CONSTRUCTION INDUSTRY IN TURKEY: AN INPUT-OUTPUT ANALYSIS USING THE WORLD INPUT-OUTPUT DATABASE (WIOD) FOR THE 2002-2011 PERIODS*

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Abstract: The construction industry is considered to be one of the main drivers of the overall economy due to its strong inter-industrial linkages. Its backward and forward linkages are ranked to be among the first four out of twenty industries. In many of the developing countries, the growth of the construction industry is used as an instrument to accelerate the overall growth in the economy. Turkish economy witnessed the growth of construction industry as well after 1980s. Two main growth periods, notably 1982-1988 and 2002-2008, in construction industry have been observed since 1980. Between 2002 and 2012, on the average the growth rate of construction industry was about 11.1 percent per year, except for 2008 and 2009, which is almost twice as much of the growth rate of national economy. In this study, the input-output tables constructed by the WIOD Project from 2002 to 2011 are employed and backward-forward linkages and several multipliers are also calculated by using 10 input-output tables. It is aimed to discuss whether the construction industry can be considered as the driver of the economy.

Keywords: Construction industry, input-output analysis, backward-forward linkages, multipliers, Turkey.

TÜRKİYE'DE İNŞAAT SEKTÖRÜ: 2002-2011 DÖNEMİ İÇİN DÜNYA GİRDİ-ÇIKTI VERİ TABANI (DGÇV) İLE BİR GİRDİ-ÇIKTI ANALİZİ

Öz: İnşaat sektörü, sektörler arası güçlü bağlantıları nedeniyle ekonominin sürükleyici sektörlerinden biri olarak kabul edilmektedir. Geri ve ileri bağlantıları açısından bakıldığında, inşaat sektörü, dünya genelinde ortalama olarak, 20 sektör içinde ilk 4 sektör arasında yer almaktadır. Gelişmekte olan ülkelerin birçoğunda inşaat sektöründeki büyüme, ekonomideki büyümeyi hızlandırmada bir araç olarak kullanılmıştır. Türkiye'de 1980 sonrası dönem inşaat sektörü açısından, ilki 1982-1988 ve diğeri de 2002-2008 olmak üzere iki temel büyüme dönemine tanıklık etmiştir. 2002-2012 yılları arasında inşaat sektörünün yüzde 11,1 ile yıllık ortalama büyüme hızı, 2008 ve 2009 yılları hariç, ulusal ekonominin yıllık büyüme hızının yaklaşık iki katı düzeyinde seyretmiştir. Bu çalışmada Dünya Girdi-Çıktı Veri tabanı (DGÇV) projesinden alınan 2002-2011 yılları arası girdi-çıktı tabloları kullanılmıştır. 10 tane girdi-çıktı tablosundan ileri ve geri bağlantılar ile çeşitli çarpanlar hesaplanmıştır. Çalışmanın amacı, mevcut veriler ışığında, inşaat sektörünün ekonominin sürükleyici bir sektörü olarak görülebilme ihtimalini tartışmaktır.

Anahtar Kelimeler: İnşaat sektörü, girdi-çıktı analizi, geri-ileri bağlantılar, çarpanlar, Türkiye.

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I. Introduction

Construction industry is considered to be one of the main sectors to contribute economic development especially for developing countries in terms of providing infrastructure and housing investments. Studies on the construction industry and its relation to economic development were specifically introduced with the works of Duccio Turin (1969) and Paul Strassmann (1970: 391-409) in the late 1960s and 1970s. They found that there is a strong relationship between the per capita Construction Value Added (CVA) and per capita Gross Domestic Product (GDP). The share of CVA in GDP increases as per capita GDP increases (Lewis, 2009: 37; Giang and Pheng, 2011: 119). Besides, Strassmann (1970: 395) pointed out that construction had overtaken manufacturing as a driving force for economic growth in countries that had begun the process of economic development (Lewis, 2009: 38).

The theoretical explanation about the relationship between growth of construction industry and economic development stages is known as the "Bon Curve" which is exposed by Ranko Bon. Bon (1992: 119-128) investigated the role of construction industry at different stages of economic development and presented a development pattern for the industry, based on the stage of development of a country's economy (Ruddock and Lopes, 2006: 717). According to the Bon's analysis, in the early stages of economic development the share of construction in the economy increases but ultimately decreases when the economy reaches a certain higher level that is represented by the industrially advanced countries. Tan (2002: 593-599) explains this phenomenon depicted as the inverted-U shape as follows: "In low income countries (L), construction output is low. As industrialization proceeds, factories, offices, infrastructure and houses are required, and construction output as a percentage of gross domestic product (GDP) reaches a peak in middle-income countries (M). It then tapers off in high income countries (H) as the infrastructure becomes more developed and housing shortages are less severe or are eliminated." More recent studies have verified this phenomenon that is summarized as declining the construction share of GDP after a certain level of economic development (Lewis, 2009: 39). Another important point is the share of construction industry in the total investment within the context of national accounts. Lewis (2009: 47) reported that construction sector historically had accounted for around 50 percent of a country's Gross Fixed Capital Formation (GFCF). Nowadays these figures are around 26 and 23 percent for the developed and developing countries respectively.

