	1 603	49 853	31%
2008	5 029	15 360	31 938	2 919	55 246	28%
2009	4 863	21 222	39 921	122	66 129	32%
2010	7 780	31 821	60 532	2 885	103 019	31%
2011	8 036	29 756	69 404	5 631	112 827	26%
2012	7 376	28 469	65 359	10 475	111 678	25%
2013	11 135	50 400	97 841	22 384	181 759	28%
2014	7 699	36 524	83 360	23 623	151 206	24%

Source: The Banks Association of Turkey

B2. Trend of Nominal Interest Rates of Residential Loans



Source: Authors' calculation based on the data from CBRT

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