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ECONOMIC IMPACT OF A HIGHWAY CONSTRUCTION PROJECT

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Economic Impact Of A Highway Construction Project

Bir Otoyol İnşaat Projesinin Ekonomik Etkisi

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LIST OF ABBREVIATIONS

A	Agriculture, Forestry and Fishing
B	Industry
C	Manufacturing
F	Construction
GHI	Services
J	Information and Communication
K	Financial and Insurance Activities
L	Real Estate Activities
MN	Professional, Administrative and Support Service Activities
OPQ	Public Administration, Education, Human Health and Social Work Activities
RST	Other Service Activities
Y1	Year 1
Y2	Year 2
Y3	Year 3
Y4	Year 4
Y5	Year 5
IO	Input-Output
GVA	Gross Value-Added
VOC	Vehicle Operating Cost

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ABSTRACT

Economic impacts of infrastructure projects have been researched and analyzed through different methods. Highways and state roads recently constructed contribute to economic development on several counts in Turkey. The subject of this study was to estimate the economic impacts of any infrastructure investment on the entire economy by using input-output analysis. For this purpose, it aimed to determine the total impacts of a selected highway project on the Turkish economy during the construction phase of a 5-year period as a case study. The project, whose economic effects will be determined is specific to 100 km in a region and it is on one of the main arterial roads in Turkey. The input-output model was applied to calculate the direct, indirect, and induced impacts. In the study, national input-output tables created by TurkStad in 2012 has been used and total output or requirements, gross value-added and employment multipliers concerning highway construction in Turkey were computed separately to calculate relative changes in the economy for grand total and each year. The findings showed that the construction of selected highway has obviously positive impacts on the national economy in terms of output, gross value added and employment. Thus, this applied method can be a good approach to quantify economic effects on both regional and national economy for policymakers and used for other infrastructure projects.

Keywords: Economic Impact, Input-Output Analysis, Multipliers, Construction, Highway

ÖZET

Altyapı projelerinin ekonomik etkileri farklı metotlarla araştırılmış ve analiz edilmiştir. Türkiye'de son zamanlarda yapılan otoyollar ve devlet yolları ekonomik kalkınmaya birçok açıdan katkıda bulunmaktadır. Bu çalışmanın konusunda, girdi çıktı analizi kullanılarak herhangi bir altyapı yatırımının tüm ekonomi üzerindeki ekonomik etkileri incelenmiştir. Bu amaçla, seçilen bir otoyol projesinin 5 yıllık inşaat aşamasında Türkiye ekonomisine olan toplam etkilerinin bir vaka çalışması olarak belirlenmesi hedeflenmiştir. Ekonomik etkileri belirlenecek olan proje 100 km özelinde bir bölgede olup, Türkiye'nin ana arterlerinden biri üzerindedir. Doğrudan, dolayı ve uyarılmış etkileri hesaplamak için girdi-çıktı modeli uygulanmıştır. Çalışmada, TUİK tarafından 2012 yılında oluşturulmuş ulusal girdi-çıktı tabloları kullanılmış ve Türkiye'de otoyol inşaatına ilişkin toplam çıktı veya gereksinimler, katma değer ve istihdam çarpanları ayrı ayrı hesaplanarak genel toplam ve her yıl için ekonomideki göreceli değişmişler hesaplanmıştır. Elde edilen bulgular, seçilen otoyol inşaatının üretim, katma değer ve istihdam açısından ülke ekonomisi üzerinde açık bir şekilde olumlu etkileri olduğunu göstermiştir. Bu nedenle uygulanan bu metot, politika yapıcılar için hem bölgesel hem de ulusal ekonomi üzerindeki ekonomik etkileri ölçmek için iyi bir yaklaşım olup, diğer altyapı projeleri için kullanılabilir.

Anahtar Kelimeler: Ekonomik Etki, Girdi-Çıktı Analizi, Çarpanlar, İnşaat, Otoyol

CHAPTER ONE

INTRODUCTION

The definition of transportation is basically the use of the necessary equipment and systems for the transportation of goods, people, and energy in the cheapest, shortest time and safely (Aysan, 1990). Besides that, it can be defined as well a service that enables people and goods to be relocated in a way that will benefit time and place in the face of their needs.

Transportation also accelerates the economic and social development in rural areas and increases the contribution to the economy, social and political life for the region of people. The transportation sector plays an important role in communities in terms of the production-distribution-consumption life cycle, and it requires an important infrastructure investment that generates economic impacts all segments of society (Gerçek, 2000).

Transportation types can be classified as follow, airline, highway, railway, seaway, and pipelines etc. The history of transportation is as old as human history (Şendağ, 2007). The road is the oldest mode of transportation in the historical forms of the basis of transport infrastructure. Nowadays, the road still considered as significant in transportation systems as it was in the past. Road transport has great importance in order to enhance the economic development and community welfare. It is not only economic activity on its own but also a service type that has a very close relationship with other sectors. Moreover, road transportation is the most preferred and used type of transportation that provides continuous transportation from a point to a point in terms of freight, passenger, and goods transport.

Due to the rapid population growth, the number of vehicles has been increasing day by day, so new roads are needed in many aspects such as commercial, tourism and industry. Especially in emerging countries, developed and planned transportation system plays an important role in the stimulating economic growth.

Due to this reason, there is a relatively close relationship between economic development and transportation systems. With respect to Turkey's transportation system, it has been monitoring since 1950's and as the transportation policies, it has become completely dependent on the road transportation.

Investments in various sectors, particularly in the transportation sector should be evaluated depending on long-term planning based on detailed and sophisticated studies to get the highest level of efficiency. The current roads in Turkey are classified as state roads, highways, provincial roads, metropolitan municipality, provincial and district municipal roads, village roads and special feature roads such as forest roads, tourist roads, other roads. In Turkey, it is obviously seen that the number of motorways and total road length as a transportation network have been increased rapidly in recent years.

Thus, the costs and economic impacts of the roads to be made are important in many ways. Road construction, maintenance and repair, operating should be considered costly on their own and it also affects other employment areas. In the conclusion, when planning in relation to the transportation projects, planning and application should be made not only in terms of transportation but also taking into account the impacts that will occur in other sectors.

For this purpose, this study examines the economic impact of investment expenditures in the Turkish economy during the construction of highways for 5 years period in the selected project as a case study. The road on which the thesis study has conducted was the construction of a highway for 100 km. Thus, in order to estimate macroeconomic impacts (direct-indirect-induced) of the project expenditures by sector of economic activity, the input-output model has been used.

This thesis consists of several sections. The first part is an introduction of some definitions with respect to road types, general definitions and terms for roads, the development of roads in Turkey, construction costs of highway and brief information about the study is given as well. The introduction is followed by a

review of the socio-economic status of the regions where highway construction is aimed to be built. Section 3 represents the overview of the literature on the economic impacts of some studies and the application of input-output models. Section 4 follows the research methodology and data sources used in the study, while Section 5 describes the empirical analysis of the total impacts of constructing highway on the whole economy in Turkey. The final part as 6, concludes the main results.

1.1 DEFINITIONS OF ROAD TYPES

The existing total roads obligation is divided into 6 groups according to the institutions that are affiliated within Turkey. These are state roads, highways, provincial roads, metropolitan municipality, provincial and district municipal roads, village roads and special feature roads such as forest roads, tourist roads, other roads.

Highways: They are defined as the road that has high standards, minimum speed limitation in traffic, high travel speed and control of access on it.

Provincial Roads: Roads that connect one place to other places required by the public need, provinces to each other, to state roads, to ports, to shipyards, to railway stations and to airports, starting and ending within a provincial border except for the roads under the responsibility of municipalities or other institutions.

State Roads: These are the main roads that carry continuously the transit traffic to provinces, ports, shipyards, airports, railway stations, and border gates except the roads under the responsibility of municipalities or other institutions.

The responsibility of the 3 different roads mentioned above belongs to the General Directorate of Highways. The construction and maintenance of the Village Roads are under the responsibility of the Governorships, while the roads of the Metropolitan Municipality and the Provincial Municipality are under the responsibility of the local administrations. In relation to the other roads,

construction and maintenance works of special touristic roads and dam roads are under the control of the Ministry of Culture and Tourism and the General Directorate of State Hydraulic Works, which are carried out by the General Directorate of Highways with a protocol.

Forest roads are under the responsibility of the Ministry of Forestry and Water Affairs.

1.2 GENERAL DEFINITIONS AND TERMS FOR ROADS

The terms that used in highway engineering are shortly given below (Yayla, 2004).

Highway: The platform and strip of land where transportation on land is provided.

Highway Traffic: The purpose of transportation of the highway is the movement of motorized, non-motor vehicles and pedestrians on the road by using the highway alone or together.

Earthworks: The works that carried out are excavation, filling in all types of rock, soils, levelling.

Levelling: It is called the grading of the natural soil.

Fine Levelling Layer (Adjustment): It is the final correction of the leveling with help of a grader by sloping transverse and longitudinal in accordance with the project.

Infrastructure: The part of the road that has been shaped into a predetermined elevation and cross-section at the end of the earthworks.

Art structures: Bridges, viaducts, tunnels, culverts, retaining walls, shoring walls, fortifications, etc. are engineering structures.

Pavement: It is the part that is built on the infrastructure to carry the traffic loads of the road and distribute this load to the base surface in a way that does not exceed the bearing capacity of the base floor and consists of sub-base (foundation) and foundation and coating layers.

Sub-Base Layer: It is the layer that is laid on the adjustment surface and is generally made of grained material such as sand, gravel, stone fractures, blast furnace slag, with a certain granulometry and with a small fineness.

Base Layer: It is the layer that is placed between the subbase layer and the coating layer and consists of natural sand, natural gravel or crushed stone and a small amount of binding thin material with better granulometry, and physical properties of the material compared to the sub-base layer.

Coating: It is the top layer of pavement that consists of material such as Asphalt concrete, surface coating, concrete, parquet, etc., and resists slipping, abrasion of traffic, and the decomposition effect of climatic conditions.

Curve (Horizontal and Vertical Curve): It is a curvilinear or circular road section that connects the linear sections on the horizontal and vertical line of the project.

Longitudinal section: It is the projection of the path axis on the vertical plane or the elevated path axis.

Cross-section: It is the intersection of the road body layers and elements with a vertical plane perpendicular to the axis, including a land-use of sufficient width.

Annual Average Daily Traffic: It is the value obtained by dividing the total traffic passing a road in a year by 365.

Project Hourly Traffic: It is the traffic that is taken as a basis during project planning.

Traffic Forecast (Expected Traffic): The traffic, which is the basis for the choice of geometric standards during road design, is generally the traffic value at the end

of 20 years as mentioned before. Accordingly, the hourly traffic of the project and the annual average daily traffic values should be the traffic values at the end of this period. To find these values, the current traffic, if any, and the increase in this traffic, as well as the traffic that may occur after the road is put into service, are calculated. The calculation of the expected traffic after this time taken into consideration is called traffic forecasting.

1.3 HISTORICAL DEVELOPMENT OF ROADS IN TURKEY

When the Republic was declared in 1923, there were a total of 18,350 km of roads and 94 bridges, 13,900 km of which were stabilized and 4,450 km of which were earth roads within our national borders. Road transportation has started to grow rapidly after the Second World War and motorways have become the dominant system in developed and developing countries in the 2000s.

A large proportion of passenger and freight transportation takes place on roads in Turkey. As a result of the studies carried out in the 1960s, were led to reveal of a 60,000 km road network, and asphalt pavement was made intensively between 1960 and 1970. The construction of high-standard roads, multi-lane expressways, and highways in the vicinity of large cities, and high-traffic roads were taken into consideration in the 1970s. Construction of high standard motorways was paid attention in the 1980s, and the road was replaced by highway construction in this period in terms of accessibility.

Within the scope of an emergency action plan that was prepared based on the lack of capacity in road transport, the integrity of the national and international network and traffic safety, divided road works have been more focused at the beginning of 2003 in Turkey. Regarding the ongoing divided road works, the length of the divided road has reached 24,280 km as of January 01, 2016.

In the direction of the determined transportation policies, it was adopted to develop the road network by using alternative financial resources as well as public resources in the 2010s. Important projects such as Gebze-Orhangazi-İzmir

Highway and Osmangazi Bridge, Northern Marmara Motorway and Yavuz Sultan Selim Bridge have started to be realized with the model of Build-Operate-Transfer (BOT) system, which is a Public-Private Sector Cooperation model.

When it was examined the relationship between the transportation sectors in terms of the distribution of domestic freight transportation in 2015, the ratio of highways in freight transportation was 90% and the ratio in passenger transportation was about 89%. In freight transportation, the ton-km value was 167 billion in 2005 while it was 244 billion tons-km in 2015 and the increase has become approximately 46%. Moreover, it was observed that there is some directional change between GDP and ton-km and their behavior during financial crisis periods. Passenger transportation in the road network under the responsibility of the General Directorate of Highways was 182 billion passenger-km in 2005 as %60 increased, and it was 291 billion for passenger-km in 2015.

Besides that, according to 2015 data, almost 20 million vehicles are registered in traffic. The automobile has the most important key position in the total number of vehicles to traffic as the share of %53. While the number of cars per 1000 people is 134 in Turkey, it is about 500 in developed countries.

Thus, it is necessary to enhance the geometric and physical standards of the road network to qualifications that required by the current and future traffic. Developing highways incompatible with other types of transport increases the level of service and the impact of the sector on the economic growth, and it ensures reducing the damage caused by heavy vehicles on the road pavement and cost of transportation.

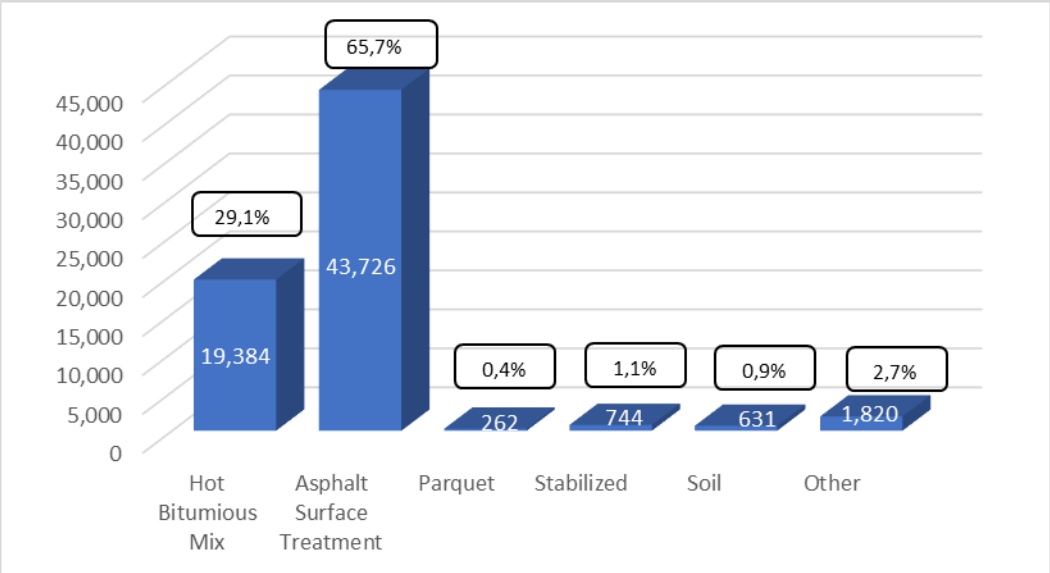
According to surface types in Turkey, there are total of 66.567 km of roads that consist of 31.213 state roads, 33.065 provincial roads, and 2.289 km highways.

