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Peer review process

All papers submitted to COBRA were subjected to a double-blind (peer review) refereeing process. Referees were drawn from an expert panel, representing respected academics from the construction and building research community. The conference organisers wish to extend their appreciation to the following members of the panel for their work, which is invaluable to the success of COBRA.

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Examining economic impact and import dependency of the Turkish construction sector: An input-output analysis, 1998 and 2002

Bahriye Ilhan
Istanbul Technical University
ilhanba@itu.edu.tr

Hakan Yaman
Istanbul Technical University
yamanhak@itu.edu.tr

The aim of this study is to examine the construction sector's impact on the Turkish economy and its import dependency. This paper is an extension of an earlier analysis by using the latest two input-output (IO) tables issued by Turkish Statistical Institute (TurkStat). Due to the incompatibility of the previous tables, the scope of this study is limited to the years 1998 and 2002. The indicators obtained from the analysis are the Gross National Product (GNP) shares of construction, manufacturing and services; the share of construction in National Income (NI); direct and total construction backward and forward linkages and direct and total construction inputs. On the other hand; in order to examine the import dependency, construction share of imported input in GNP production; construction share of importation in total input usage; construction backward and forward linkage indicators in importation and direct imported construction inputs are analysed using IO tables for imports. The results of the analysis are represented by tables and key findings are concluded.

Key words: Backward and forward linkage indicators, input-output analysis, import dependency, Turkish construction sector.

1. Introduction

This paper examines the economic impact and import dependency of the Turkish construction sector via input-output (IO) analysis. The construction sector which is a powerful member of the economic and social environment, takes place an important role within the economy due to its share in Gross National Product (GNP) and National Income (NI), strong linkages with the other sectors and effect on employment and exportation. Construction sector is called as the impulsive, driving, stimulating sector since it activates more than two hundred industry branches affiliated to it. The construction sector as a determinant force on economic and social environment has an important role in national economy apart from the development level of the country (Ilhan and Yaman, 2008). Examining the construction sector in a developing country, therefore, is of the essence due to its place in the national economy. The growth rate of Turkish economy has increased since 2001. However, the statistics also show that the increase in imports has been higher than the increase in exports (Akdemir and Konur, 2010). In this context, it is important to measure the import dependency of the construction sector. Measuring the import dependency is one of the areas that IO analysis is used besides the general usage such as examining the economic structure and determining the relationship among the sectors. The inter-sectoral relation degree shows the import dependency of the sectors. The reason for being dependent

on importation is the low degree of inter-sectoral relation or in other words, low forward and backward linkages of the sectors.

This study aspiring to determine the economic impact and import dependency of the Turkish construction sector, is built on four parts including background, data and methodology, IO analysis and conclusion. In this sense, first, the related studies are presented. Next, the research methodology and data are explained. Then IO analysis is applied in order to obtain the indicators for examining the economic role and import dependency of the Turkish construction sector. The findings and general assessments are represented in the conclusion.

2.   Background

The literature review shows that there are many studies carried out using IO tables for determining the economic role of the construction sector and the relationship between the construction sector and other sectors in the economy. Bon et al. have been examined the construction sector several times (for further details see, Bon and Minami, 1986; Bon and Pietroforte, 1990; Bon and Pietroforte, 1993; Pietroforte and Bon, 1995; Bon et al., 1999; Pietroforte and Bon, 1999; Pietroforte et al., 2000; Wu and Zhang, 2005; Kofoworola and Gheewala, 2008; Ilhan and Yaman, 2008 and Ilhan and Yaman, 2009). There are also comparative IO studies which analyse the time varying economic role of the construction sector, its performance and interactions with other sectors in various countries. Pietroforte and Gregori (2003) examined and compared the construction sectors in eight highly developed economies using Organisation for Economic Co-operation and Development (OECD) IO tables. Turkish construction sector was first examined by Bon et al. (1999) using four IO tables between the years of 1973-1990. The study examines the economic role of the Turkish construction sector and its relations with other sectors by the construction, manufacturing and services shares of GNP and NI; backward linkage indicators and output multipliers; forward linkage indicators and input multipliers and direct and total construction inputs. In addition, the economic role and import dependency of the Turkish construction sector have been analysed by Ilhan and Yaman (2008) using six IO tables compiled to date including 1996 and 1998.