In this paper, it is aimed to explore the structure of construction industry in the input-output framework and to reveal the changing trends in construction sector based on inter-industrial linkages for the post 2002 period. For this purpose, the input-output tables constructed in the WIOD Project are employed from 2002 to 2011 for Turkey. For this period, backward and forward linkages on the one hand and on the other hand input, output, income, employment and

type II multipliers are calculated by using 10 input-output tables. The motivation of this analysis is to understand whether construction industry can be considered as the main driver industry to solve the structural problems of Turkish economy.

The paper is designed as follows. First of all, some basic observations within the construction industry over the last 10 years are summarized. Thereafter literature review is presented. Literature review is especially devoted to the studies using Input-Output (IO) framework to analyze construction industry. In the following section, data and methodology are introduced. In this part, it will be focused on the data which is used and how to operationalize data to calculate backward and forward linkages and multipliers mentioned above. Lastly, empirical findings are analyzed and discussed to conclude about the place of construction industry in the overall economy.

II. Construction Industry in Turkey

Turkish economy witnessed the growth of construction industry after the neoliberal transformation in 1980s. When the development of construction industry is considered after the period of 1980, there have been two growth periods one of which is in 1980s and the other is in 2000s. In the first growth period of 1982-1988, the share of construction investment in GDP rose up to 7.3 percent in 1987 from 5.2 percent in 1982. The share of CVA in GDP peaked in 1987. The second growth period began in 2002 and continued until 2008. The growth process was interrupted by the global economic crisis in 2008 and 2009, but growth inclination in construction industry in Turkey maintained its position in the economy (Balaban, 2011: 21-22).

Between 2002 and 2012, on the average the growth rate of construction industry was about 11.1 percent per year, except for 2008 and 2009, which is almost twice as much of the growth rate of national economy. Figure 1 shows the annual growth rate of value added, investment in construction industry and GDP.

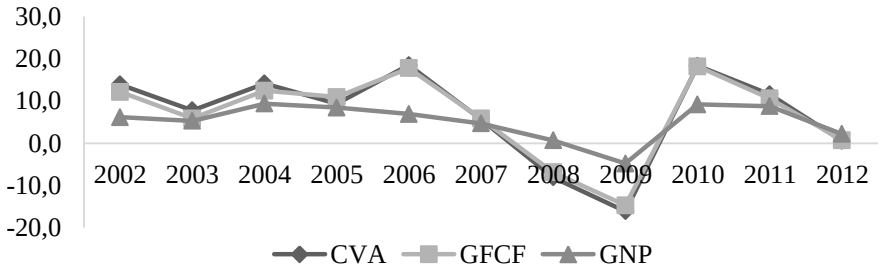

Figure 1. Growth rate of CVA, Construction GFCF and GDP
(Source: Turkish Statistical Institute (TSI))

According to Figure 1, growth paths of CVA and GFCF of construction industry are quite similar. Another observation is that except for 2005-2006 there has been a very similar trend between the growth rates of construction industry (CVA) and overall economy (The ups and downs in the construction growth seem to be sharper compared to overall growth, which is expected as the overall growth might be smoothened by some industries). This indicates that there is a fairly direct relationship between the level of activity in construction industry and the economy as a whole but we cannot tell the direction of causality relationship. Important question: which is the driver and which is the follower?

In order to determine the direction of causality, the cumulative experience function can be used to provide non-parametric evidence on the direction of causality between two variables (Lewis, 2009: 53-54).

$$Cum\ \exp x = \sum_{i=t_0}^{t} x_t \Big/ \sum_{i=t_0}^{t_1} x_t \qquad \textbf{(1)}$$

Equation 1 gives the formal illustration of a cumulative experience (cumexp) function for a variable *x*, where t_0 and t_1 are the initial and end years of the data period and *t* is the current time period. Figure 2 corresponds the illustration of cumexp functions of CVA and GDP at fixed prices.