Table 1.1. Road lengths according to surface types of km.

Road Type	Surface Type						
	Hot Bituminous Mixture	**Asphalt Surface Treatment**	**Parquet**	**Stabilized**	**Soil**	**Other**	**Total**
Highway	2.289	0	0	0	0	0	2.289
State Road	14.393	16.399	71	45	17	288	31.213
Provincial Road	2.702	27.327	191	699	614	1.532	33.065
Total	19.384	43.726	262	744	631	1.820	66.567

Source: Karayolları Genel Müdürlüğü. (2016). *Karayolları Genel Müdürlüğü Stratejik Planı 2017-2021*

Graph 1.1. General Directorate of Highways Road Network Status According to Surface Types.



Source: Karayolları Genel Müdürlüğü. (2016). *Karayolları Genel Müdürlüğü Stratejik Planı 2017-2021*

In 2014 "The Turkish Highways Awareness and Satisfaction Survey" was carried out to reveal the public's attitudes, thoughts and perceptions about the General Directorate of Highways and its services, and to determine the level of awareness of drivers who transport freight and passengers on the road. The study includes two different questionnaires as "Public Opinion" and "Drivers". As road users, 5,036 public opinion surveys in 2,959 households in 63 provinces to households (every person over the age of 18 in the household), and 933 driver surveys in 33 provinces were applied to the drivers who transport freight and passengers by interviews.

Within the scope of the research, it has been determined that the top priority expectation by the public is to take measures to increase traffic safety and to build new highways and divided roads for drivers. Moreover, increasing afforestation and landscaping along the road stands out as one of the priority issues for the public. In terms of traffic safety, 61.5% of the public and 61.6% of the drivers who transport freight and passengers feel safe while travelling on interurban highways.

1.4 CONSTRUCTİON COSTS OF HIGHWAYS

Transportation investments have a high cost for expropriation, construction, and operation. Because of that reason, countries cannot realize their transportation investments on time with the limited force of financial sources. thus, they have to meet significant economic losses due to the prolongation of the opening times of the projects. In addition to the use of public resources in the construction of transportation infrastructure investments, methods such as build-operate-transfer, private sector-public cooperation, service-based agreements with a purchase guarantee or pre-purchase of income have been developed.

Even though the cost of road infrastructure construction is less than railways, the cost of modern highways is close to the construction costs of railways. Another feature of the highway is that it might be built gradually.

Regarding the construction costs of the highways, it usually depends on the geological and topographic structure of the area where the road will be built, the number of lanes, the amount of pavement, the number of art structures, the amount of expropriation, the length of the regions that need lighting and other unforeseen costs. In a study conducted, the estimated kilometer costs of highways have been built in Turkey changes between 5.13-7.85 million USD, excluding expropriation cost for 1993 (Tığlı, 1993). The table 1.2. shows that the construction costs per km of some highways and bridges built in Turkey (TSKB, 2012). Therefore, the average construction cost per km of the highways and bridges built was found to be 8.47 million dollars/km.

Table 1.2. Construction costs of highways and bridges under privatization (Km/$).

Highways and Bridges subject to Privatization	Opening Date	Length (Km)	Tunnel (pieces)	Viaduct (pieces)	Total Construction Cost (Million)	Construction cost per km (Million)
Edirne-İstanbul-Ankara Highway						
O-3 Edirne-İstanbul Highway	1987-1997	277	-	20	2,000	7.22
O-4 İstanbul-Ankara Highway	1990-2007	445	6	38	4,000	8.99
O-20 Ankara Beltway	1993-1998	114	-	1	888	7.79
Fatih Sultan Mehmet Bridge and Beltway						
O-20 İstanbul-FSM Bridge-Anatalian Highway	1988	35	1	7	391.5	11.19

Bosphorus Bridge						
Table 1.2 Continue						
O-1 Bosphorus Bridge K-9. Barbaros Junction-K12 Altunizade Junction	1973	6	-	2	44.5	7.42
İzmir-Çeşme Highway						
O-32 İzmir-Urla-Çeşme Highway	1993-1996	89	-	2	607	6.82
İzmir-Aydın Highway						
O-31 İzmir-Aydın Highway	1996-2004	112	1	3	1,391	12.42
O-30 İzmir Beltway	1993-2006	61	2	6	460	7.54
Pozantı-Tarsus-Mersin Highway						
Pozantı-Tarsus-Mersin Highway	1981-2006	836	15	54	5,750	6.88
Average construction cost per km of highways and bridge that are subject to be privatizated as privatization (Km/Dollar)						**8.47**
Note: The values were in US dollars and considered as of the year of construction.						

Source: TSKB. (2012). *Otoyollar Ve Köprülerin Özelleştirilmesi Ön Tanıtım Dokümanı*. İstanbul, Tskb Yayınları.

Although the construction costs of highways change from region to region, highway construction costs per km (Survey-project, taxes, and excluding expropriation costs) is approximately 2,283,429 TL in smooth land, 3,743,862 TL in rough land, and the average cost is 2.837.586 TL. The high construction cost of highways depends on many factors such as geographical differences between regions and the unevenness of the landforms (Karayolları Genel Müdürlüğü, 2016).

Items were analyzed in terms of cost of construction activities are following, earthwork, mobilization of the site, pavement, drainage, art structures, and administrative and miscellaneous items. In previous road projects, earthwork generally is the highest cost among all the components.

Table 1.3. Main components of construction for highway

Item	Share of Total Construction (%)
Site Preparation	5%
Earthwork	30%
Pavement	20%
Drainage	15%
Art Structures	20%
Other	20%

Source: Markow, M. J., & Aw, W. B. (1983). Estimating Road Construction Costs for Sector Planning in Developing Countries. *Transportation Research Record, 898*, 52–61.

In another study was conducted between Karamanlı and Tefenni, the construction costs have been involved earthworks, art structures and pavement works. According to the 14 km, 2x2 divided road tender by the General Directorate of Highways, road construction costs are as follows. As it can be seen from the table 1.4., earthworks constitute approximately half of the total costs (Çoşar, 2019).

Table 1.4. Total costs and quantity for Karamanlı-Tefenni road

Description	Unit	Total Quantity	Total Cost
Earthwork	m^3	1.558.000	6.319.400 TRY
Art Structures	m^3	4.499.640	1.886.542 TRY
Pavement	Ton	349.666	3.825.860 TRY
Total			12.031.784,00 TRY

Source: Çoşar, V. H. (2019). *Şehirlerarası Bölünmüş Yol Çalışmalarında Ekonomik Analiz Değerlendirmesi; Karamanlı Tefenni Yolu Örneği.*

CHAPTER TWO

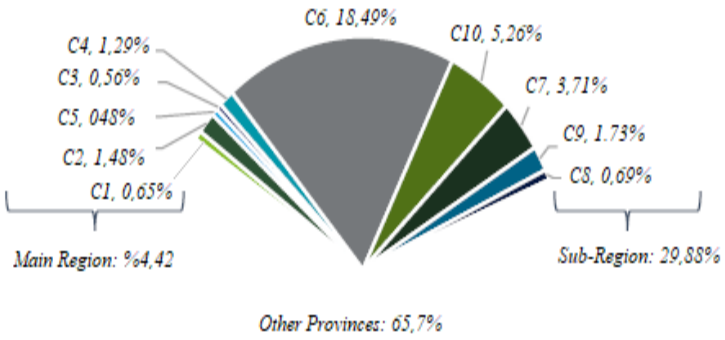
REVIEW OF THE SOCIO-ECONOMIC STATUS FOR REGION

The regions in the thesis study are grouped under two groups. The first of these is the route through which the highway is going to be built as the main region and the other includes the provinces around the highway as a sub-region. The main region consists of C1, C2, C3, C4 and C5 provinces while the sub-region includes C6, C7, C8, C9 and C10 have been examined based on several demographic, macroeconomic, and microeconomic indicators as well as the sectoral division of agriculture, industry, service, and framework of total lengths of state roads as of types. Overall, the economic structure of the sub-region reflects similarities with Turkey's economic structure. Considering the economic indicators, the main region is economically lagging the sub-region.

2.1 DEMOGRAPHIC FRAMEWORK OF THE REGIONS

It is one of the fundamental indicators in the socio-economic structure is a population that shows both the demographic conditions of the main region and sub-region. According to the population numbers of the region given in table 2.2., the population of the sub-region is almost 6,76 times more than the population living in the main region.

Figure 1.1. Population Shares of Both Main Region and Sub-Region



Source: Türkiye İstatistik Kurumu. (2021). *Adrese dayalı nüfus kayıt sistemi sonuçları, 2020: Yıllara göre il nüfusları* (TUIK Publication No. 37210).

While the sub-region constitutes 29.88% of the population of turkey, this ratio is 4.42% for the main region. According to the unemployment rates by TurkStat the main region was aggregated under two regions and the average unemployment rate was 9.65% in 2019. Regarding the sub-region, it was grouped in 4 groups similarly and the average unemployment rate was 12.97% while the whole unemployment rate for January 2019 was 14.7% in Turkey.

While the poverty level was 12.952 TRY for 2019 in Turkey, the poverty line in the main region was 14.187 TRY. On the other hand, the poverty rate (relative to 60% of median income) was 21.3% in Turkey, while it was lower in the main region, 19.2%.

Well-being index is another evaluation parameter of region features, is to measure, compare and monitor the lives of individuals and households in terms of life dimensions using objective and subjective criteria at the local level. The index contains 41 indicators under the 11 dimensions that are housing, work-life, income and wealth, health, education, environment, safety, civil engagement, access to infrastructure services, social life, and life satisfaction. According to TurkStat rankings and index values of well-being index for provinces in 2015, from the point of the general index, C2 ranks 7 in all of Turkey and first in the

main region. In contrast, C8 ranks 4th in the whole of Turkey, ranking 1st in both the main region and the sub-region.

2.2 OVERVIEW OF ECONOMIC STRUCTURE

In relation to the framework of economic status for both the main region and sub-region, the main region comprises mainly cities on the highway route as of C1, C2, C3, C4 and C5 that constitutes 4.62% of Turkey's GDP with 201.930.139 thousand Turkish liras in 2019. In the main region, C2 and C4 have the two biggest economies that represent 65,15% of the GDP of the region among these cities.

While the main region shows a small amount with 4,62% of the Turkish economy, the sub-region that is consist of the C6, C7, C8, C9 and C10 represents 43,11% of Turkey's GDP. The following tables show the ratio of the regions GDP and indicate the difference between the GDP of the main region and sub-region.

A comparison of these two regions was given in the table 2.1. in terms of GDP and substantial GDP difference between these two regions were observed.

Table 2.1. GDP of the regions, main region, sub-region and Turkey, 2019

	GDP	Share (%)
Main Region	201.930.139	4,62%
Sub-Region	1.885.859.031	43,11%
Turkey	4.374.368.962	100,00%

Source: Türkiye İstatistik Kurumu. (2021). *İl bazında gayrisafi yurt içi hasıla, 2019: İl bazında gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A10) göre, cari fiyatları, 2018-2019* (TUIK Publication No. 33663).

The average GDP per capita for the main region is 53.978 TRY that is close to Turkey's average of 52.316 TRY for 2019. With respect to the GDP of the cities

in the main region, C4 has the highest GDP with 70.788 TRY while C3 is the lowest GDP with 44.088 TRY in the main region. In relation to sub-regions GDP, the average GDP for sub-region is 59,447 TRY in which is above the main region and average of Turkey. Thus, other than C8 and C9, the rest of the cities in the sub-region has higher GDP than the average of Turkey and average main regional cities. Hence, it can be said that with these data's, the region is open to development when compared to cities of sub-region.

Table 2.2. Total population and gdp per capita on the regions.

Region	Province	Population	Share of as percentage %	GDP - thousand TRY	GDP per Capita - TRY	Share of as percentage %
Main Region	C1	541.548	0,65%	29.070.297	53.680	0,66%
	C2	1.240.285	1,48%	54.947.106	44.302	1,26%
	C3	470.763	0,56%	20.754.999	44.088	0,47%
	C4	1.081.065	1,29%	76.526.429	70.788	1,75%
	C5	361.737	0,43%	20.631.308	57.034	0,47%
Total		3.695.398	4,42%	201.930.139	54.643	4,62%
Sub-Region	C6	15.462.452	18,49%	1.342.109.909	86.798	30,68%
	C7	3.101.833	3,71%	181.758.108	58.597	4,16%
	C8	576.688	0,69%	24.117.092	41.820	0,55%
	C9	1.450.616	1,73%	71.757.622	49.467	1,64%
	C10	4.394.694	5,26%	266.116.300	60.554	6,08%
Total		24.986.283	29,88%	1.885.859.031	75.475	43,11%
Turkey		83.614.362	100,00%	4.374.368.962	52.316	100%

Sources: Türkiye İstatistik Kurumu. (2021). *İl bazında gayrisafi yurt içi hasıla, 2019: İl bazında gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A10) göre, cari fiyatları, 2018-2019* (TUIK Publication No. 33663) & Türkiye İstatistik Kurumu. (2021). *Adrese dayalı nüfus kayıt sistemi sonuçları, 2020: Yıllara göre il nüfusları* (TUIK Publication No. 37210).

Besides that, allocation of GDP into sectors is another important parameter. The sectoral GDP distribution in 2019 is shown below for the main region, sub-region in terms of cities, and Turkey as well. Sectors in the table are (A) Agriculture, (BCDE) Industry, (C) Manufacturing Industry, (F) Construction, (GHI) Services

and aggregated other sectors (J) Information and Communication, (K) Finance and Insurance Activities, (L) Real estate activities, (MN) Professional, Administrative and Support Service Activities, (OPQ) Public Administration, Education, Human Health and Social Work Activities and (RST) Other Service Activities.

As a result of the evaluation of the main region in terms of GDP by sectors, it shows that (BCDE) and (C) sectors are mainly dominant in the main region. Moreover, it has been also observed that the share of (A) is almost twice the average of Turkey. Therefore, when the provinces of the main region are examined, the reason for the high rate of agriculture compared to Turkey and sub-regions is that the cities in the region have a higher share of agriculture and are an important source of income.

Table 2.3. GDP by sectors for main region, 2019.

Main Region Cities	**A**	**BCDE**	**C**	**F**	**GHI**	**J, K, L, MN, OPQ, RST**
Total	2.286.905	65.497.554	55.646.814	9.674.089	34.073.560	46.093.863
Share of %	10,9%	28,2%	23,90%	4,16%	14,66%	19,81%

Source: Türkiye İstatistik Kurumu. (2021). *İl bazında gayrisafi yurt içi hasıla, 2019: İl bazında gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A10) göre, cari fiyatları, 2018-2019* (TUIK Publication No. 33663).

On the other hand, it is evidently seen that the services sector has a greater share in the cities of the sub-region. In the provinces forming the sub-region, the share of the (GHI) sector in the GDP ranges from 0,61% to 77%, while the share of the (BCDE) of GDP has between 2,12% to 56,51%.

Table 2.4. GDP by sectors for sub-region, 2019.