3.   Data and Methodology

This study is based on input-output data issued by Turkish Statistical Institute (TurkStat). The IO tables comprise the years of 1998 and 2002. This study's scope is limited to the two years mentioned due to the lack of data concerning recent years and the incompatibility of old and new series. This supports the argument that a major obstacle to such studies has been the lack of appropriate data on the sector, particularly in developing countries (Ruddock and Lopes, 2005).

This study uses IO analysis for examining the Turkish construction sector following the method used in the previous study. It is, therefore, useful to give the basic concept of IO tables and analysis. IO analysis which is defined as one of the useful planning tools correlates the functional relation between the whole economy and the industries that comprise the economy. IO analysis is based on a transaction table that shows the flows of goods and services among the industries. These tables are used to get the indicators for measuring the performance of an economy. The transaction among the industries is not one way; it is two way. The primary requirement of IO analysis is "technical coefficient matrix" or "input coefficient matrix" which summarizes the interrelated linkages among the sectors. Each sector needs other sectors' input in order to produce. Input Coefficient Matrix (A) shows the required direct input from one sector in order to produce 1 unit in another sector. IO transaction table has four sections. The first section shows the interchange of the intermediate inputs while the final demand comprises the second section. The compounds of the final demand are consumption; gross fixed capital formation; changes in inventories and valuables; goods and services exports. The third section of the table includes the main inputs that are not produced by the sectors such as taxes on production, fixed capital and compensation of employees. The final section contains the indirect basic factor inputs in final demand.

IO tables used in this study are use tables at purchasers' prices. Nine major sectors are obtained with the help of aggregation which is a common method used in IO analyses. The sectors are agriculture, mining, food processing, manufacturing, trade, transport, services, utilities and construction. Input Coefficient Matrix (A), Leontief Matrix (I-A) and Leontief Inverse Matrix $(I-A)^{-1}$ are derived via aggregated IO tables. The indicators used in the analysis are obtained from these matrixes. On the other hand, IO tables for import are used to examine the import structure and import dependency of the Turkish construction sector. IO tables for import are issued by TurkStat in addition to IO tables, which show the imported intermediate input that the sectors provide one another. IO tables for imports at basic prices are used. All data is expressed in current prices. Import dependency is measured by Importation Inverse Matrix (R) derived from the multiplication of Leontief Inverse Matrix $(I-A)^{-1}$ and Imported Input Coefficient Matrix (A_m). Importation Inverse Matrix (R) shows both direct and indirect input that one sector needs to import from other sectors. The IO tables for import are also aggregated into nine sectors as given in the above. The mentioned matrixes are used to obtain the indicators relating to measure the import dependency of the construction sector.

4.   Input-Output Analysis

The analysis comprises of two main parts: Examining the economic impact and the relations of the construction sector and secondly measuring the import dependency of the construction sector. GNP

shares of construction, manufacturing and services; the share of construction in NI; direct and total construction backward and forward linkages and direct and total construction inputs are the first indicators examined. Moreover, the indicators used for measuring the import dependency of the Turkish construction sector can be listed as construction share of imported input in GNP production; construction share of importation in total input usage; construction backward and forward linkage indicators in importation and direct imported construction inputs.

4.1 Data Obtained from IO Tables

Data series resulting from the Input Coefficient Matrix (A) and Leontief Inverse Matrix $(I-A)^{-1}$ can be summarised in three groups such as GNP and NI shares; direct and total construction backward and forward linkages and direct and total construction inputs from manufacturing and services.

4.1.1 Shares in Gross National Product and National Income

Table 1 shows the GNP shares of construction, manufacturing and services and the share of construction in NI. IO tables provide more accurate data relating to GNP and NI shares, than standard accounts because of the double entry accounting rules. Share of construction in GNP and NI can be defined as the indicator of its role changing in various stages of economic growth and development of construction sector. It is determined that construction sector follows the bell-shaped pattern of the manufacturing sector as being the old engine sector of economy and supporter of the sector uses for production and development model (Bon et al., 1999).

Table 1: GNP and NI Shares

	1998	2002
Share of Construction in GNP	0,1057	0,0693
Share of Manufacturing in GNP	0,3482	0,3518
Share of Services in GNP	0,2278	0,2830
Share of Construction in NI	0,0729	0,0466

GNP value is equal to the total of Final Demand in an IO table while the total of Value Added gives the NI value of the related year. The data given in Table 1 are determined via Final Demand and Value Added values of the aggregated IO tables. The share of construction sector in GNP and NI show a decrease tendency while manufacturing and services shares have increased even the changes are not too high. The decrease of the construction shares can be explained by the economic situation of the country since 2001 financial crisis ended up with an unexpected economic shrinkage in Turkey. The increases in the manufacturing and services shares in GNP verify the argument that the construction

sector is one of the foremost sectors affected in a negative way by a change in the economy. On the other hand, it can be seen that manufacturing generates more than construction and services in terms of GNP shares.