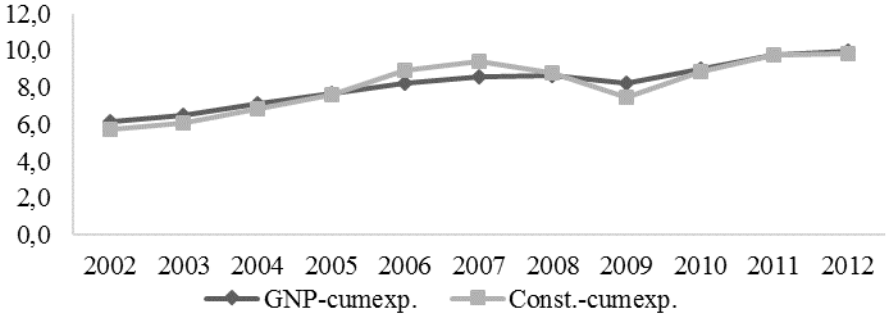

Figure 2. A Cumulative Experience Function

(Source: Adapted from Lewis (2009) and calculated using TSI data)

Three phases can be underlined in this period. From 2002 to 2005 and 2008-2010 period, the value added of the construction industry was led by that of the overall macro economy. On the other hand, the construction industry drove the whole economy between 2005 and 2008. After the year 2010 construction sector and economy moved together.

The other important dimension of construction industry is the place of construction in the investment capacity of an economy. The share of construction's GFCF in total investment in Turkish economy is 43 per cent on average. This is absolutely an important figure considering the importance of the investment capacity of construction industry and to comprehend the capital accumulation strategy of Turkey based on construction industry for the last decade. Fig. 3 shows the relationship between the growth of construction

investment and GDP by using the disaggregated graphs of the total investment in construction industry with respect to the sources as public and private sectors (The separation of GFCF in construction industry as public and private can help to understand which one is more dominant for capital accumulation and growth rate of the economy) and also providing the GDP.

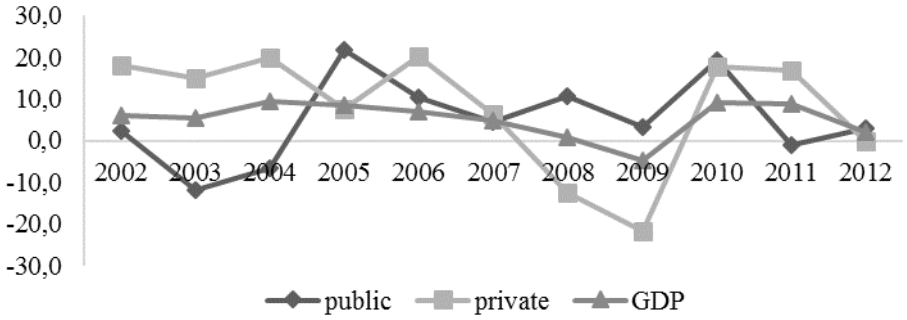

Figure 3. The growth of public-private investments in construction industry and GDP
(Source: TSI)

There has been a more one-to-one relationship between growth of private investment in construction and GDP but public investment expenditures in construction sector in some years falls apart from the main trend (between 2004-05; 2007-08; 2010-12). It might be said that in these years public investment expenditures in construction industry are used as an instrument to trigger the economic growth but probably private investment expenditures are triggered by the overall growth.

Until the 2008 global crisis, construction employment share in total employment has been below the share of CVA in GDP. After the recovery, while CVA has been going down, employment in construction industry hold its position. This might be interpreted that the elasticity of employment according to production is low (Şenesen, etc., 2013: 28).

Governments support the growth of construction industry both by directly investing and implementing policies for the development of infrastructure using legal arrangements for the both growth periods of construction industry in Turkey (Penpecioğlu, 2011: 66-68). Especially for the 2002-2012 period, it can be obviously stated that basic capital accumulation strategy of the state was based on the growth of construction industry in Turkey.

III. Literature Review

There has been a vast amount of literature concerning the construction industry and its relation to the economy as a whole from both the narrow aspect which focuses only on construction industry and economic growth, and from the broader perspective relevant to investigation of construction industry within the development context (Giang and Pheng, 2011: 119). Besides, the studies on

IO analyses of construction industry take up considerably and could not be underestimated in the literature.

In this section, after mentioning various descriptive studies based on the observations of macroeconomic and sectoral indicators briefly, we will especially pay attention to IO analysis of the construction industry in the world. Covering 7 developed and 18 developing countries (*Developed Countries*: UK, Japan, France, Germany, Canada, USA, Norway; *Developing Countries*: Afghanistan, India, Kenya, Pakistan, Sri Lanka, Philippines, Nigeria, Thailand, Colombia, Ecuador, Paraguay, Mexico, Greece, Guyana, Jamaica, Trinidad and Tobago, Turkey, Czech Republic) and using the construction output, GDP and GFCF of construction industry data based on the United Nations Statistics Division for the period of 1970-2006, Lewis (2009: 55) revealed that as an economy develops, construction industry loses its importance in the economy. In the early stages of development, construction can be responsible for a large part of all economic activity, and can play a significant role in modernization.