Sub-Region Cities	A	BCDE	C	F	GHI	J, K, L, MN, OPQ, RST
Total	31.784.366	402.199.668	349.372.345	106.766.590	547.864.467	590.648.423
Share of %	1,56%	19,82%	17,22%	5,26%	27,00%	29,11%

Source: Türkiye İstatistik Kurumu. (2021). *İl bazında gayrisafi yurt içi hasıla, 2019: İl bazında gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A10) göre, cari fiyatları, 2018-2019* (TUIK Publication No. 33663)

Table 2.5. GDP by sectors for Turkey, 2019.

Turkey	A	BCDE	C	F	GHI	J, K, L, MN, OPQ, RST
Total	277.494.885	941.475.504	789.675.113	233.275.95	1.053.520.883	1.386.176.282
Share of %	5,92%	20,11%	16,86%	4,98%	22,50%	29,63%

Source: Türkiye İstatistik Kurumu. (2021). *İl bazında gayrisafi yurt içi hasıla, 2019: İl bazında gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A10) göre, cari fiyatları, 2018-2019* (TUIK Publication No. 33663)

The industrial gross domestic product by region distribution for a 5-year period is given in table 2.6. the for the main region, sub-region, and Turkey. While the share of the sector (A) decreases year by year, the share of (BCDE) and (C) have been increased in recent years within the main region. In addition, the sector (GHI) has also increased slightly in recent years.

Table 2.6. Comparison of sector in regions for 5-year period.

Regions	Sectors	Years				
		2015	2016	2017	2018	2019
Main Region	A	12,71%	12,29%	12,14%	11,95%	12,58%
	BCDE	22,64%	22,67%	23,06%	23,08%	22,47%
	C	19,08%	19,11%	19,47%	19,04%	18,17%
	F	5,27%	4,24%	5,25%	5,64%	6,13%
	GHI	15,75%	15,96%	16,43%	16,47%	16,44%
	J	0,41%	0,43%	0,43%	0,43%	0,44%
	K	2,60%	2,68%	2,58%	2,32%	2,38%
	L	8,76%	8,49%	7,95%	7,91%	7,89%
	MN	2,42%	2,70%	2,73%	2,55%	2,47%
	OPQ	9,41%	9,42%	8,96%	9,61%	10,06%
	RST	0,96%	1,00%	0,99%	1,00%	0,98%
Sub-Region	A	6,78%	6,61%	5,99%	5,36%	5,68%
	BCDE	24,51%	24,74%	25,00%	25,28%	25,22%
	C	19,84%	19,94%	20,07%	20,39%	19,80%
	F	5,39%	5,60%	5,79%	5,43%	4,83%
	GHI	18,57%	18,11%	18,92%	19,20%	19,25%
	J	1,51%	1,57%	1,64%	1,65%	1,77%
	K	3,21%	3,35%	3,18%	3,09%	3,32%
	L	6,41%	7,54%	7,20%	7,17%	7,34%
	MN	4,06%	4,18%	4,25%	4,11%	4,02%
	OPQ	7,20%	7,16%	6,75%	7,10%	7,55%
	RST	1,25%	1,21%	1,20%	1,22%	1,22%
Turkey	A	6,47%	6,09%	5,91%	5,86%	6,05%
	BCDE	18,63%	18,81%	19,01%	18,72%	18,43%
	C	15,63%	15,72%	15,88%	15,61%	15,16%
	F	6,94%	7,05%	7,14%	6,80%	6,18%
	GHI	21,81%	21,23%	21,83%	22,34%	22,51%
	J	2,41%	2,47%	2,59%	2,67%	2,80%
	K	3,98%	4,19%	4,00%	3,92%	4,16%
	L	8,07%	8,08%	7,64%	7,64%	7,73%
	MN	5,07%	5,18%	5,29%	5,04%	4,97%
	OPQ	9,24%	9,42%	8,98%	9,63%	10,10%
	RST	1,74%	1,73%	1,74%	1,77%	1,91%

Source: Türkiye İstatistik Kurumu. (2021). *İl bazında gayrisafi yurt içi hasıla, 2019: İl bazında gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A10) göre, cari fiyatları, 2018-2019* (TUIK Publication No. 33663)

While the share of (A) was between 5,36% and 6,78% over the years, (GHI) sector was below the average of Turkey for the sub-region. Therefore, the main region and sub-region can be interpreted as complementary two regions. While sector of (F) has increased in the main region in recent 3 years, it has been decreasing in the sub-region. Moreover, when compared to the average for Turkey, the main region is below the average of Turkey.

2.2.1. Agriculture

It is one of the important means of livelihood in the main region when the economic framework is regarded. The agricultural sector is usually considered as vegetative production, livestock, and animal products based on production values. Thus, it is clearly seen that the agriculture sector in the main region contributes highly to GDP and it is not only above the average of sub-region but also an average of the country too.

When evaluated in terms of agricultural areas, according to TurkStad data, the total agricultural land in the sub-region is 15,126,325.5 decares, while the total agricultural land in the main region is 16,226,637 decares in 2019. Regarding the agricultural activities in the main region, predominantly wheat, sunflower, paddy, barley, and corn are produced, and the region has the potential to develop in agriculture. At the same time, in terms of agricultural products such as wheat, sunflower and rice, most of the country's needs are provided from this region (Semerci, 2006). Besides that, it is known that 60% of Turkey's sunflower production and approximately 50% of paddy production is provided from the main region (Alp, 2016). One of the most important features of the region is the fields parted for olive trees.

Within the scope of plant production that is consist of a significant part of the agricultural production in the region, it is analyzed practically how the cultivated areas in the region are used and which plant products and crops are grown in the region.

2.2.1.1. Animal Husbandry

Livestock is another component that constitutes agricultural production and plays an important role in regional agriculture. According to 2019 data, there are 17.688.139 million cattle and 48.481.478 million small cattle animals registered in Turkey. while there are 1.203.613 million cattle in the main region, the sub-region has 1.559.681 million cattle. In relation to small cattle, the share of the small cattle in the main region is 6,18% and while the sub-region is 6,34%. In addition, that poultry farming is at the forefront, and poultry farming has an important place in the main region. Also laying hen numbers are 24,504,688 in the sub-region and 8,572,914 in the main region.

2.2.1.2 Animal Production

Animal production, which is another agricultural field of activity, takes an important place both in the main region and in the sub-region like other agricultural activities. Especially in the region, cow's milk, sheep's milk, goat's milk, and buffalo milk are produced. In addition, honey production, another animal production, contributes to the economy of the region.

2.2.2. Industry in The Regions

The number of active companies and enterprises in both regions were over 157.336. As of the end of 2019, the total number of firms and enterprises in the provinces forming the region is shown in the table below. Another fact that the main region is surrounded by a great number of industrial zones.

Table 2.7. Number of business.

Region	City	Number of business	Share (%)
Main Region	C1	950	0,60%
	C2	2.356	1,50%
	C3	2.993	1,90%
	C4	1193	0,76%
	C5	767	0,49%
Sub-Region	C6	34.083	21,66%
	C7	78.041	49,60%
	C8	218	0,14%
	C9	2.652	1,69%
	C10	34.083	21,66%
Total		157.336	100%

Source: T.C. SANAYİ VE TEKNOLOJİ BAKANLIĞI. (2019). *81 İl Sanayi Durum Raporları.*

2.2.3. Services

When many components of the service sector have been investigated, the service sector corresponds to an average of 21,94% of the Turkish economy and 16,26% of the main region economy. Besides that, it can also be indicated that there has been an increasing trend in both. It is observed that the sub-region follows a similar trend to the country and main region economies.

2.2.4. Construction

As the construction sector is playing a crucial role in Turkey's economic structure, activities in the construction industry might trigger many industries. The revival in the construction industry can lead to growth in many sectors in the main region connected to the construction of highway along. While the main region's gross domestic product accounts for 5.30% of the region's economy on average. Thus, it is clearly seen that it is below the average of both the sub-region and Turkey with

this value, and it can be said that the construction of the highway is expected to gain great momentum in growth and development.

2.2.5. Total Lengths of State Roads as of Types

According to the table 2.8. given below, according to the data of the General Directorate of Highways in 2021, the total road lengths in the sub-region are 7903.6 km in all road types, while the total length of roads in the main region is 5827.11. Therefore, especially in cities of Sub-region, roads are more developed compared to the main region in terms of the total length of roads.

Table 2.8. Lengths of state highways according to surface types by provinces as km for 2021.

State, Province and Highways									
Regions	Cities	Asphalt Roads			Stone Block (km)	Primitive (km)	Total Length (km)	Highway (km)	Divided Road (km)
		Asphaltic Concrete (km)	Surface Treatment (km)	Total (km)					
Main Region	C1	494	558	1052	6	0	1058	0	329,61
	C2	499	709	1208	4	21	1233	104	548,7
	C3	537	134	671	0	3	674	51	194,9
	C4	499	57	556	0	1	557	44	285,9
	C5	328	195	523	0	0	523	70	154
Sub-Region	C6	382	0	382	0	58	440	534	318,6
	C7	458	577	1035	1	14	1050	199	335,4
	C8	327	584	911	5	35	951	0	288,4
	C9	406	649	1055	2	0	1057	128	460,9
	C10	531	715	1246	7	9	1262	355	524,3

Source: ULAŞTIRMA VE ALTYAPI BAKANLIĞI. (2021). *İllere göre karayolu uzunlukları.* Karayolları Genel Müdürlüğ

When the regions are evaluated in terms of their connections with airports, there are 10 airports in total in both the sub-region and the main region. Therefore, it can be said that the highway to be built will increase the transportation to the airports. Moreover, it is predicted that passenger and cargo traffic of the main region will enhance with the highway.

CHAPTER THREE

LITERATURE REVIEW

The effects of the economic impact of a highway construction project, any infrastructure project or industry on the national economy or a specific region were analyzed in the literature using different methods, the most common approach for applying the Input-Output method based on the related studies,

To see the numerical results by using the Input-Output model in which is widely used and easy to use for highway projects was carried out. The results can also give an idea with respect to economic benefits for decisions maker when come up with building a highway project. The conducted study brought into focus its analysis on direct and indirect benefits of highway projects in terms of consumption, circulation and estimating output values for building highways. Direct benefits result in direct consumption, indirect consumption of construction substances while indirect economic benefits were seen as the increment of output value for the industry of transportation. Finally, research indicated that the total direct benefit of highway in construction for a 5-year period and indirect benefit of Jinji Highway project respectively were (¥) 14,7 billion and (¥) 147,66 million (Sun, Shi, Fan, and Shi, 2010).

Applied Input-Output model to analyze the macroeconomic impacts direct, indirect and induced of the construction expenditures by output, employment and occupations, found that the construction of motorway in Athens Metropolitan Area in Greece had positive impacts in terms of direct, indirect and induced for the national economy during 1999-2004 years. The total direct and indirect outputs of construction of highway generated nearly € 2,5 billion. Moreover, with respect to the contribution of employment of period 1999-2004, the total number of employment (persons) 27.947 and (persons) 7.747 indirect employment were generated. Having analyzed employment for construction was contributed

indirectly nearly 27% for the Greek and Athens economies in the way of industry linkages.

Thus, investments in highway construction will encourage national and regional economies and jobs and income in other sectors (Belegri-Roboli, Markaki, and Michaelides, 2010).

Used the input-output model to estimate the economic impact of the copulating toll road. The total cost of toll construction for 58 km was +1.6 trillion rupiahs. The findings indicated that the main industry of the Bandung region was the processing industry with respectively forward linkage and backward linkage 2.38 and 1.19.

Authors also found that the direct economic impact of cost savings reached Rp. 595,965 (million). In addition, the increment of value added was +1.79% for the region Bandung processing industry. Estimation of indirect economic impact that is related with (main industry) processing industry input will enhance the output of other production industries approximately Rp. 835,463 (million) and nearby +2.51% of aforesaid region's GDP. Total impacts are not limited to direct and indirect but also household income will enhance by Rp. 127,010 (million) besides that 21,311 workers will be increased in the total production industry (Anas, Tamin, and Wibowo, 2015).

In authors paper, indicated the economic impact of High-Speed Rail investments on the selected region also determined the regional output, employment and income impacts for policymakers therefore new regional Input-Output table was created by indirect methods. The Regional Input-Output table was like the national Input-Output table except for the purposed area. In addition to research that used Regional Weights (RW) and Location Quotient (LQ) were mixed of the indirect methods. Created regional I-O table was explained very well with four steps process. Thus, regional I-O tables and multipliers were examined with real data of HSR stations and railroads in Sejong. Economic impacts are usually computed with total changes in output, gross regional product, employment, and

income. Effects that are abovesaid in terms of total economic impacts were analyzed for a new HSR investment. The regional economic impact of railway systems might be thought of manufacture of vehicles, construction of stations and tracks of railroads. With created multipliers, economic impacts for specific regional sectors in the region-Sejong were examined. The findings indicated that investment of a new HSR will create respectively total output worth $100,635,308 and income effects $21,145,402, together with 988 jobs. Research indicated that in current use and mostly applied (BCA and MCA) were not enough with the calculation of regional economic impacts. So, to quantify a regional economic impact, the methodology in which applied in the study might be carried out for a region that does not have a regional Input-Output table. However, the indirect methods that applied in the study with the four-step approach were only effective through the previous studies. To provide more accurate results, a direct method should be used (Lee, Ma, and Oh, 2018).

(Batey, Madden, and Scholefield, 1993) applied input-output methods to examine the impact of development and expansion of airports in the large city of the United Kingdom. As lack of any Regional Input-Output Modelling System (RIMS II), the authors built up a regional input-output model to determine the impacts of this development on the industrial sectors during construction and operation phases. When research was conducted, the most recent available input-output table was available for 1984 and authors advanced aggregation of the standard industrial classification (SIC) for 34 sectors. They developed the UK table for 1984 to 1987 using the RAS method and the regional input-output table was created by updated UK Table using away based on semilogarithmic location quotients. It is also essential to determine household consumption tends to achieve the model. The construction phase of job requirements was between 3,260 and 13,240 annuals according to the representative years. Three different throughputs respectively 3, 10 and 21 mppa were shown as operational of the airport in terms of impacts in the job. The most impressive increment was seen when the airport

widens from one experiencing passenger volume of 10 mppa to 21 mppa, almost 15,000 jobs added into the large city economy (Bateyet al., 1993).

(Ivanova and Rolfe, 2011) focused that impact assessment of a mining blasting in the small towns and local regions applying input-output analysis and also discussed the application of input-output analysis and indicated the strong aspects in terms of interaction between different sectors on the economy and applied the input-output model to estimate the impact of increased mining movements for regional as well as local. Changes in the coal industry were inserted into the model as an input and outputs were read from the model as changes in each of the other industries for changes in expenditure, employment, and incomes. The authors have carried out the comparison of the results for two case studies. Impacts for regional level were calculated using 25% expansion scenario in terms of (direct, indirect, and induced effects) Fitzroy region, sub-regional Central Highlands region and two former shires. (Ivanova and Rolfe, 2011) found the maximum impact on the regional level of the Fitzroy region under given assumptions. Industry output of Fitzroy Region was found to expect $2,074 million and household income in an average year $348 million 5,775 jobs, respectively. I-O model can be used to determine the economic impact of a region however, providing more precise results will depend on better information in which are about quality and reliability. To Conclusion of the paper shows us as I-O modelling can be properly applied for an industry that is not big as we consider (Ivanova and Rolfe, 2011).