4.1.2   Direct and Total Backward and Forward Linkage Indicators (Pull and Push Effect)

Backward and forward linkage indicators are the indicators that show the degree of inter-sectoral relations in the IO analysis. Direct backward linkage indicators represent the intermediate to total input ratio of the construction sector. Backward linkage indicators are generally used as a measure of the degree of the industrialization of the construction process because they show the extent to which building materials and components are manufactured off site. Total backward linkage indicators, also known as output multipliers represent the effect of monetary unit change in the final demand of the construction sector on the total output of all other sectors. Direct forward linkage indicators represent the intermediate to total output ratio of the construction sector, while total forward linkage indicators, in other words, input multipliers represent the effect of monetary unit change in value added by the construction sector on total input of all other sectors. The direct forward linkage indicator of a construction sector represents the proportion of Maintenance and Repair (M&R) construction to total construction (Pietroforte and Bon, 1995). Direct and total backward and forward linkage indicators reflect the "pull" and "push" power of the sectors. The former shows the direct backward linkage indicators and output multipliers, the latter shows the power of feeding other sectors, in other words, direct forward linkage indicators and input multipliers. Table 2 displays the backward and forward linkage indicators and output and input multipliers of the construction sector for the years 1998 and 2002.

Table 2: Direct and Total Construction Backward and Forward Linkages

	1998	2002
Direct Construction Backward Linkage	0,5236	0,5681
Construction Output Multipliers	2,1294	2,6503
Direct Construction Forward Linkage	0,0119	0,0400
Construction Input Multipliers	1,0190	1,0662

The data shown in Table 2 obtained from Input Coefficient Matrix (A) and Leontief Inverse Matrix $(I-A)^{-1}$. (A) gives the direct backward and forward linkage indicators while $(I-A)^{-1}$ shows the output and input multipliers. As it can be seen, the pull effect of the Turkish construction sector is quite high when compared to the push effect. Having strong backward linkage and output multipliers show that the construction sector needs other sectors' input in order to produce. The construction sector is very

dependent on the other sectors in the economy. It receives a great deal of manufactured off site input from other sectors. However, its feeding power or the amount of input that construction sector provide for other sectors is low. This shows that the proportion of M&R sector in Turkey is also lower. On the other hand, it can be easily said that there is an increasing tendency for both pull and push effect values. The high the backward linkage indicators the more the construction sector activates other sectors. The increase of the forward linkage indicators shows that there is a growth trend in M&R sector.

4.1.3 Direct and Total Construction Inputs (Construction Technologies)

The technology used in construction can be examined by direct and total construction inputs. The direct inputs or technical coefficients represent the proportion of direct inputs of construction coming from a sector while the total inputs show the change in a sector's outputs resulting from a monetary unit change in final demand for goods and services of the construction sector. As specified in the previous part, the construction sector has strong relations with the other sectors in the economy in terms of providing input. It is, therefore, important to determine the sectors directly related to the construction sector. Table 3 displays the direct and total construction inputs from manufacturing and services.

Table 3: Direct and Total Construction Inputs

	1998	2002
Direct Construction Inputs from Manufacturing	0,4367	0,4618
Total Construction Inputs from Manufacturing	0,8600	1,2257
Direct Construction Inputs from Services	0,0421	0,0427
Total Construction Inputs from Services	0,1048	0,1448

The values of Input Coefficient Matrix (A) and Leontief Inverse Matrix $(I-A)^{-1}$ show the direct and total construction inputs respectively. The direct construction inputs from manufacturing are ten times bigger than the direct construction inputs provided from services. Similarly, total manufacturing inputs are eight times bigger than total services inputs. There is an increase in direct and total construction inputs from both services and manufacturing. However, the gap between the rates of increase is considerably high. This shows that the Turkish construction sector is directly related to manufacturing sector in terms of the technology used. Although the values of direct and total inputs from services has increased, it should be kept in mind that the replacement of manufacturing and services is out in the near future regarding to the inputs provided for construction sector.