Another comprehensive study is about the investment in construction and economic growth by Lopes (2009: 94-112). The indicator used as a proxy for construction investment is CVA and the main indicator of economic activity is GDP. Three main indicators ranking as GDP, GFCF and CVA are used in this analysis and data are adapted from United Nations Yearbook of National Accounts Statistics and World Bank. Data comprise 93 countries disaggregated into three subgroups as the low, middle and high-income countries. In order to give a general picture of different regions of the world, these three groups were divided into eight additional subgroups according to the World Bank nomenclature of world sub-regions. The analysis suggests that the share of construction in gross output tends to increase with the level of per capita income in the first stages of economic development. With the certain level of economic development, the construction output will grow slower than the GDP. That is, it decreases relatively but not absolutely. It is reasonable to conclude that when the countries enter into a period of sustained economic growth, the construction output tends to grow with the same rate of growth of that of the GDP.

The study of Ruddock and Lopes (2006: 717-723) which used the dataset of gross value added (GVA) in construction and GDP per capita adapted from United Nations to analyze the relationship between a country's level of construction activity and its stage of economic development for 75 countries, demonstrates that the inverse U-shaped pattern holds for the share of construction in the national economy. That is, the share of construction in total output first rises up and then decreases with economic development.

IO analysis reveals the interconnections of the industries in an economy and provides useful insights as to whether this sector is a driving force of economic growth in both developed and developing countries. Construction can be divided into subsectors as "new construction" and "maintenance and repair (M&R)" (New construction includes private and public new buildings addition and alterations

that increase the stock of constructed facilities. Maintenance and Repair (M&R) comprises restoration and upkeeping expenses of existing capital stock performed also on own account) (Gregori, 2009: 72). In the literature, construction industry is considered to be one of the main drivers of the overall economy due to its strong inter-industrial linkages. In general, its backward and forward linkages are ranked to be among the first four out of twenty industries (Balaban, 2011: 19; Giang and Pheng, 2011: 119-120). In the demand side, the construction activity induces growth through the use of large amounts of intermediate inputs from other industries while on the supply side it provides basic infrastructure that is required for production of any goods and services. On the other hand, the construction industry also has a significant impact on level of employment, particularly unskilled labor force, as it is a highly labor-intensive industry.

In general, IO analyses of the construction industry point out that the indicators of forward linkages are relatively less extensive than backward linkages (Bon and Pietroforte, 1990: 240; Giang and Pheng, 2011: 121-122). But when focusing on developed countries, the pull effects of the sector as revealed by backward linkage indicators such as output multiplier seem relatively weak by comparison with the push effects represented by forward linkage indicators in the economy (Pietroforte and Gregori, 2003: 323-325). Many studies on the IO analyses of construction industry in developing countries emphasize those backward linkage indicators that can be summarized as the pull effects of this industry become more significant than push effects of that (Bon, et.al. 1999:544; Wu and Zhang, 2005: 907-910; Kofoworola and Gheewala, 2008: 1234-1236).

In Turkey, the studies using IO tables to analyze construction industry has been limited because of the backdated IO tables used until recently. (Turkish Statistics Institute (TSI) published the last IO table for 2002 in 2008) Nevertheless a number of studies revealed that the industry had strong backward linkages with the rest of the economy, but forward linkages were weak and so far unpromising. From the theoretical explanation of the sectoral importance of an industry, if any sector can be considered as a driving force of an economy, it should have strong linkages in both backward and forward directions. In this case, according to the studies, construction industry cannot be termed as dynamic leading industry in the economy (Bon, et.al. 1999: 545-547; Türkiye Kalkınma Bankası, 2008: 7-8; Gündeş, 2011: 67). Looking from the bright side of the industry, about 93 percent of the production of construction industry is produced by domestic input. At the same time, there is no capital outflow to the rest of the world via the profit transfer in the construction industry (Türkiye Kalkınma Bankası, 2008: 11-12). These two observations point out that the construction industry might relieve the burden of current account deficit to the economy.

IV. Data and Methodology

Two shortcomings can be articulated with regard to existing input-output tables in Turkey. First of all the industrial classification in various I-O tables is not homogenous. Secondly the last one belongs to year 2002 which is quite backdated. (Officially, there are six input-output tables (1973, 1979, 1985, 1990, 1998 and 2002) published by the Turkish Statistics Institute (TSI) and the important part of them were compiled and calculated in different methods) For this reason, rather than using the latest I-O table developed by the Turkish Statistics Institute in 2002, the analyses in this study are carried out by employing the period 2002-2011 input-output matrices of Turkey which are prepared and organized by the World Input-Output Database (WIOD) (The World Input-Output Database has been developed to analyse the effects of globalization n trade patterns, environmental pressures and socio-economic development across a wide set of countries. The database covers 27 European Union (EU) countries and 13 other major countries in the world from 1995 to 2011. For more detailed information, look at Timmer (ed.) (2012)). In the original I-Os there are 35 industries and in this research, those are aggregated into 18 industries. The organization of industries used for input-output tables can be seen the table below.