(Mikulić, Lovrinčević, and Keček, 2018) analyzed the effects of wind power expansion in terms of gross value added (GVA) and employment as the most important items of economic activities and applied the input-output method was the most frequently used analysis tool that was based on the input-output table. The input-output model is generally used in order to determine the direct, indirect, and induced impact of any specific industry on the national economy. Data of research about expansion and operation of wind power plants were provided by

Croatian Energy Market Operator (HROTE) in addition a special survey in relation to financial data of operation was conducted for 13 plants in Croatia.

Determination of total impacts with regards to employment and GVA on a national economy can be divided into two sections, operations of plant and investment. They found that investment in a wind power plant expansion for 1 million euro generated 345 thousand euros of GVA in the Croatian economy and created a total of 14 hired persons with respect to full-time equivalent (FTE). Besides that, energy production with the wind of 1 million euro created 1023 thousand euros of the GVA for the national economy in Croatia and 11 jobs in the way of full-time equivalent labor. The operation of wind power plants also created 114 million euros of Gross Value Added and 481 full-time equivalent jobs in the national economy in 2016. Authors do not only determine the total direct, indirect, and induced impacts for wind power plants but also indicated the industrial distribution of the wind power plant expansion. In final, they found a positive contribution to the Croatian economy with respect to incentivizing investments in wind power plants (Mikulić et al., 2018).

A paper using the input-output model analyzed Turkey's interrelationship among food, agriculture, and energy industries. It was also explained that dependency or not between different sectors within the economy. Economic change in a sector or more sectors that will impact the total economy is described well by input-output analysis. Moreover, finding main industries using the input-output method is important for policymakers as well. In this study, the input-output table was published by TurkStat in 2012 was aggregated to ten industries and created a new aggregated input-output table to get respective coefficients such as Leontief Matrices, Leontief Inverse Matrices so on for the agriculture, energy, and food. According to the results from coefficients in line with the indirect effect, the energy sector has the greatest impact among the other sectors that is 1,44. Thus, it plays important role in the national economy. It was also found that the following energy industry; construction, and food manufacturing have a significant indirect impact on the economy. Employment multipliers also calculated as energy and

agricultural sectors, 0,1280 and 0,0534 respectively. The study also includes the income multipliers. Agriculture will generate the most income sector in terms of demand increase has the highest number as 0,880. In the conclusion of the paper, the authors emphasized that the energy, food manufacturing and agriculture sectors will create low employment capacity. Nevertheless, according to the income multipliers, the aforesaid 3 sectors generate high income. Hence, these sectors might be a locomotive of the whole economy in terms of policymakers (Karkacier and Bölük, 2017).

In a study, the development process of airway transportation, and playing an important role in the sector in terms of the economy was analyzed as of sectoral in Turkey. The input-Output approach was taken apart to explain the structural change in the economy in the paper. The input-output model used widely applied by explaining both the inter-industry structure and the connections between this structure and the economic mechanism elements that were not included in the model. While input-output analysis indicated how much input is obtained from other sectors and it expresses total production amounts made with these provided inputs and shows that how much of the output it produces is used as input for other sectors through the input-output coefficients. In the research, impacts that airway transportation the located in the services sector in turkey in terms of demand and production were analyzed by using input-output. While the total back linkage coefficient of the air transport services sector was 2.06 in 2002, then it was calculated as 1.96 in 2012. On the contrary, the total forward linkage coefficient of the air transport services sector was 1.21 in 2002 and 0.80 in 2012. Hence, sectors in the economy that have high back linkage and forward linkage were considered as key sectors. marginal employment coefficient and sectoral employment multipliers were also determined for the 2002 and 2012 years. They found that the sector with the highest marginal employment coefficient was the air transport services sector as 0,08 and 0,14 respectively in 2002 and 2012. As a result of the input-output analysis made by using tables for the years 2002 and 2012 in the economy, it has been concluded that the airway transportation sector

is a sector that has the power to influence the sectors from which it provides input. Even if it is not a key sector, and it will create value in the economy and it will also contribute beside that the sector of the airway will also contribute to employment (Kundak and Aktop, 2018).

In the essence of the research, mining sectors were aggregated and used Leontief's input-output analysis to determine the relationship between the mining sector and other sectors as well for getting some results with help of table published in 1996 by Turk Stat. In the analysis, the mining sector was aggregated under 9 sectors. To determine both direct and indirect impacts, the inverse matrix of (I-A) was estimated in the study. In addition, that by using this matrix, backward and forward coefficients of sectors were calculated, and key sectors were determined overall economy. Authors also found that when an evaluation was made for the mining sector, the highest value was 'coke oven and refined petroleum products manufacturing, which was the 6th sector with 0.872. Thus, the interindustry structure was affected mostly by this sector and as a key sector, it might be seen that ‘coke oven and refined petroleum products manufacturing sector’. It was because this sector has the highest value in terms of both forward linkage and backward linkage. Regarding the emphasis on inverse matrix, to understand the impact of demand for a particular good on all sectors, a total column of the sector was considered that was the producer of that good in the inverse matrix. While the backward linkage effect of the 'crude oil and natural gas extraction sector was low, the forward linkage effect is high. The paper also showed that sectors that have fewer backward linkages produce generally intermediate goods (Çondur and Evlimoğlu, 2007).

(Gerçek, 2000) discussed and suggested some important factors in the economic assessment of highways, in the light of the results obtained from some recent highway feasibility studies. Transportation is one of the first sectors that Cost-Benefit analysis is applied in investment decisions as well. Two different cases were examined in the assessment. One is a 2x3 lane highway that will be constructed in a corridor that is a state road with 2 lanes. In another case, the

current state road will be improved as a 2x2 lane divided road and its capacity will be enhanced. While the study also considered some assumptions as 4,6 and 8 million USD per kilometre as construction period and estimated highway cost, the cost per kilometre of improving the current state road into a 2x2 lane divided road is projected as 1 million USD. Besides that, duration of road, the project is usually evaluated as 25-30 years. In the economic assessment of the project, the economic net present value and internal rate of return of the project have been examined by calculating the economic costs and benefits for the highway and divided roads for 30 years of operation phase. economic cost and benefits are considered in the economic assessment of the project are following, highway construction cost, vehicle operation costs, maintenance and repair costs for both highway and state roads and accident costs as well. In this research, the cost of highway per kilometer was taken between 4-8 million USD and the average of travel time was taken respectively for automobile and bus passenger as 2.45 $ hour/person and 1.05 $ /hour/person. The value of EIIR the Annual Average Daily Traffic values in respectively 2000 and 2030 are 12,000 and 100.000 vehicles for highway, was found about %9. Also, the total highway cost per kilometer was taken as $ 4 million in the study. If the economic value of the time increases from $ 2.45 / hour to $ 3.50 / hour for automobile passengers and from $ 1.05 / hour to $ 1.50 / hour for bus passengers, EIIR is found as %10. The author also mentioned in the research that in the case of the proportion of heavy vehicle on the highway decrease, economic feasibility will be affected positively (Gerçek, 2000).

(Topçuoğlu and Ersungur, 2017) emphasized the need for planning on a city basis in Turkey and a static input-output model that might be based on city planning was applied. In this regard, the Economic structure of the city of Iğdır was analyzed using the input-output method in the study, key sectors also were determined with the aid of forwarding and backward linkage coefficients of the sectors in the city. In addition, production, employment, and income multiplier analyses needed in the economic planning process of Iğdır were made in the study. The data used in the analysis process were provided from official

institutions, organizations, and fieldwork. Also, A survey was applied to a total number of 213 businesses in 33 industries in Iğdır. The static input-output model assumes constant production coefficients between inputs and outputs, investments regard as exogenous and examine in the final demand. Research indicated that key sectors in an economy can be defined as sectors that total backward and forward linkage effects were high and positively affect other sectors in the economy towards development with these linkage effects. Sectors that have high total backward relationship were respectively: Agriculture hunting and related service activities, auxiliary activities to financial institutions, retail trade excluding motor vehicles and motorcycles, repair of personal and household goods and hotels as well while, the sectors with high total forward connections are respectively as to agriculture, hunting and related service activities, auxiliary activities to financial institutions, wholesale trade and trade brokerage, furniture manufacturing industries, etc. In the study, the highest production multiplier in the sectors and therefore high structural bonding are respectively in agriculture and hunting, and related services activities. In addition to the production multiplier, the industries with the highest employment multiplier are printing and extension, water collection, treatment and distribution, quarrying, and other mining. As a result of the study, it was concluded that urban planning would help eliminate the socio-economic imbalances arising from the development level differences in Turkey (Topçuoğlu and Ersungur, 2017).

In the research, the contributions of industry and service sectors to growth and employment in Turkey, the structural changes in the Turkish economy, relations between industry and service sectors and the role of these sectors in the Turkish economy, investment priorities and key sectors were analyzed using input and output tables. The interindustry connection is essential in identifying the key sectors in the country economy that accelerates the development process. Key sectors are also defined as sectors with high total forward and backward linkage effects. The data in the study were used input-output tables for 35 sectoral that has been created for Turkey and published by World İnput-Output Database (WIOD).

In Input-Output tables for WIOD, a classification that was based on NACE Rev. 1 was used and a total of 59 sectors are aggregated into 35 sectors. Authors found that the production structure of the Turkish economy tends towards the industry and service sectors from agriculture in developments in the value-added and employment ratio of the key sectors. Population related with agriculture that has left was employed in majority by the service sectors. In the end, the study indicated that the share of agriculture in production and employment significantly decreases, while the share of industry and services sectors increased. Besides that, during this period, the share of the service sector increased faster than the industrial sector, had importance in employment increasing. It was also found that public administration, defense, social security, education, and other public service activities have high employment multipliers while their efficiency was quite low. Except for these sectors, the industry and service sectors have relatively lower employment multipliers. Key sectors are also found that textile and textile products, wood products, paper and paper products, printing and publishing, coke, petroleum products and nuclear fuel, etc. for the Turkish Economy in 2011. Backward and forward linkage effects of the industrial sector were high than the service sector was important in terms of generating demand and providing intermediate inputs for the service sectors (Uğurlu, 2017).

(Erkök, 2018) applied using input-output analysis to examine the interaction of the automotive sector with other sectors and the dependence of production on imports as the automotive sector that has the largest share of foreign capital companies, plays an important role in terms of exports. Direct backward and forward linkage coefficients, total backward and forward linkage coefficients and leakage coefficients were also calculated for the automobile industry. In the study, features of the input-output table were also mentioned as follows; Intermediate inputs used in the national production of a particular sector might be calculated in which was based on a national input-output table. In addition, it enabled to determine the sectors in domestic that use imported inputs from which sectors abroad obtain these inputs. In the input-output table for 2002 that has 59 sectors,

the automotive sector was 4th place in terms of numerical size and backward linkage coefficient was 0,7572. Thus, the aforesaid sector requires 76 units of input from other sectors to produce 100 units, so it significantly increases the productivity in the economy. Contrary to this, the automotive sector was 41st place in term of size among 59 sectors. In the study, partial forward linkage coefficients were calculated on a sectoral basis to find out by which sectors the automotive sector production was used as input. As a result of the calculation, it was found that the sector with the highest direct forward linkage coefficient was the automotive sector (motor vehicle, trailer, and semi-trailer manufacturing) with a value of 0.2267. The ratio of imported intermediate inputs in the production of all sectors in the Turkish economy was found to be 0.2462 for the automotive sector and from this result, it was 15th place among 59 sectors. Thus, the intermediate inputs approximately of 25% used in the production of one unit in the sector consist of imported intermediate inputs. The share automotive sector imported inputs in the production was calculated as 0,1210 has the highest coefficient in all sectors. It was also stated in the study that the sector with the second highest coefficient with 0.0291 was the 'plastic and rubber products manufacturing sector. Apart from these, leakage coefficients were calculated for the Turkish economy on a sectoral basis. From the calculations, the automotive sector takes place with a coefficient of 0.4856. The total backward linkage coefficient of this sector was found 2.9942. Therefore, in case of a one unit increase in the final demand of the sector, total production in the whole economy increases by 2.9942 units. For this reason, the authors indicated that the automotive sector, which has a high total backward linkage, has a high capacity to increase total production in the economy, and so the automotive sector can be said as the key sector in the economy. Even though the automotive sector is the leading sector in term of export, it makes a limited contribution to the country's economy due to its structure of dependent on imports during the production process (Erkök, 2018).

It was analyzed the forward, and backward linkage coefficients of sectors were calculated for both developed (G-7 Countries; Germany, US, United Kingdom, Japan, France, and Italy) and emerging countries (China, India, Argentina, Turkey, Brazil, Greece, and Indonesia) and applied input-output analyze to explain the relationship between sectors and to determine sector or sectors that have a high efficiency on the economy. The basic information used in the input-output analysis is related to the product streams originating from each sector and it can be thought of as a producer and acted as a consumer. The data of input-output tables used in the study were provided by compiling OECD data. The study was examined the total forward linkage and total backward linkage ratios showing indirect effects as well as the forward-backwards linkage effects from the technical coefficient's matrix and the Leontief inverse matrix to analyze the inter-sectoral relationships by using the input-output tables. Within the scope of the analysis, sectors with high forward linkage effect in developing countries are the following: 3rd sector (Manufacture of paper and paper products, coke, refined petroleum products and nuclear fuel manufacturing-chemical and pharmaceutical manufacturing-plastic and rubber manufacturing so on) for Turkey and China. Sector 10th (Machinery and equipment rental-computer and related activities-research and development services so on) for Indonesia, Argentina, and Brazil, Sector 1st (Agriculture-forestry-hunting-fishing-mining and quarrying) for Poland and Hungary, and 4th (Machinery and equipment manufacturing-office, accounting, and data processing machinery manufacturing so on) for Greece. Besides that, the sector with high backward effect in developing countries is Indonesia (Sector 6), China (Sectors 3 and 4) and Hungary is Sector 2. In the paper, the authors also determined that the sector with a high total forward linkage effect was the 3rd sector, while the sector with a high total backlink effect was the 2nd sector for Turkey, Brazil, and Greece in all developing countries. Therefore, according to the result, they concluded that the activities in the manufacturing industry in developing countries are an extremely important sector. It was also calculated the employment and value-added multipliers that show changes between sectors in terms of employment and value-added in the study.

Concerning employment coefficients and employment multipliers, sectors affecting employment could vary. Hence, Sector 11 (Public administration and defense defense-compulsory social security-education services etc.) in Turkey, Sector 12 (Service works performed at homes-entertainment, recreation, culture, and sports-related activities) in Brazil and Greece, and Sector 1 (Agriculture-forestry-hunting-fishing-mining and quarrying) in China are effective sectors both according to employment coefficients and employment multipliers. According to the value-added coefficients and value-added multipliers, outstanding sectors in the countries are respectively, 11th and 3rd sectors in Turkey, 9th and 1st sectors in Indonesia and India, 9th and 3rd sectors for China, Brazil, Argentina, Greece, Poland. 12 and 3 sectors. In final, In the analysis that was performed that manufacturing sector has the highest effect on the economy in emerging countries was determined. Besides that, the manufacturing industry has the highest added value in developing countries. Another important subject that was mentioned in the study, usually the same results have been obtained in countries in the same region and with close development levels (Yıldız and Akduğan, 2014).