4.1 Data Obtained from IO Tables for Import

Data series measuring the import dependency of the Turkish construction sector are resulted from the Imported Input Coefficient Matrix (A_m) and Importation Inverse Matrix (R). In this sense, direct import construction inputs from other sectors are first examined. Next, construction backward and forward linkage indicators in imports are determined; finally construction share of import input in GNP production and construction share of importation in total input are analysed. The mentioned import dependency indicators are shown in Table 4.

Table 4: Import Dependency Indicators

	1998	2002
Direct Import Construction Inputs from Manufacturing	0,0696	0,0645
Direct Import Construction Inputs from Services	0,0000	0,0012
Direct Import Construction Inputs from Mining	0,0015	0,0002
Construction Backward Linkage Indicators in Imports	0,1749	0,3060
Construction Forward Linkage Indicators in Imports	0,0000	0,0000
Construction Sector's Share of Import Input in GNP Production	0,0775	0,0663
Construction Sector's Share of Importation in Total Input	0,1595	0,1167

The elements of Input Coefficient Matrix (A) give the direct construction inputs including both local and imported inputs. Imported Input Coefficient Matrix (A_m), on the other hand, is used to determine the direct import construction inputs from other sectors. Manufacturing, services and mining which are the foremost sectors for providing input to the construction are handled. Although the value of manufacturing has decreased it is considerably high when compared to services and mining. The value of imported services inputs is zero for 1998. This means that all direct construction inputs from services are the local inputs for that year. The imported services inputs have an increasing tendency while the imported mining inputs have decreased. When the imported inputs are examined in product base, manufacture of ceramic products; basic iron and steel; general and special purpose of machinery; non-metallic mineral products; cutting and finishing of stone are the most conspicuous products partaking in manufacturing. Financial intermediation services except insurance and pension funding and, insurance and pension funding services excluding compulsory social security can be defined as the services imported for the Turkish construction sector.

When final demand of the construction sector increases one unit, total direct and indirect imported input needed from abroad shows backward linkage indicator of the construction sector in importation. When final demand of all sectors increase one unit, input needed from abroad for the construction sector shows "forward linkage indicator" in importation (Ilhan and Yaman, 2008). The backward and forward linkage indicators are obtained from Importation Inverse Matrix (R). The backward linkage indicators have an increasing tendency while forward linkage indicators are zero. Having high backward linkage indicators shows that the Turkish construction sector has been more dependent on importation. The value of the forward linkage indicators can be explained by no input provided from construction to the other sectors. Share of import input in GNP production and share of importation in total input are the last indicators used in measuring the import dependency of the sectors. It can be said that the import dependency of construction has decreased in terms of both import input in GNP production and importation in total input.

5.   Conclusion

Turkish construction sector has been examined in terms of its role in national economy, degree of relations with the other sectors and import dependency. It can be seen that the construction sector which is directly proportional with the economy, is easily affected by the change of the economic situation. The results of IO analysis applied for examining the economic impact and import dependency of the Turkish construction indicate that the shares of construction sector in GNP and NI have decreased between the years 1998 and 2002 while manufacturing and services shares have an increasing tendency. Outbreak of financial crisis in 2001 can be shown as one of the main reasons that affected the construction sector negatively. Backward and forward linkage indicators which help to determine the inter-sectoral relations in the economy, show that the construction sector has strong relations with other sectors in the sense of direct and total backward linkages. On the other hand, direct and total construction forward linkages are low. In other words, while its power to stimulating other sectors is high, its power of feeding other sectors is quite lower. The direct and total forward linkage indicators measure the strength of M&R sub-sector by which the construction sector can contribute to the other sectors. In this sense, it can be easily said that the M&R sub-sector is weak in Turkey. Furthermore, direct and total construction inputs provided from other sectors have an importance in order to determine the construction technologies and the sectors that should be put emphasis on. Although the construction inputs provided from services have been increasing, manufacturing sector keeps its place of being the first supplier for the Turkish construction sector. Manufacturing is replaced by services in developed countries in terms of the inputs provided to the construction sector. The indicators for measuring the import dependency show that the Turkish construction sector has been dependent on importation as per the direct inputs provided from services and the backward linkage indicators in imports. On the other hand, the values of direct import inputs from

manufacturing and mining; construction shares of import input in GNP production and importation of total input have decreased.

In conclusion, IO analysis applied in this paper provides a snapshot of the Turkish construction sector. The lack and incomparability of Turkish IO tables limits the study's scope into two years. It is, therefore, not possible to see the performance of the construction sector for a long period. The further studies can be carried out after the publication of new data shedding light on the recent years.

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