Table 1: Industrial Concordance Table

1	Agriculture, Hunting, Forestry and Fishing	1	1	Agriculture, Hunting, Forestry and Fishing
2	Mining and Quarrying	2	2	Mining and Quarrying
3	Food, Beverages and Tobacco	3+4+5+6+7+16	3	Manufacturing
4	Textiles and Textile Products	8+17	4	Energy supply/distribution
5	Leather, Leather and Footwear	9	5	Chemicals and Chemical Products
6	Wood and Products of Wood and Cork	10	6	Rubber and Plastics
7	Pulp, Paper, Paper , Printing and Publishing	11	7	Other Non-Metallic Mineral
8	Coke, Refined Petroleum and Nuclear Fuel	12	8	Basic Metals and Fabricated Metal
9	Chemicals and Chemical Products	13+14+15	9	All sorts of machinery
10	Rubber and Plastics	18	10	Construction
11	Other Non-Metallic Mineral	19+20+21+22	11	Trade
12	Basic Metals and Fabricated Metal	23	12	Inland transport
13	Machinery, Nec	24+25+26	13	Other transport
14	Electrical and Optical Equipment	28	14	Financial Intermediation
15	Transport Equipment	29	15	Real Estate Activities
16	Manufacturing, Nec; Recycling	30	16	Renting of M&Eq and Other Business Activities
17	Electricity, Gas and Water Supply	31	17	Public Admin and Defence; Compulsory Social Security
18	Construction	32+33+34+35+27	18	Other services
19	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel			
20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles			
21	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods			
22	Hotels and Restaurants			
23	Inland Transport			
24	Water Transport			
25	Air Transport			
26	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies			
27	Post and Telecommunications			
28	Financial Intermediation			
29	Real Estate Activities			
30	Renting of M&Eq and Other Business Activities			
31	Public Admin and Defence; Compulsory Social Security			
32	Education			
33	Health and Social Work			
34	Other Community, Social and Personal Services			
35	Private Households with Employed Persons			

Backward and forward linkage coefficients, simple input and output multipliers, then truncated output, employment, income, and type II multipliers-for both employment and income-are calculated. Truncated multipliers are based on total multipliers which use the input coefficients matrix closed with respect to households, but they consider only original n sectors by excluding added household sector. One of the reasons why the truncated multipliers are at the core of the analysis is that truncated multipliers give additional induced effects of household income generation through payments for labor services and associated consumer expenditures on goods produced by the various sectors. Whilst simple multipliers generally underestimate economic impacts of final demand increments, total multipliers overestimate. Truncated multipliers stand between these two multipliers and can give moderate estimations.

The backward and forward linkage coefficients (Backward linkage reveals dependency of a sector on inter-industry inputs. Forward linkage denotes other industry's dependency on a sector's output. Backward linkage indicators are essentially the column sums of input coefficient matrix, known as A. Forward linkage indicators are also calculated as the row sums of output coefficient matrix, known as B) are calculated as in equations in order of (2) and (3). $\boldsymbol{BL_C}$ and $\boldsymbol{BL_C^N}$ represents backward and normalized backward linkage coefficients for construction industry respectively. *N* stands for normalized and is calculated by dividing BL_C to industrial average *BL*. In a similar way in equation (3), forward (FL_C) and normalized forward linkage ($FL^N{}_C$) coefficients for construction industry is calculated.

$$BL^N{}_C = \frac{BL_C}{(1/n)\sum_{i=1}^{n} a_{ij} \sum_{j=1}^{n} a_{ij}} \quad \textbf{(2)}$$

$$FL^N{}_C = \frac{FL_C}{(1/n)\sum_{i=1}^{n} b_{ij} \sum_{j=1}^{n} b_{ij}} \quad \textbf{(3)}$$

The multipliers calculated in this study are given briefly as the table as follows.

Table 2: Multipliers

Multipliers	Demand-driven	Supply-driven
Simple	Output: $\boldsymbol{m(o)_j = \sum_{i=1}^{n} l_{ij}}$	Input: $\boldsymbol{m(inp)_i = \sum_{j=1}^{n} g_{ij}}$
Truncated	*i)* Output: $\boldsymbol{\overline{m}[o(t)]_j = \sum_{i=1}^{n} \bar{l}_{ij}}$ *ii)* Employment/Income: $\boldsymbol{\overline{m}[h(t)]_j = \sum_{i=1}^{n} a_{n+1,i} \bar{l}_{ij}}$ *iii)* Type II: $\boldsymbol{m[h(t)]^{II}{}_j = \frac{\overline{m}[h(t)]_j}{a_{n+1,j}}}$	