It has been analyzed analytically using the input-output method whether the ICT sector was a key sector for the Turkish economy. In the scope of OECD World Input-Output works, it was examined the effects of employment and value-added of ICT on the Turkish economy by using the newest input-output tables with 48 sectors for 1998-2002 that created for Turkey. According to the tables for 1998 and 2002, It showed that for the information and communication technologies sector, 0.71 units of value-added in 1 unit of output, so 0.29 units of intermediate input were used. In 2002, it changed dramatically and 0.46 unit of added value in 1 unit so, 0.54 units of intermediate input, within 1 unit of output was used. This result shows that the value-added of the sector decreased and became more dependent on intermediate inputs between 1998-2002. It was also determined that manpower of 0.18 units in 1998 decreased to 0.14 in 2002 in 1 unit of output and the amount of capital in which was 0.52 units in 1 unit of output in 1998, decreased by 0.31 in 2002. According to the sectoral value-added rates, the share

of value-added in the sectoral domestic production decreased from 72% in 1998 to 46% in 2002. Similarly, this situation has been observed in all production sectors. The decrease in the value-added ratio in the whole of the economy means that an increase in the number of intermediate inputs used in domestic production. Regarding the marginal employment intensity coefficient and total employment multipliers, it was found that while the marginal employment intensity coefficient decreased, the total employment multiplier coefficient of the sector increased. In addition, according to the determination carried out using the input-output table, the Information and Communication Technologies sector was the sector with the highest rate of import dependency in 2002 compared to 1998. With respect to ICT Sector forward and backward linkages, the ICT sector is in 19th place in terms of being a key sector according to Input-output tables, which were created for Turkey and aggregated into 45 sectors. As a conclusion of the paper, he found that the information and communication technologies sector started to take increasingly an important place for the Turkish economy and spread its relationship with other sectors. As a result of the study conducted according to the input-output table in 2002, even though it is difficult to say that ICT is a macroeconomically critical sector for the whole economy, it increases its relationship with other sectors and creates additional employment (Taşçı, 2013).

(Farooq, Hardy, Gao, and Siddiqui, 2008) applied static I-O model to determine the effects of the Intelligent Transportation system (ITS) on Michigan's economy and analyze the relationship on other sectors. Moreover, the study was examined that effect is limited on a single industry (transportation industry) or not within a region so, the Regional Input-Output Modelling System (RIMS II) of the I-O model include all sectors within a specific region and adjusted regional I-O tables were used to calculate the output and employment multipliers for every industry in the study. Advantages of ITS implementation in the applied region were evaluated by calculating reduction contributions as of fuel cost, delay-congestion time savings. The multipliers were also given as before and after ITS opening. In the I-O table, ITS is not described yet thus, ITS effects will be measured locally

by targeting an industry or more. The most definitive method of determining a regional I-O model was based on the survey of the businesses in a region however that costs a lot and usually were not completed. Thus, non-survey models are usually conducted. Output multipliers were computed respectively, before ITS, ITS incorporating maximum 22% delay reduction, and Conventional transportation methods. Results showed that it will generate more jobs in the transportation sector than in the other cases. Thus, they found that execution of fully ITS outcomes will have a positive impact on Michigan economy in terms of output and jobs in many industries (Farooq et al., 2008).

(Kayacan, 2014) analyzed the inter-sectoral relationship of services and goods related to forest resources with the input-output model at a national scale. Apart from the analysis on the basic model created, it was also examined that the structure of the basic model and the possible effects of various changes and expansions that can be predicted in the final demand about its resources that is based on the input-output model. A new inter-industrial input-output model was created that was based on TurkStad's input-output model. The Paper also indicated I-O tables can serve two main purposes analytical and statistical. Analytical I-O analyzes mainly focused on the interactions and connections of the sectors within the economy. The purpose of analytical I-O was to predict the possible economic effects of various changes that can be expected in the economy (for example, new industry development, changes in final demand, etc.). All eight national I-O models that have been generated for Turkey include the forestry sector. The study data were based on the basic or initial national I-O model that was the most updated data in 1996 by TurkStad. The economic impact analysis made in the study was considered as fundamental and scenario analysis. In a scenario, is to predict to see the possible results of another direct use of grass and foliage utilization for forest resources into the basic I-O model. Because of that, the approach of extensionality of the forestry sector with the utilization of grass and leaves in the model was chosen. In this scenario, it has been tried to be predicted not only weight in the economy but also impacts of basic inputs in what direction

and level changes for the forestry sector. Another scenario in the study is to be examined the possible economic impacts of the predictable increases for the spending of the hunters in the country. The inputs of the Hunting Service sector added to the basic model were taken as the expenditures of the General Directorate of National Parks. Concerning the hunter of expenditure increase, the profile of an annual hunter's expenditure was tried to determine for a hoofed animal. Then the economic effects were determined if five hundred thousand hunters face a situation that they can hunt one hoofed animal per year. The analytical results of the analysis made within the framework of the basic model and the multiplier analysis were calculated respectively for production, basic input (income and imports), and employment. The simple output multiplier of the forestry sector was calculated as 1.190868 for the forestry sector with code 04 in the model of research. The multiplier value was lower than the arithmetic average of the multipliers of 48 industry. Moreover, the forestry sector ranks 45th place in terms of simple output multiplier size. Thus, he found that the low simple output multiplier of the forestry sector is generally due to the relatively weak backward linkage of the sector. About the final demand increase of 1 TL for the outputs of the forestry sector and the direct production increase of 1 TL in the sector so, it generates 0.26 TL salary-wage income and another factor income 0.57 TL and total 0.83 TL value-added. In this case, the forestry sector is at the top in terms of direct factor income impact ratios. From the point of forestry sector, 1 TL of outputs of sector final demand for increase in whole economy with direct and indirect interactions will create 0.280 TL in wages-wages, 0.657 TL in other factor income (therefore 0.280 + 0.657 = 0.937 TL in net value added), 0.009 TL in depreciation, 0.033 TL in indirect taxes (therefore 0.280 + 0.657 + in gross value added). 0.009 + 0.033 = 0.979 TL) and 0.021 level increase in complementary imports. About scenario analysis, the total expenditure of the Budget of the General Directorate of Forestry is shown in the study as 6 884 986 million Turkish Lira in 1996. 6 613 289 Million TL is for personnel expenses and 52% is for salaries, 32% is compensation and awards and for the rest of it is social aids, medical support, and overtime payments, etc. Within the scope of this

scenario, 6 613 289 Million TL from the Budget of the General Directorate of Forestry has been transferred from the basic input item of "Compensation" in the State Services sector to the forestry sector of "Compensation " as the basic input item. A transaction that has been made was also illustrated in the usage and flow tables. The levels and ratios of inputs and outputs of the forestry sector in the basic model were already calculated. Thus, there has been a change in the values in the table related to this change. Therefore, it was found that the total input and output level of the forestry sector increased to 100.984.177 Million TL, thus the share of the sector in the whole economy increased from 0.34% to 0.37%. Along with the scenario, there have been changes in the basic input multipliers of the forestry sector. For example, the increase in the compensation that was paid to employees has brought the sector from 4th place to 2nd place. On the other hand, even though the increase in net and gross value-added rates, these increases were not enough to change their place in the ranking. At the end of the scenario, the author indicated that there was no change in the ranking of the Forestry sector according to the basic analysis in terms of any Type I basic input multiplier. However, there was a decline in all of them as of level. For the scenario related to grass-foliage utilization, the lower limit value of grass-foliage utilization provided from forest resources was 186.184.172 US Dollar and it was equal to 15.15 Trillion TL in 1996. This value is about one-third of the income obtained by the General Directorate of Forestry's sales of forest products in 1996. According to the changes in the usage and flow tables, the total input and output level of the forestry sector has been increased to 109.523.673 Million TL and the share of the sector in the whole economy has increased from 0.34% to 0.40%. As other factor payments in the sector have increased, the level of value-added for the sector, their ratio to the total input of the sector and their share in the relevant items of the whole economy also increased. As a result, the share of the sector in GDP has increased from 0.51% to 0.61%. If grass-foliage utilization is included in the model, the effect of other factor incomes of the forestry sector according to the basic analysis is directly 15.152.785 million TL and indirectly 3.008 Million TL, a total of 15.155.793 million TL more. However, the added-value increase caused

by the scenario could be limited to 15 153 032 Million TL due to a decrease in other net and gross value-added items. On the other hand, the use of imported inputs decreases 247 million TL with the scenario. In this study, regarding the Hunting Service sector, the General Directorate of National Parks of inputs was obtained as 123.504 million in terms of budget types and expenditure items. The transactions made for the hunting sector were added to both the usage table and the supply table as the 49th sector. "Symmetricization" process which was made in the basic analysis was conducted to have new usage and supply tables for 49 sectors. At the end of symmetrization, the 49 numbered column of the new sector that was named the Hunting Sector, has been created in terms of "industries". Therefore, the effects of the Hunting Service sector, which was added to the model with the numbered 49 has been determined on the economy in various aspects and the output (production) multiplier of the new sector was calculated as 1.929381 with 6th place. According to the results that were obtained, it was found that the Hunting Service General Directorate of National Parks sector was much more effective than the forestry sector that was 45th in terms of simple output multiplier. In addition, the basic input payments (value-added and complementary imports) created by the hunting service sector in the economy were examined separately and in comparison, with the forestry sector. Since studies statistically have not been done insufficient scope and in detail on hunter expenditures in Turkey, a hunter expenditure profile for the hoofed animal has been envisaged by considering Turkey's hunting life potential and socio-economic conditions with respect to the increase of hunter expenditures. The possible effects of five hundred thousand hoofed animals to be hunted sustainably by five hundred thousand hunters on sectoral production levels have been calculated based on predictable assumptions and values. Findings show that it led to additional production of (approximately 418 million dollars) in the economy for the first scenario. It was 1.7 times the projected increase in direct hunter expenditure of 20 Trillion (245 Million Dollars). Even though production increase is expected in almost all sector due to backward linkages (indirect relations), the production of some sectors is relatively more affected by these backward linkages except for the 11 sectors that

were predicted to be directly affected in the scenario for example agriculture and refined petroleum products. In conclusion of the study, it has been determined that the simple and weighted simple output multiplier of the forestry sector were very low. To explain more clearly, the direct or indirect effect of the sector on the whole economy is very low which means that the backlinks of the forestry sector were weak. On the other hand, the author showed that the forestry sector was relatively efficient in creating income directly and indirectly. The direct and indirect effect of income (value-added) that occur because of production of the sector and one-unit increase in the final demand for forestry sector outputs in the whole economy was indicated to be significant in the study. When the forestry sector was found out in terms of the linkages in the economy, it was one of the three weakest sectors in the research model in terms of backward linkages (total direct and indirect). The strongest backward linkage of the forestry sector was come up "Road transport" in both direct and total. Forestry is the 5th sector with the highest direct forward linkage. However, it has been observed to be somewhat lower in terms of total (direct and indirect) forward linkage. The two sectors with the strongest forward linkages in the forestry sector were found "Timber, wood products, papermaking and furniture manufacturing" and "Dairy products manufacturing", although their rankings differed in terms of direct and total forward linkage. Regarding goods and services related to forest resources in terms of expected some changes and their consequences were also examined in the basic analysis. As a result of these scenarios, changes in levels, ratios and rankings were compared with the basic analysis. Regarding the transfer of 6.613.289 Million TL (80.814.391 Dollars) of personnel expenses belonging to the Budget of the General Directorate of Forestry from the government services sector to the Forestry sector, compared to the basic analysis, the changes in direction with, simple multiplier and Type I effects of the forestry sector on basic inputs with aforesaid scenario were not very striking, however, it still could be considered remarkable. The total impacts of this scenario on the basic inputs for the whole economy, an increase of 6.616.344 million TL has been occurred in compensation for employees, while the other factor incomes have been decreased 2.787 million

TL. If the grass and leaf value was included in the basic model as an intermediate input from the forestry sector to the Livestock sector, the other factor income of the forestry sector from 53.590.383 million TL to 68.743.168 million TL, and therefore the gross added value of the sector was from 81.413.926 million up to 96.566.711 million TL. Therefore, it increased the share of the sector in other factor incomes in the whole economy from 0.48% to 0.61% and its share in GDP from 0.51 to 0.61%. it can be said that there were significant changes in the impact rates of the forestry sector on basic inputs with this scenario. A total (direct + indirect) increase of 15.155.793 million TL has also occurred in the other factor income earned in the whole economy with the inclusion of the utilization of grass and leaves from the forest into the basic model. Another scenario of economic impact that was analyzed in the study was related to hunting-wildlife management and its expenditures. At the beginning of this scenario, the 'Service of Hunting' sector has been added to the model. The activity volume of service of hunting was 123.504 million TL (1.509.219 Dollars) in 1996. Even though the volume of the added Hunting Service sector was indicated little, the author found that the multiplier effects were quite considerable. The simple output multiplier of the sector was calculated as 1.929381 and was ranked 6th among 49 sectors. In the second part of this scenario, the economic impact of the hunter expenditures was determined by the realization of Turkey's hoofed animal potential in a particular measure and to be made to hunt these animals. According to the results of the study, the projected expenditures of 20 trillion (245 million dollars) for hoofed hunting in 1996 was resulted in additional production of 34 trillion (418 million dollars) in the whole economy due to backward linkages. Since impacts of direct or/and indirect expenditures of hunter, levels of production for 46 of the 49 sectors, including the service of hunting sector have been increased a less or more. The largest direct and /or indirect increase in their production with hunter expenditures increase scenario has been found in the manufacturing of 'metal goods including machinery and equipment sector as 5.934.050 million TL. Since the projected, 20 trillion total of hunter expenditures was considered as final expenditure the level of increase basic input in the whole of the economy (direct-

indirect) would be again 20 trillion as well. It has been concluded that the proposed and illustrated changes and expansion concerning the inclusion of good and services about forest resources in the national input-output model and the impacts and place of forest resources in the national economy were more clear than the conventional approach (Kayacan, 2014).