Source: Miller and Blair, 2009:245-259

Simple multipliers (Simple multipliers are only calculated for making a comparison between output and input multipliers. The principal multipliers for the analyses are truncated multipliers.) are obtained from Leontief and Ghoshian inverse matrices as output and input multipliers respectively. The output multiplier of sector *j* is the sum of the column *j* of the Leontief inverse matrix which indicates the total value of production in all sectors of the economy that is necessary in order to satisfy a monetary units' worth of final demand for sector *j*'s output (Miller and Blair, 2009: 245). The following equation is the general form of output multipliers:

$$\boldsymbol{x = L.f} \tag{4}$$

where *L* is the Leontief inverse matrix which is equal to $\boldsymbol{(I - A)^{-1}}$ and f is the vector of final demand. Similarly, input multipliers can be expressed as:

$$\boldsymbol{x = G.v} \tag{5}$$

where *G* is the Ghoshian inverse matrix which is equal to $\boldsymbol{(I - B)^{-1}}$ and *v* is the vector of value added. The row sum of the Ghoshian inverse matrix for sector j is defined as the input multiplier of sector j represents the effect on total output throughout all sectors of the economy that would be associated with one monetary unit change in primary inputs for sector j.

Truncated output multipliers are the column sums of augmented Leontief inverse calculated from input coefficients matrix which is closed with respect to household but considers only original n sectors. Truncated employment and income multipliers are also calculated in a similar way. For employment and income multipliers, physical employment coefficients (Physical/person per unit of output) and labor compensation coefficients (Wages earned per unit of output) are multiplied with augmented Leontief inverse respectively. Type II employment and income multipliers are also calculated by dividing total multipliers-based on original n sector- by employment and labor compensation coefficients respectively. Generally, both type I and II multipliers are designated to specify the total employment or income for all sectors of the economy that is necessary in order to satisfy a physical or monetary unit worth of employment or income for one sector. The difference between type I and type II is that type II multiplier uses the total multipliers closed with respect to labor compensation raw and household consumption column.

See the table 2 above, $\boldsymbol{l_{ij}}$ and $\boldsymbol{\bar{l}_{ij}}$ are represented by the coefficients of Leontief and augmented Leontief inverse matrices respectively. As mentioned before, augmented Leontief inverse matrix are calculated from the input coefficient matrix closed with respect to household expenditure column and labor compensation raw. But, truncated multipliers only take in consideration the original *n* sector by excluding household sector demonstrated as *n+1*. $\boldsymbol{g_{ij}}$ is the element of Ghoshian inverse matrix obtained from the direct-output coefficient matrix as denoted *B* where the elements of it are calculated as

dividing each row of inter-industry input matrix by the gross output of the sector associated with that row. At last, $a_{n+1,i}$ can be considered as either monetary (wages earned per unit of output) or physical (employment per unit of labor). In this study, both are used to calculate truncated income and employment multipliers respectively.

V. Empirical Findings

The main objective of this study is to understand how valid is the argument of *"construction industry is the main driving force of the economy especially in developing countries"*, as mentioned in the previous sections, in case of Turkish economy. The implicit idea behind this argument is that in developing countries, investment expenditures in construction industry constitute the main demand that triggers the overall growth in the economy. Therefore, construction industry pulls investment expenditures and creates strong backward linkages rather than putting upward pressure on real estate demand and creating forward linkages as it is expected in developed economies. If the above argument is valid for Turkey then construction industry should be considered strategic and crucial in maintain sustained economic growth.

It is started by looking at the backward and forward linkage coefficients of the construction industry. Table 2 depicts the inter-sectorial dependence by classifying backward and forward linkages.

Table 3: Classification of Backward and Forward Linkages

		Forward Linkage	
		Low (<1)	High (>1)
Backward Linkage	Low (<1)	(I) Generally independent	(II) Dependent on inter-industry demand
	High (>1)	(III) Dependent on inter-industry supply	(IV) Generally dependent

Source: Miller and Blair, 2009:560

In general, sectors are classified as four categories to determine interconnection among sectors as (I) generally, independent of other sectors (both linkage measures less than 1), (II) generally dependent on or connected to other sectors (both linkage measures greater than 1), (III) dependent on inter-industry supply (only backward linkage greater than 1) and (IV) dependent on inter-industry demand (only forward linkage greater than 1) (Miller and Blair, 2009:559-560).

Table 4: Dependency Relationship of All Industries

Generally independent	12 (until 2006), 15,17,18
Dependent on inter-industry demand	1,2,4 (until 2008), 11, 12 (after 2006),14,16,
Dependent on inter-industry supply	3,9,10
Generally dependent	4 (after 2008), 5,6,7,8,13

Source: Adapted from Miller and Blair, 2009: 560

Table 4 is generated based on the backward and forward linkages classification shown in table 3. Generally an independent sector means that the capacity of creating inputs for other industries and using intermediate inputs from other industries are relatively low. Similarly in a dependent sector, the exact opposite situation is valid which means that the capacity of creating inputs for other industries and using intermediate inputs from other industries are relatively high. The sector depends on inter-industry demand indicates the push effects that the forward linkages of the industry are relatively high and the capacity of creating inputs for other industries is higher than using intermediate inputs from other industries. The sector's dependency on inter industry supply points out the pull effects that the backward linkages of the industry are relatively high and using intermediate inputs from other industries are higher than the capacity of creating inputs for other industries.

Table 5: Linkages and Multipliers of Construction Industry[*]

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Backward L.	1.131	1.131	1.126	1.124	1.124	1.111	0.999	1.020	1.018	1.004
Forward L.	0.194	0,222	0,147	0,135	0,132	0,148	0,149	0,159	0.143	0.121
Output M.	1.791	1.780	1.737	1.734	1.689	1.684	1.713	1.780	1.767	1.708
Input M.	1.127	1.118	1.092	1.084	1.078	1.087	1.094	1.103	1.092	1.074
Truncated Output M.	2.229	2.199	2.151	2.176	2.095	2.098	2.106	2.193	2.163	2.045
Truncated Employment M.	0.064	0.051	0.033	0.032	0.032	0.027	0.023	0.035	0.033	0.038
Truncated Income M.	0.297	0.288	0.291	0.308	0.287	0.291	0.296	0.307	0.303	0.286
Truncated Type II Employment M.	1.386	1.099	0.726	0.684	0.702	0.584	0.506	0.753	0.711	0.824
Truncated Type II Income M.	2.570	2.491	2.516	2.667	2.487	2.523	2.561	2.661	2.621	2.473

*: L: Linkages, M: Multipliers

Table 5 shows all the calculated indicators in this study. When the table 4 and 5 are considered together, the construction industry-labelled as 10-can be

described as the sector which has relatively strong backward linkages. According to the annual average of 2002-2011 period, the construction industry is ranked the 8th and 17th among the 18 industries in terms of backward and forward linkage indicators respectively. Output and input multipliers are also ranked as the same rows with the backward and forward linkages. Taking into consideration the truncated multipliers, output, employment, income, type II employment and type II income multipliers are ranked 11th, 3th, 12th, 17th and 9th among the 18 industries respectively. Truncated multipliers are interpreted as the total multipliers by adding the household's expenditure and income effects. In this regard, the indirect and induced effects push back the output multiplier to 11th place.

One of the notable information is that the employment creation impact of the construction industry by considering the interpretation of the truncated output multipliers is ranked to be the 3th out of 18 industries which is a considerable indicator of employment stimulation capacity peculiar to the construction industry. On the other side, income creation impact of the construction industry is relatively weak by comparison with the employment impact because of the fact that the income multipliers of the construction industry ranked to be the 12th out of 18 industries.

Type II employment and income multipliers can be defined as the total employment and income in all sectors of the economy that is necessary in order to satisfy one person employment and a monetary unit's worth of income of the construction industry respectively. The relative place of the construction industry in terms of the truncated type II employment multipliers is 17th out of 18 industries. Employment and type II employment multipliers are taken together, the relative places of these multipliers obviously reveal that the employment creation capacity of the construction industry in relation to increase its final demand indisputably preponderate over the other industries. The type II employment multipliers' 17th place among 18 industries means that the other industries' employment creation capacities in order to satisfy one person employment in the construction industry are overwhelmingly weak. This can be interpreted that the employment can be served easily to satisfy the final demand of the construction industry, but no need to create such a big value added by the other sectors to generate employment in the construction industry.

Linkages and multipliers' trends of the construction industry have been shown on figure 4 as follows. The backward linkage indicators and output multipliers seem to be steady between 2002 and 2007. Whilst the backward linkage indicators slightly decrease, the output multipliers increase after 2007. Besides, forward linkage indicators of the construction industry start to increase from 2002 to 2003 and decrease from 2003 to 2004. After 2004 period, they show relative stability for which the values range from 0,147 in 2004 to 0,121 in 2011. Input multipliers of the construction industry also show the stability around 1,100 values during the 2002-2011 periods. Low levels of forward

linkage indicators reveal that the most of the output produced by the construction industry goes to satisfy final' rather than intermediate demands.

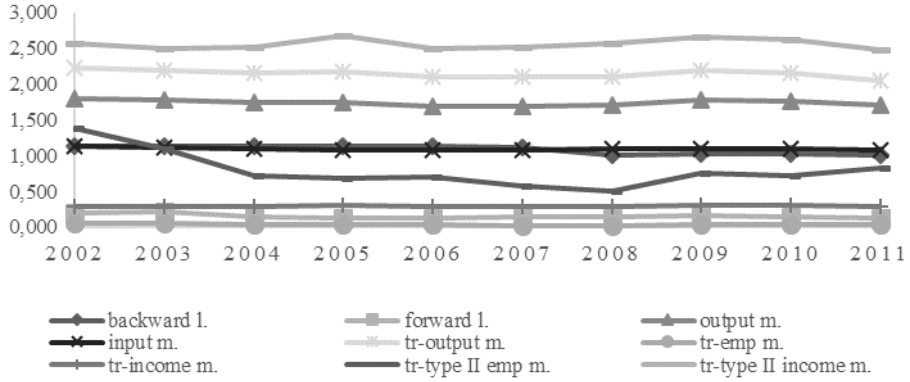

Figure 4. Linkages and Multipliers' trends of the Construction Industry
(l: linkages; m: multipliers)