In the study, it was examined that to measure the interindustry connection, calculate different multiplier coefficient of the sectors and analyze the dependence on imports by assessing the structure of production in the Turkish economy. The data used in the study were aggregated from 59 sectors to 33 sectors for an input-output table of 2002. Especially, the manufacturing industry sub-sectors namely 'Food, Drinks and Tobacco', 'Textile', 'Paper and Paper Products', 'Coke Coal' etc. sectors have been evaluated as the main subject of the study was to examine the production structure of the manufacturing industry. Since the main subject of the study was to examine the production structure of the manufacturing industry especially, the manufacturing industry sub-sectors such as 'Food, Drinks and Tobacco', 'Textile', 'Paper and Paper Products', 'Coke Coal' sectors etc. have been evaluated. At the beginning of the study production, income, and capital multipliers have been calculated using the input-output table with 33 sectors. The sectors with the highest production multiplier value were found respectively; radio tv and communications devices (3,0936), motor vehicles and trailers, basic metal industry. Thus, concerning the production multiplier, one unit increase in the final demand of the "Radio, TV and Communication Equipment" sector that has the highest production multiplier will cause an increase of 3,0936 units in all sectors of the economy. while one unit of this increase is direct, and the other 2.0936-unit part shows the indirect increase of production. The sectors with the lowest production multiplier are 'Education Services', 'Real Estate and Leasing', 'Financial Intermediation'. About income multipliers, income multipliers were calculated, the sector with the highest income multiplier was found as the ‘Education Services' sector. Hence, a one-unit increase in the final demand of the 'Education Services' sector will, directly and indirectly, lead to an increase of

0.7249 units of labor income in the economy. The author emphasized and found that although the education services industry's production multiplier was the lowest value, it had the highest income multiplier value. The highest capital multiplier value in the sector was found in 'Electricity, Gas, Water' by calculating the capital multiplier. One unit increase in the final demand of the sector causes a direct and indirect increase of 0.1486 units in the consumption of fixed capital of the economy. Sectors with the highest capital multiplier except water, electricity and gas sector was found 'Non-Metallic Mineral Products', 'Textile', 'Plastic and Rubber Products, etc. in the study, while the lowest capital multiplier become 'Education Services', 'Real Estate, Rental, "Other Social, Social and Personal Service Activities" etc. The direct backward and forward linkage impacts of the sectors were calculated according to the Chenery Watanabe Method using the 2002 Input-Output table of the sectors in the Turkish economy. Besides that, direct backward and direct forward linkage impacts in the increase of production only reflect direct effects for sectors. The sector with the highest direct backward linkage was Radio, TV, and Communication Devices, while the sector with the highest direct forward linkage was the Paper and Paper products sector. It was found in the study that all the top ten sectors with the highest direct forward linkage impact and eight of the top ten sectors with the highest direct forward linkage effect were manufacturing industry sub-sectors. The direct forward and backward linkage effect index values of the sectors were determined by using the Chenery-Watanabe method. As a result of these results, sectors with an index value greater than 1 are identified as a key sector in the economy. Therefore, sectors with both index values for backward and forward greater than 1 were found following; 'Textile', 'Wood and Cork Products', 'Paper and Paper Products', 'Printing and Publishing', 'Coke Charcoal, Refined Petroleum, Chemical Substances and Products' etc. In the study, five sectors that can be regarded as key sectors for the Turkish economy were found for manufacturing industry sub-sectors such that 'Paper and Paper Products', 'Printing and Publishing', 'Plastic and Rubber Products,' 'Metal Goods', 'Electrical Machinery and Devices'. About the dependence of production on imports, the backward linkage coefficients of

imports were calculated. As a result of this calculation, the sectors with the highest dependency on imported intermediate inputs were found as 'Radio, TV and Communication Devices', 'Base Metal Industry', 'Motor Land Vehicle and Trailer', 'Coke Coal, Refined Petroleum, Chemical Substances and Products'. The sectors with the lowest use of imported intermediate have been found as "Education Services", "Public Administration and Defense, Compulsory Social Security", "Real Estate, Rental, R&D", "Hotels and Restaurants". In final, the author implied that import dependency in terms of intermediate inputs was high in the Turkish manufacturing industry in the study. Sectors with the highest multiplier values and linkage impacts were found to be sub-sectors of the manufacturing industry. However, the increase in production in these sectors will increase the import demand of the sectors. Therefore, it was also mentioned in the study that this situation will lead to a foreign trade deficit (Alp, 2016).

The study has been evaluated in terms of the public benefit and total cost of road construction on the public economy. In addition, that it was examined the transportation, planning for the design of divided roads, maintenance, and operation phases by applying scientific methods. In this regard, the studied divided state road was 14 km asphalt surface treatment and was examined the cost and benefit analysis and evaluated also according to the net benefit and cost ratio at the end of the project life, together with the discount rates. With respect to analysis items in the study, it was limited with construction cost, maintenance and operation expenditures benefit from vehicle operation expenses, time-saving for passenger and driver and time saved capital. The estimated average cost of the Karamanlı-Tefenni road was 12.031.784 TL, including art structures, earthworks and pavement works. In addition, the road maintenance cost of the 14 km road has been determined as 402.297 ₺ annually. The total cost of the road to be built was 6.015.892.00 TL according to the discount rate of 12% in 2013, the total of the benefits was 2.394.607.00 TL, and its net present value was as for 2.934.493,27 TL. The benefit/Cost (B/C) ratio was found as 1.20. According to this result, as this ratio was higher than 1, it could be said that the project was feasible. At the

end of the study, the improvement of the state roads or highway provide economic benefits and enables fast and safe transportation for the desired location. Hence, these benefits have been proven because of the investigations. The study was also shown that the 14 km state road between Karamanlı-Tefenni was a proper study for the purpose of road improvements, and a good example for other projects to be carried out (Çoşar, 2019).

(Li, Cai, and Wang, 2017) applied input-output model and scenario analysis to estimate the economic impacts of wind and PV power expansion in terms of industrial output and GDP on the economy in China. In addition, the economic effects of renewable energy resources generation replacing coal-fired power generation were also examined in the study. In the paper, the value-added and total gross output value were examined in terms of the economic impacts of renewable energy resources like the wind and solar industry of China. Recent updated Chinese 2012 input-output table for 139 sectors was used in the study. Results concerning impacts of wind and solar PV power expansion were calculated for value-added and gross output from 2016 to 2030. it was found that when one unit of output is to produce the mentioned renewable energy sectors, approximately 0.95 unit of indirect output will be generated in other sectors, so the total sector output will be 1.95 units. With regards to total value-added, it is calculated as 1.50 units and it consists of 0.50-unit indirect value added in other industries. According to the calculations made in the study, for the period between 2016 and 2030, wind and power sectors will create directly and indirectly 1300 billion dollars in value-added while the solar industry will create 1042 billion dollars. Expansion of renewable energy resources in terms of solar and wind will trigger power, grid, and finance sectors. In the study, besides that, it was found development framework has a greater contribution to GDP than in the reference framework. Thus, the author concluded that renewable energy in terms of wind and solar power generation in 2030, whole investment in wind and solar would be 2541.5 billion dollars that are approximately %1.05 of the total Gross Domestic Product (Li et al., 2017).

(Spörri, Borsuk, Peters, and Reichert, 2017) determined changes in production and employment as of particular-industry using the twelve-sector input-output model. Before estimation of the planned rehabilitation project for a 4 km river impacts, building a regional model has been made from the national matrix with a non-survey. Thus, national coefficients were revised as to local technical coefficient by using regional purchase coefficients. The total cost of construction was regarded between CHF 22 to 37 million for 4 different reclamations except for land purchases. According to the model that was developed for river rehabilitation, the annual impact of local output and employment were calculated for 1 million CHF as follow; employment increase about 8 jobs in the construction industry and local output increase was determined 1.4 million CHF for annual. Besides, that indirect impact was found also 0.4 million CHF in other words 40%. Total employment in area A changes between 0.5% - 0.8% and between 0.01% - 0.02% of the total employment in area B for additional employment as it relies on the different rehabilitation alternatives. Concerning output for the construction sector in the study that it varies respectively, between 0.8% - 1.3% for A and between 3.8% and 6.4% for B. Model used in the study, should be adapted to other projects that are quite simple. Data on employment in a region was sufficient to account for the impacts (Spörri et al., 2007).

(Sarıışık, Akova, Türkay, and Sarı, 2011) applied the input-output model to determine the economic impact of tourism on the whole economy. The backward linkage coefficient enables the calculation of the contribution of each sector to tourism production. According to the description of the backward linkage coefficient, it was found as 0,521 for the tourism industry. Therefore, for this calculated number, it shows that almost 0.52 units of input must be provided for 1 unit of production in tourism. In addition, it is possible to have an idea about the relations between the industries by calculating the interrelationship. The proportion of the amount that a sector provides input for tourism to the total production input in tourism shows the contribution coefficient of the sector. Supporting and auxiliary transport activities were the highest backward linkage

coefficient as of %17. The next highest contribution was encountered by the food and beverage manufacturing sector with 13%. In relation to the forward linkage coefficient for tourism, it shows the level of contribution of a sector to other sectors. Thus, it is the proportion of the total amount of intermediate products produced to the production amount. In this context, the forward linkage coefficient ratio of tourism was found to be 0.41. This result shows that a 1 unit of production increase in tourism will contribute 0.41 units to the production of other sectors. The highest sectoral contributions are following %25 with land transport and %23 supporting and auxiliary transport and travel agencies. In addition, the article also emphasized the General Equilibrium Model which can be considered as an alternative approach apart from the input-output analysis. General Equilibrium Model explain the impacts of decreases or increases in variables such as income, price, and demand on other dependent industries (Sarıışık et al., 2011).

(Gül and Çakaloğlu, 2017) accounted for the structure of the construction sector using input-output modelling and he showed the position of construction sectors between other industries and improvement over time that based on inter-sectoral linkages after 2000 with forward and backward linkages multipliers. Backward and forward linkage multipliers, input, output, discrete output, discrete income, discrete type II income, discrete employment, and discrete type II employment through the updated 15-year input-output table 2000-2014 from provided the World Input-Output Database (WIOD) project multipliers have been calculated. IO tables consist of 56 sectors and the sectors were aggregated to18 sectors. As a result of these calculations, the authors aimed to reveal whether the construction sector was one of the key sectors of the economy between 2000-2014. the average growth rate of the construction industry was 9.2 percent between 2000 and 2014, while the growth rate of the gross domestic product remained at 5.2 percent according to the average growth rate. The dependency relationships of the sectors were calculated within the framework of the forward and backward linkage multipliers. According to the results, sectors with strong backward linkages multipliers were found as manufacturing and industries that use all kinds of

machinery. Sectors with strong forward linkages multipliers were agriculture, mining, finance and machinery and equipment sectors in the study. Besides that when the employment and income multipliers were examined together, it was seen that the capacity of the construction sector to create employment is limited to itself in the face of demand increase, and the income generation effect was more widespread than employment. In the light of the findings of the study, it has been revealed that the construction sector remains limited in the economy and was not a key sector (Gül and Çakaloğlu, 2017).

CHAPTER FOUR

RESEARCH METHODOLOGY AND DATA

4.1 METHODOLOGY

Economic impact estimation of infrastructure investments can be analyzed with most widely used methods such as Regional Input-Output Modelling (RIMS), Economic Input-Output Life Cycle Assessment (EIO-LCO) models, Regional Economic Modelling (REMI), Impact Analysis for Planning (IMPLAN), Spatial Computable General Equilibrium models for Input-Output approach. In addition to these methods, while another widely used approach is Benefit-Cost Analysis (BCA) for planners and researchers to analyze and compare transportation projects Multi-Criteria Analysis (MAC) is also one of the famous models to analyze transportation investments to help policymakers. Hence, Input-Output analysis that has been employed mostly is one of the general equilibrium methods. Among all these methods, the I-O model is most suitable to analyze the direct, indirect and induced economic impacts when the data is sufficient, as it is clear in structure and intuitive in results.

Input-Output model has been used in many fields in terms of identifying the effects in the regional and national economies since Wassily Leontief was firstly published in 1936 (Farooq et al., 2008). I-O model analysis can be accounted for as one of the most important contributions to the economy in the 20th century. The Basic Leontief Input-Output model is derived from observed economic data in a particular region. In the I-O model, fundamental information used is related to product streams generating from a sector so it can be considered as a producer and acts as a consumer (Yıldız and Akduğan, 2014). Thus, I-O models also give an idea to help policymakers in organizing a region development.

With respect to the model, it can be considered as the most beneficial tool for determining the inter-industry impacts by using the coefficients from the I-O table

(Lee et al., 2018) and application of input-output methods is based on the input-output tables (Richter, 1998). I-O tables consist of row and columns that represent the inter-relations and linkages of industries and explain the inputs that are used by the other sectors in order to produce one unit of each sector in an economy.

Especially, it helps to assess the economic impacts of big projects in terms of identifying the direct, indirect, and induced effects at regional, local, state or country level. I-O model might be a good research methodology to find out the influence of the construction spending (which predominantly works with respect to construction and secondary effects of construction) on the other sectors (Anas et al., 2015). Therefore, in order to estimate relevant changes in output for the whole economy, gross value, and employment. I-O model will be implemented in the thesis. Moreover, the application of the model is easy, and the obtained outcomes are interpretable.

Typically, the classification of I-O analyses is grouped under two types: one is the closed model approach and the open model approach. In the open model, final demand changes (for example in raises) can be envisaged of sectoral production, income and employment impact and final demand is regarded as being an exogenous parameter. Thus, it determines the industrial production to meet the given demand in terms of prices and quantities for the vector of the final demand and evaluates the impact of demand on supply. With this approach, changes in the final demand can be analyzed the direct, indirect, and induced impacts on the industries and entire economy.

Apart from the open model, one of the components from the value-added ‘compensation’ row and another factor of the final demand ‘household’ consumption’ column are got involved in the inter-industry structure in the closed model. It is necessary to understand the point that what expenditures and which incomes in the economy will be covered in the rows and columns of the new household sector to be an equal total of the row and columns. Besides that, while the household industry gets income (sector row) by selling the labour that is

'output' to other sectors and final demands, it buys from other sectors (sector column) for the supply of labour as its output (Davis, 1993).

4.2 BASIC STRUCTURE OF INPUT-OUTPUT MODEL

I-O model focus on the linkages between sectors and inter-sectoral relations Therefore, it determines the possible economic impacts of various changes which based on expected changes in the economy (new industry or final demand changes etc.). Moreover, it has to be set production function or its technology for each sector to solve this kind of analytical problems. Thus, it requires modelling that based on an industry symmetric table.

In a regional or national economy, it is possible to sort production activities into various industries and divide them into n industries. Industry in the economy might use outputs of all industries including itself as intermediate inputs for production or industry can give its output to all industries including itself as an intermediate input. An example of illustrated table 4.1. is given below and explains how I-O table for the economic structure that contains three productions sectors.

Table 4.1. I-O Table for 3 production sectors.

Input Structure \ Output Allocation			Intermediate Demand			Final Demand	Total Output
			Production's Sector				
			1	2	3		
Intermediate Demand	Production's Sector	1	X_{11}	X_{12}	X_{13}	F_1	X_1
		2	X_{21}	X_{22}	X_{23}	F_2	X_2
		3	X_{31}	X_{32}	X_{33}	F_3	X_3
Primary Input			V_1	V_2	V_3		
Total Output			X_1	X_2	X_3		

Source: Anas, R., Tamin, O., & Wibowo, S. (2015). Applying input-output model to estimate the broader economic benefits of Cipularang Tollroad Investment to Bandung District. *Procedia Engineering, 125*, 489–497.

It can be understood from table X that the I-O table consists of 3 quadrants, each associated with intermediate demand, final demand, and primary inputs. Then, the supply and demand equation i sectors above can be used in the form of notation.

$$\sum_{j=1}^{n} x_{ij} + V_j = X_j$$

where:

x_{ij} = the amount of output in sector i used as input in sector j

V_j = primary input (adding value) in sector j

X_j = total input of sector j

The model is basically a general equilibrium model. In the model, the total input of any sector is equal to total output, so the total input for the whole economy is equal to total output. In other words, each sector demand and supply are equal in the economy. This content is shown in the table above. Accordingly, the sum of the column containing the inputs for any sector is equal to the sum of the row for the same sector.

Besides that, it is not only sufficient to intermediate inputs from other industries in order to make production but also in the I-O models, primary inputs for production factors such as labor and capital are necessary for production.

On the other hand, it is assumed that the relationship between the output of each production sector and inputs taken from other sectors to produce this output is constant and linear as well, so this relationship is called input coefficients or technology coefficients. Technological coefficients can be obtained from the I-O table by dividing each component of the intermediate demand sub table by the total production. Hence, the production of sector i, that sector j uses for one unit of production shown as aij and the input coefficient to the ratio of the sector i used in sector j, a matrix consisting of these coefficients is called as the input (technology) coefficients matrix (Leontief, 1986).

$$a_{ij} = \frac{z_{ij}}{X_j}$$

where:

a_{ij} = input-output coefficient

z_{ij} = intermediate demand for sector j from sector i

X_j = total input of sector j

The matrix formed from input coefficients corresponding to the I-O table for all sectors is called the -Structural matrix or A matrix of the economy.

Besides that, I-O model composed of a set of linear equations. With the help of I-O tables equations can be created and by inverse matrix, it can be predicted the impacts of changes in sector outputs on each sector. These predictions are mainly sectoral output multipliers and sectoral income multipliers. If sectoral labour input coefficients or labour/output ratios are known, employment multipliers can be calculated which means the amount of physical labour required for a unit of output in each sector (Miller and Blair, 1985).

Leontief inverse matrix is used to measure the impacts of possible changes in the final demand for production of all sectors of the economy.

$$\mathrm{X} = (1 - \mathrm{A})^{-1}\mathrm{F}$$

X is the vector of total production,

I the unit matrix,

A the technology matrix,

F the vector of final demand and

$(I-A)^{-1}$ is called as Leontief inverse matrix or multiplier matrix.

Thus, it is possible to predict the industrial production level that should be occurred or is expected as a result of direct and indirect impacts, at certain final demand change levels for the products of various industries in the economy thanks to Leontief inverse matrix. Besides that, it replies the question of what new

production level of industries should be in order to meet envisaged final demands for the future with A the technology matrix as a constant data. The (I-A)-1 matrix in the equation is called the Total Requirement Matrix.

4.3 MULTIPLIERS

As a result of one unit increase in the final demand of a sector, all direct and indirect impacts that occur in production, income and employment of sectors can be determined by multiplier analysis. Besides that, an increase in the final demand has an important impact not only on the sector in which it occurs but also on the other sectors in the economy. Multiplier analysis is also an essential tool for regional planning. Due to multiplier analysis, the investments that might be made can be connected to the best sectors to achieve the intended results. The calculated multipliers will allow us to make predictions of the impacts of changes in the economy.

4.3.1 Output Multipliers

Output multipliers are the proportion of total change in output to the change in the purchase by the final users. In other words, the output multiplier is a coefficient that expresses the total change in the output levels (production) of all industries in the economy because of a unit change in the final demand for the outputs of any industry j (Türker, 1999). Moreover, the data required by the definition is totally the components of the Leontief inverse matrix. The production multiplier for each sector is the sum of the column constituents that belonging the related sector in the Leontief inverse matrix besides that these multipliers make the basis for all other multipliers. it can be expressed as follow.

$$Z_j = \sum_{i=1}^{n} r_{ij}$$

where:

r_{ij} = the components of $(I-A)^{-1}$ Leontief inverse matrix

n = number of industries in I-O matrix

Z_j = output multiplier of industry j

4.3.2 Gross Value-Added Multipliers

Definition of gross value-added multipliers determines the total value-added created in the economy due to one-unit value change of final demand for each industry. Thus, the gross value-added multiplier of a sector is the sum of the income increases caused by one unit of increase in the final demand of a sector. As the value of the GVA multiplier increases, the degree of structural connectivity in the economy increases and thus, the dependence of the economy on imports decreases. The Gross value-added multiplier can be shown (Bocutoğlu, 1990).

$$g_i = \sum_{i=1}^{n} A_{ij} \frac{v_I}{X_i}$$

Here:

Xi: total output of industry i,

Vi: net value-added of industry i,

Value-added coefficient of industry i,

vi = Vi / Xi and [v] vector. Thus, GVA multipliers can be calculated as follows.

$$[g] = [V].[I - A]^{-1}$$

4.3.3 Employment Multipliers

Multiplier indicates that as a result of final demand increases in an economy determines the direct and indirect employment needs of the sectors (Özyurt, 2007). In other words, the employment multiplier is the sum of the direct and indirect increase in the labour force employed by the sectors when there is one unit increase in the final demand of a sector. Thus, it can be calculated as the compensation of employees divided by total output for each of the columns/sectors.

4.4 DATA

To compute the economic impacts of construction of highway investment, construction expenditures (budget) and input-output table are necessary (Lee et al., 2018). In the study, due to the lack of a regional input-output table, the national input-output table in 2012 published by the Turkish Statistical Institute (TurkStat) in 2016, has been used. I-O table is designed as a (64x64) matrix that shows the input from each industry to each industry and thus the proportion of each industry's contribution to the output of an industry. In relation to the final demand vector, all items related to construction expenditures that are given below in table 15 were provided by the contractor company with a special survey for a 5-year period. Operation and maintenance expenditures are not included in the model. Figure 4.1. shows the general approach for calculating the macroeconomic impacts of the construction of the highway.

(i) All works related to the construction of highways such as the material used in construction site and components of engineering have been revealed and arranged to be corresponding economic sectors to establish a final demand vector. (ii) About the previous step, the elements of the final demand vector (1x15) that is shown in table 4.2. has been obtained with the help of the input-output table. Imports are excluded from the construction expenditures while calculating the economic contributions of the Project through the I-O Model.

Table 4.2. Industry classification based on input-output table.

No	Sector Number	Sector Definition
A	**4**	Mining and Quarrying
B	**15**	Basic Metals
C	**2**	Products of Forestry, Logging and Related Services
D	**19**	Machinery and Equipment n.e.c.
E	**31**	Land transport services and transport services via pipelines
F	**54**	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
G	**10**	Coke and Refined Petroleum Products
H	**11**	Chemicals and Chemical Products
I	**13**	Rubber and Plastic Products
J	**14**	Other Non-metallic Mineral Products
K	**16**	Fabricated metal products, except machinery and equipment
L	**25**	Natural water; water treatment and supply services
M	**47**	Architectural and Engineering Services; Technical Testing and Analysis Services
N	**27**	Construction and Construction Works
O	**51**	Rental and Leasing Services

After all, with respect to computing the multipliers, the Leontief model is used. As a first step, (i) the share of the inputs from each industry within the total output that takes place at the bottom of each column that represent a particular industry within the I-O table is calculated. After that, the function can be repeated for all sectors (64) columns/industries within the I-O table. Obtained 64x64 new matrix consisting of the input ratios from each industry is called technology coefficient matrix and denoted with “A”.

(ii) Secondly, for all industries so identity matrix “I”, same sized with technical coefficient matrix “A” is taken. The technology matrix is subtracted from Identify matrix and the inverse of that matrix is taken, then Leontief I “L1” output

coefficients are calculated. The sum of the coefficient in each column/industry gives L1 output multipliers for that industry.

The process can be represented by the formula below as explained in detail before:

$$L = (I - A)^{-1}$$

After that, as we calculate all impacts in terms of direct, indirect, and induced effects, we need to include the household consumption so to generate a 65x65 new matrix. By adding a row and column to matrix A with each industry's coefficient for compensation of employees and household consumption respectively are needed. This new matrix is subtracted from the 65x65 identify matrix and the inverse of an obtained matrix is taken to get L2 output coefficients. Thus, the sum of the L2 coefficients in each column, L2 output coefficients are calculated.

In final, by using output multipliers for both L1 and L2, Gross value-added and employment coefficients can be calculated Thus, based on the methodology explained above, the I-O model is constructed, output, GVA and employment multipliers are derived and accordingly induced and indirect output, GVA and employment impacts are calculated during the construction phase so each year of highway construction.

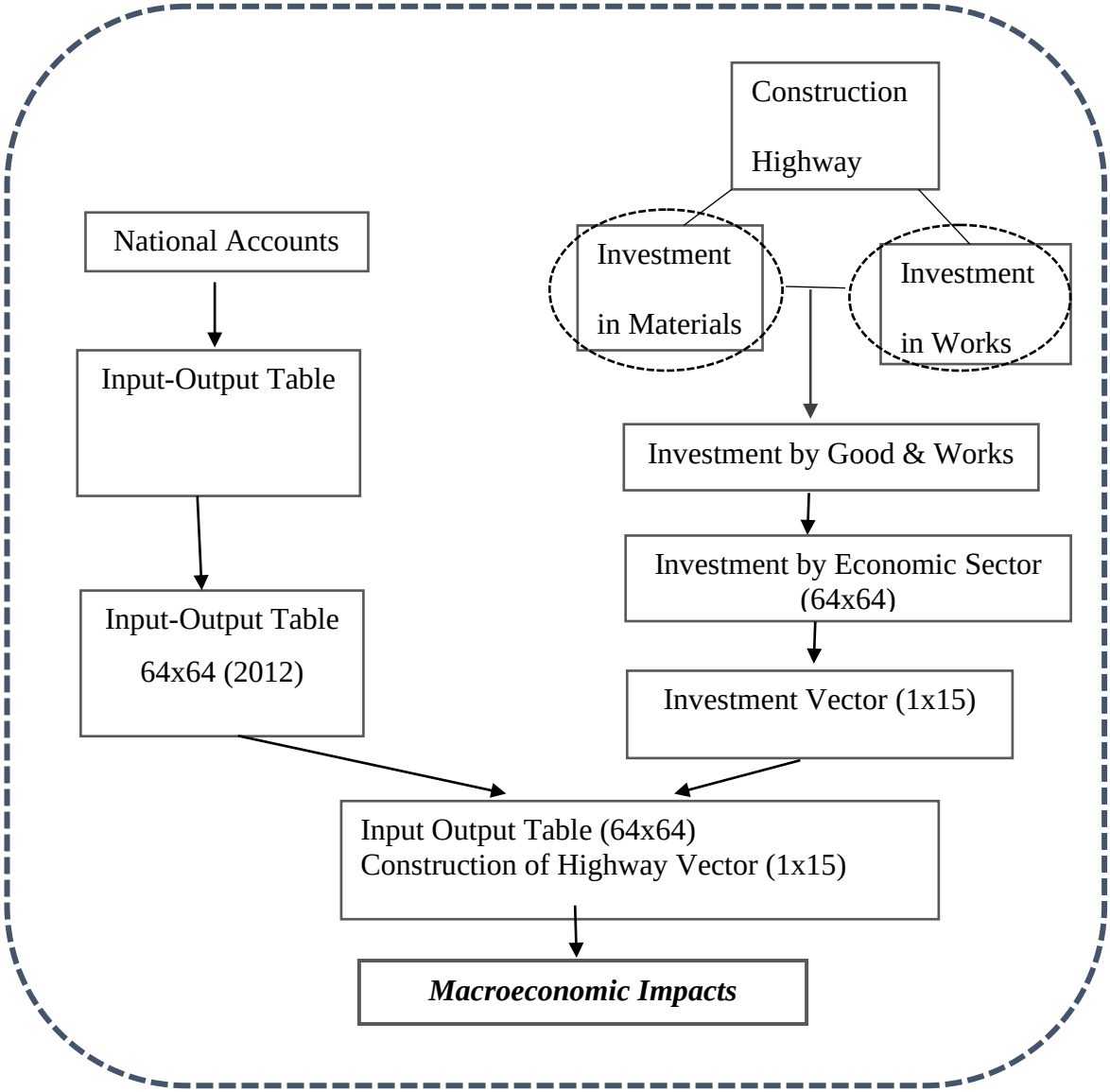
(i) Indirect Impact = Direct Impact x (1-L1 Multiplier)

(ii) Induced Impact = Direct Impact x (L2 Multiplier-L1 Multiplier)

Table 4.3. Expenditures for highway construction for 5-year period.

No	Industry Classification	Y1	Y2	Y3	Y4	Y5	Total Cost (Million Turkish Lira)
A	**4**	0,00	16,02	33,11	37,56	33,94	**120,63**
B	**15**	0,00	32,81	87,30	61,46	24,81	**206,37**
C	**2**	0,00	11,89	5,56	1,57	1,57	**20,60**
D	**19**	0,00	1,50	1,59	1,56	1,55	**6,20**
E	**31**	2,03	47,60	82,44	103,23	94,93	**330,23**
F	**54**	0,00	0,00	0,00	3,64	21,14	**24,78**
G	**10**	0,00	0,00	7,64	33,03	45,41	**86,08**
H	**11**	0,00	1,78	3,49	7,79	4,54	**17,61**
I	**13**	0,00	0,82	2,01	4,63	3,08	**10,54**
J	**14**	0,00	9,00	21,39	17,75	12,17	**60,30**
K	**16**	0,00	0,00	0,00	8,76	49,04	**57,79**
L	**25**	0,41	2,11	2,81	2,85	2,34	**10,53**
M	**47**	12,46	8,04	4,46	2,01	1,97	**28,94**
N	**27**	15,21	43,53	355,52	350,66	228,40	**993,33**
O	**51**	2,02	3,72	5,47	7,31	8,46	**26,99**
Total		32,13	178,84	612,81	643,80	533,35	**2.000,93**

Figure 4.1. Flow Chart of Investment Vector.



CHAPTER FIVE

RESULTS

In this part, the economic impacts (output, gross value-added and employment) on the local or entire economy associated with the investment in highway construction are examined from beginning to end of the project. Multipliers from the currently existed national I-O table (2012) were generated and used. With the obtained multipliers (Table 5.1.) economic impacts on 15 industries by the construction expenditures are studied annually in Turkey. The integrated output, gross value-added and employment results are shown (Table A.1., A.2., A.3., A.4. and A.5.) for each year by application of the input-output analysis.

Table 5.1. Summary of gva and employment multipliers from type I and type II.

Multipliers						
	Gross Value Added (GVA)			**Employment**		
Sector	**Direct**	**İndirect**	**Induced**	**Direct**	**İndirect**	**Induced**
4	0,5770	0,0778	0,3105	0,1613	0,7463	0,0762
15	0,1604	0,1141	0,2993	0,0503	0,755	0,1105
2	0,8444	0,0175	0,1868	0,1163	0,8475	0,0458
19	0,3197	0,0936	0,3932	0,144	0,6783	0,0964
31	0,4872	0,1124	0,1944	0,0563	0,8412	0,0476
54	0,7508	0,0286	0,6407	0,4528	0,4765	0,1571
10	0,0642	0,187	0,2660	0,0112	0,7827	0,0652
11	0,2772	0,1165	0,2723	0,06	0,7777	0,0667
13	0,2602	0,1095	0,3455	0,1128	0,7187	0,0847
14	0,3538	0,0918	0,3342	0,1176	0,727	0,082
16	0,378	0,085	0,3517	0,1359	0,7128	0,0862
25	0,6591	0,042	0,3080	0,1659	0,7484	0,0755
47	0,5909	0,036	0,3965	0,2084	0,6761	0,0972
27	0,3735	0,0723	0,3152	0,0954	0,7425	0,0772
51	0,7578	0,0400	0,1328	0,0541	0,8915	0,0325

The total cost of the project is equal to 2.000,93 million Turkish liras (Table 4.3.) in the base year (not specified in the study). In addition, expropriated prices are not included in the total cost of investment. It can be obviously seen from the expenditures table, there are 15 industries are in the economy that supply materials and services for the project and most industries are in the main region or sub-region thus, the contribution of the economic impacts can be also evaluated in terms of regional. Among the industries, construction and construction works (27) account for about 50% of the total cost, while other important items respectively are 16,5% land transport services and transport services (31) and 10,3% basic metals (15).

In sum (Table 5.2.), total output impacts worth 4.595,7 million Turkish lira, gross value added worth 1.061,6 million Turkish lira are created, as well as the generation average 64.260 employment by the construction of highway for 5 year-period in terms of direct, indirect, and induced effects. Thus, it is clearly seen that indirect impact is higher than direct impacts. This shows us to internal dynamics of the economy and apart from this induced impact is 36,6% of the direct impact that explains the consumption of the household.