From the figure 4, truncated income and employment multipliers remain their position steady throughout the period in comparison with the other indicators. In particular, truncated type II income and employment multipliers fluctuate toward upward and downward directions respectively. Truncated type II employment multipliers show a falling tendency until 2008. After this period, they are slightly rising up. When the trends and relative positions of the indicators mentioned in the article are gathered, it can be stated that the employment stimulation effect of the construction industry originated from its own industrial capacity is lower than the employment creation impact of the construction industry originated from its final demand. This indicates that the construction industry is much more depended to its final demand and also sensitive to its final demand changes.

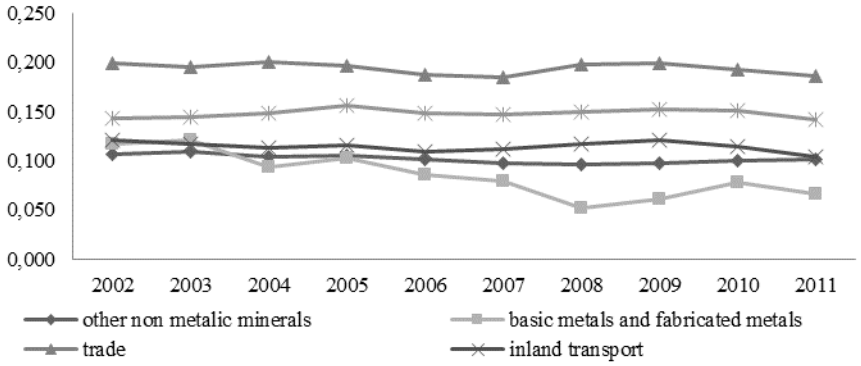

Figure 5. Total multipliers of the industries in connection with the final demand of construction industry

Figure 5 shows the changes in total multipliers of the first five industries which provide inputs most. In the simplest term, these multipliers are the elements of the augmented Leontief inverse matrix in which the industries that provide inputs to the construction industry are on the rows and the construction industry is on the column. Actually the multiplier mentioned in figure 5 is the output of an industry that is necessary in order to satisfy one monetary unit worth of final demand for the construction industry. From this viewpoint, except the basic metals and fabricated metals industry, all the industries can be considered as stable around their own mean values.

According to figure 5, the multipliers represented by the outputs of the basic metals and fabricated metals in response to increase in the final demand of the construction industry show the downward tendency throughout the periods generally. From 2002 to 2008, the figures belong to the mentioned industry gradually decrease. Between 2008 and 2010, they have an upward position then, after 2010 they slightly go down. In other respects, the basic metals and fabricated metals is the most import-dependent industry among the 18 industries in terms of using the imported inputs. The considerable usage of imported inputs in the basic metals and fabricated metals industry may cause the multiplier be underestimated due to the fact that the augmented Leontief inverse matrix only reflects the usage of domestic inputs.

VI. Conclusions

The main point of this study is to reveal whether construction industry in Turkey is the main driver of the overall economy as it is in most of the developing countries. According to some observations between 2002 and 2012, the growth rate of construction industry was about 11.1 per cent per year on average, except for 2008 and 2009, which is almost twice as much of the growth rate of the national economy. Another important observation from the analysis

defined as the cumulative experience function indicates that the national economy drives the construction industry in almost two thirds of the period under review. One of the impressive results from the empirical data in the same period is that the public investment expenditures in construction industry are used as an instrument to trigger the economic growth but the private investment expenditures are triggered by the overall growth of the economy. The input-output analysis also gives some objective insights about the relative place of the construction industry among all industries that cover the economy. The forward linkage coefficients present that the contribution of the construction industry in terms of creating inputs for other industries is quite low while the industry has stronger backward linkages. According to the linkage coefficients and multipliers, employment creation capacity of the construction industry is remarkably high but its income creation impact is highly weak. The findings from the multiplier analysis also underline that the employment stimulation effect of the construction industry overall the economy with respect to its final demand is highly strong but other industries' employment capacity to create the employment in the construction industry is conspicuously low. This point can be attractive for the policy makers in terms of using the construction industry to struggle with the unemployment. As a consequence, the construction industry in Turkey plays a significant role in the economy especially when it is brought into forefront by policies. However, if its comparative position in domestic economy is analyzed and if its role in other developing economies is considered, we may say that the industry's contribution is far from expected.

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