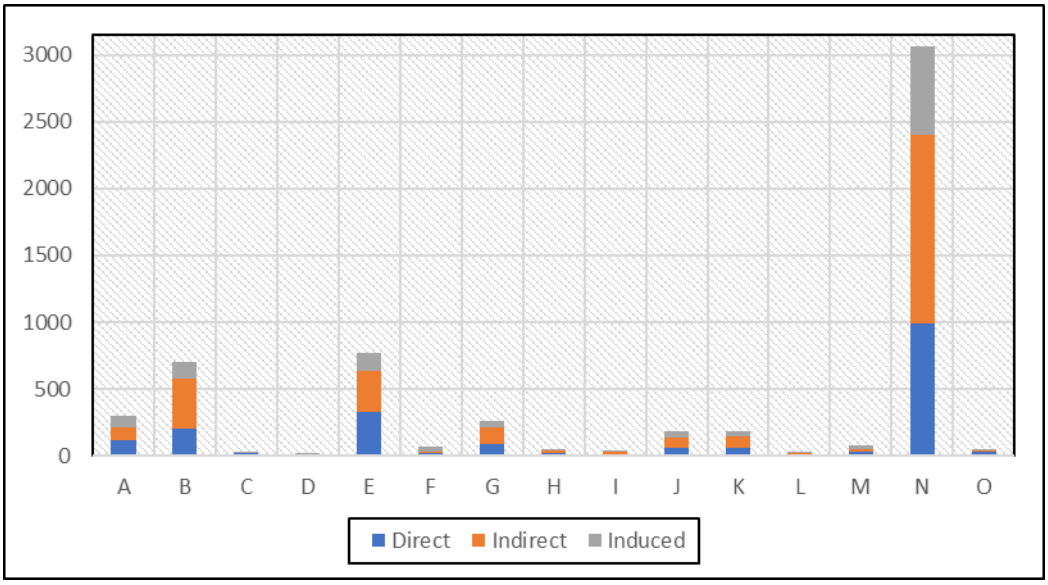
Table 5.2. Total output, employment, GVA.

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Output (million Turkish lira)	66,4	388,3	1438,4	1495,7	1206,9
Employment (person)	7.416	28.474	94.448	98.455	92.511
GVA (million Turkish lira)	21,88	103,27	314,19	330,64	291,63

In the output impacts, ‘‘construction’’ (N), ‘‘land transport services and transport services’’ (E) and ‘‘basic metals’’ (B) create respectively 3058,63 (66,5%) Turkish lira, 770,99 (16,7%) Turkish lira and 707,26 (15,3%) Turkish lira. Thus, the construction of highway does not largely influence other sectors except ‘‘construction’’, ‘‘land transport services and transport services’’ and ‘‘basic

metals''. Only a few industries such as ''mining and quarrying'' (A) and ''coke and refined petroleum products (G) are affected relatively (Figure 5.1.) more than other sectors.

Figure 5.1. Total Output From Highway Construction (Million Turkish Lira).



With respect to total employment number for 5 year-period, average direct employment is equal to 37.018 person annually, while the indirect employment is equal to about 27.242. Hence, it creates the additional employer contribution to the Turkish economy with indirect employment by about 73,1% from a total number of direct employments. Transfer of employment distribution to all sector of the Turkish economy was shown as (Figure 5.2.). It also suggests that all impacts of employment have been increased by the time as Y3 and Y4 were the maturity period of the project. Besides that, the results are significant for the Turkish and local economy as the unemployment rate is about 11,3% for the average of the last 5 years.

Figure 5.2. Total Employment From Highway Construction During 5 Year-Period.

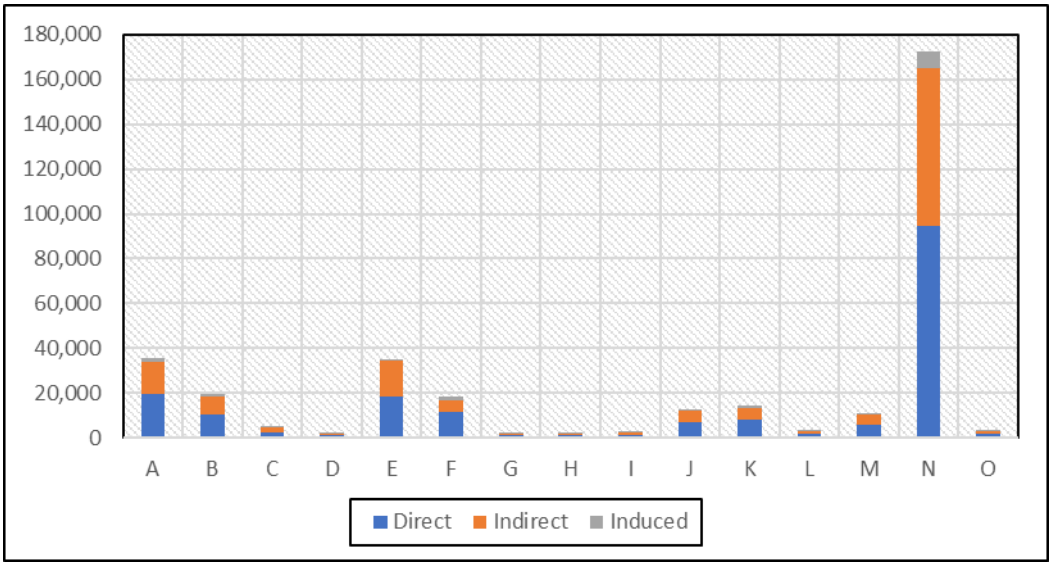


Table 18 shows the annual total gross value added of direct, indirect and induced impacts on the overall Turkish economy. In relation to GVA, the highest total gross value added were observed in Y4 (Table 5.3.) when most construction activities have been executed as 330,64 million Turkish liras. After year three and four, GVA started to decrease as all works decreased in the construction site. According to the direct multipliers of GVA, Products of forestry, logging, and related services (C) industry ranks first in GVA in the economy and Chemicals and chemical products (H) with basic metals (B) have the highest impact on the economy in terms of GVA. The share of indirect GVA is 5,86% overall while the direct impact is 72,8%. At the industry level, the construction sector (N) has the highest impact of GVA in the entire economy with a share of 48,4%.

Table 5.3. Annually total gross value-added.

Impacts	Year 1	Year 2	Year 3	Year 4	Year 5
Direct	15,83	77,13	229,44	241,03	209,75
Indirect	0,86	6,04	18,62	20,06	16,98
Induced	5,19	20,1	66,13	69,55	64,9
Total GVA Impacts of Project	21,88	103,27	314,19	330,64	291,63

CHAPTER SIX

CONCLUSION

The research in this thesis, I-O analysis was used to determine the macroeconomic effects of the highway construction investment for 100 km in a region of Turkey. It has also great importance for the development of the regional economy with the entire economy as the number of motorways has been recently increased in Turkey. The most widely used I-O model was applied to determine the relative changes in output for the whole economy/region, gross value-added and employment as its usage is quite simple.

Investment in transportation most especially highways affect the economy positively in many aspects. The completion of highway will help regional and national economies enhanced by attracting new organization and providing access to new markets. Thus, in the study, it was shown that highway construction obviously generates substantial direct, indirect, and induced impacts on the country economy in the 5-year period.

The methodology in the research that has been applied can be conducted and developed for large infrastructure projects. Apart from that, the suggested methodology can be applied for the effects regarding maintenance, operation of highway, an efficiency gain of business users due to travel time and distance savings, increased tourism activities and as well as accidents and carbon emission in terms of the environment. Besides that, the regional I-O table and multipliers can be obtained and employed to measure other future police investigation.

The transportation infrastructure strategy of Turkey has been improved across the nation for 20 years and it is considerably expected the share of transportation projects will grow further countrywide. In final, the total impacts of highway construction may be a more important and good example for future policies and studies too.

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APPENDİX A

Table A.1. Total impact of the construction in Y1.

		Changes in output			Changes in GVA			Changes in Employment		
No	Industry	Direct	Indirect	Induced	Direct	Indirect	Induced	Direct	Indirect	Induced
A	**4**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
B	**15**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
C	**2**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
D	**19**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
E	**31**	2,03	1,88	0,83	0,99	0,11	0,19	114	96	5
F	**54**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
G	**10**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
H	**11**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
I	**13**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
J	**14**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
K	**16**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
L	**25**	0,41	0,33	0,26	0,27	0,01	0,08	68	51	5
M	**47**	12,46	9,64	10,34	7,36	0,27	2,92	2597	1756	252
N	**27**	15,21	21,58	10,04	5,68	0,41	1,79	1451	1077	112
O	**51**	2,02	0,89	0,56	1,53	0,06	0,20	109	97	4
	Total	**32,13**	**34,32**	**22,04**	**15,83**	**0,86**	**5,19**	**4.339**	**3.077**	**379**

Table A.2. Total impact of the construction in Y2.

		Changes in output			Changes in GVA			Changes in Employment		
No	Industry	Direct	Indirect	Induced	Direct	Indirect	Induced	Direct	Indirect	Induced
A	**4**	16,02	12,98	10,41	9,24	0,72	2,87	2584	1928	197
B	**15**	32,81	59,06	20,57	5,26	0,60	1,58	1650	1246	182
C	**2**	11,89	3,52	4,65	10,04	0,18	1,88	1383	1172	63
D	**19**	1,5	2,41	1,69	0,48	0,04	0,19	216	147	21
E	**31**	47,6	44,14	19,39	23,19	2,61	4,51	2680	2254	128
F	**54**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
G	**10**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
H	**11**	1,78	2,81	1,02	0,49	0,06	0,13	107	83	7
I	**13**	0,82	1,40	0,59	0,21	0,02	0,07	92	66	8
J	**14**	9	11,84	6,30	3,18	0,29	1,06	1058	769	87
K	**16**	0	0,00	0,00	0,00	0,00	0,00	0	0	0
L	**25**	2,11	1,71	1,36	1,39	0,06	0,43	350	262	26
M	**47**	8,04	6,22	6,67	4,75	0,17	1,88	1676	1133	163
N	**27**	43,53	61,76	28,74	16,26	1,18	5,12	4153	3083	321
O	**51**	3,72	1,64	1,04	2,82	0,11	0,37	201	179	7
	Total	**178,82**	**209,49**	**102,44**	**77,33**	**6,04**	**20,10**	**16.150**	**12.324**	**1.209**

Table A.3. Total impact of the construction in Y3.

		Changes in output			Changes in GVA			Changes in Employment		
No	Industry	Direct	Indirect	Induced	Direct	Indirect	Induced	Direct	Indirect	Induced
A	**4**	33,11	26,82	21,52	19,10	1,49	5,93	5341	3986	407
B	**15**	87,30	157,14	54,74	14,00	1,60	4,19	4391	3315	485
C	**2**	5,56	1,65	2,18	4,69	0,08	0,88	647	548	30
D	**19**	1,59	2,55	1,79	0,51	0,05	0,20	229	155	22
E	**31**	82,44	76,45	33,58	40,16	4,51	7,81	4641	3904	221
F	**54**	0,00	0,00	0,00	0,00	0,00	0,00	0	0	0
G	**10**	7,64	11,37	4,26	0,49	0,09	0,13	86	67	6
H	**11**	3,49	5,50	1,99	0,97	0,11	0,26	209	163	14
I	**13**	2,01	3,42	1,45	0,52	0,06	0,18	227	163	19
J	**14**	21,39	28,15	14,97	7,57	0,69	2,53	2515	1829	206
K	**16**	0,00	0,00	0,00	0,00	0,00	0,00	0	0	0
L	**25**	2,81	2,28	1,81	1,85	0,08	0,57	466	349	35
M	**47**	4,46	3,45	3,70	2,64	0,09	1,04	929	628	90
N	**27**	355,52	504,45	234,75	132,79	9,60	41,85	33917	25183	2618
O	**51**	5,47	2,41	1,52	4,15	0,17	0,55	296	264	10
	Total	**612,79**	**825,65**	**378,27**	**229,44**	**18,62**	**66,13**	**53.894**	**40.554**	**4.163**

Table A.4. Total impact of the construction in Y4.

		Changes in output			Changes in GVA			Changes in Employment		
No	Industry	Direct	Indirect	Induced	Direct	Indirect	Induced	Direct	Indirect	Induced
A	**4**	37,56	30,42	24,41	21,67	1,69	6,73	6058	4521	462
B	**15**	61,46	110,63	38,54	9,86	1,12	2,95	3091	2334	342
C	**2**	1,57	0,46	0,61	1,33	0,02	0,25	183	155	8
D	**19**	1,56	2,51	1,76	0,50	0,05	0,20	225	152	22
E	**31**	103,23	95,74	42,05	50,29	5,65	9,78	5812	4889	277
F	**54**	3,64	1,72	4,89	2,73	0,08	1,75	1648	785	259
G	**10**	33,03	49,18	18,41	2,12	0,40	0,56	370	290	24
H	**11**	7,79	12,28	4,44	2,16	0,25	0,59	467	363	31
I	**13**	4,63	7,89	3,35	1,20	0,13	0,42	522	375	44
J	**14**	17,75	23,36	12,43	6,28	0,58	2,10	2087	1518	171
K	**16**	8,76	13,07	6,45	3,31	0,28	1,16	1190	849	103
L	**25**	2,85	2,31	1,84	1,88	0,08	0,58	473	354	36
M	**47**	2,01	1,55	1,67	1,19	0,04	0,47	419	283	41
N	**27**	350,66	497,55	231,54	130,97	9,47	41,28	33453	24839	2583
O	**51**	7,31	3,22	2,03	5,54	0,22	0,74	395	353	13
	Total	**643,81**	**851,89**	**394,42**	**241,03**	**20,06**	**69,55**	**56.395**	**42.060**	**4.414**

Table A.5. Total impact of the construction in Y5.

		Changes in output			Changes in GVA			Changes in Employment		
No	Industry	Direct	Indirect	Induced	Direct	Indirect	Induced	Direct	Indirect	Induced
A	**4**	33,94	27,49	22,06	19,58	1,52	6,08	5475	4086	417
B	**15**	24,81	44,66	15,56	3,98	0,45	1,19	1248	942	138
C	**2**	1,57	0,46	0,61	1,33	0,02	0,25	183	155	8
D	**19**	1,55	2,49	1,75	0,50	0,05	0,19	223	151	22
E	**31**	94,93	88,04	38,66	46,25	5,20	8,99	5345	4496	254
F	**54**	21,14	9,97	28,38	15,87	0,45	10,17	9572	4561	1504
G	**10**	45,41	67,61	25,31	2,92	0,55	0,78	509	398	33
H	**11**	4,54	7,16	2,59	1,26	0,15	0,34	272	212	18
I	**13**	3,08	5,25	2,23	0,80	0,09	0,28	347	250	29
J	**14**	12,17	16,01	8,52	4,31	0,40	1,44	1431	1040	117
K	**16**	49,04	73,16	36,13	18,54	1,58	6,52	6665	4750	574
L	**25**	2,34	1,90	1,51	1,54	0,06	0,48	388	291	29
M	**47**	1,97	1,52	1,64	1,16	0,04	0,46	411	278	40
N	**27**	228,4	324,08	150,81	85,31	6,17	26,89	21789	16179	1682
O	**51**	8,46	3,73	2,35	6,41	0,26	0,85	458	408	15
Total		**533,35**	**673,53**	**338,11**	**209,75**	**16,98**	**64,90**	**54.315**	**38.196**	**4.882**