

EXAMINATION OF THE EFFECTS OF CHANGE IN GLOBAL METAL
PRICES ON TURKISH BASIC METAL PRODUCTION AND EXPORTATION

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF SOCIAL SCIENCES

MARCH 2018

Approval of the Graduate School of Social Sciences

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ABSTRACT

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March 2018, 107 pages

The basic metal production industry constitutes up 11% of Turkish manufacturing industry which makes it the second largest industry in manufacturing after food manufacturing with 15.6%. Basic metal production is the second largest industry for Turkish export and import, with 11-13% and 11-14% share respectively. However, the literature lacks studies in terms of the effects of change in basic metal prices on basic metal production industry in Turkey. The thesis contributes to literature by explaining the effects of global price changes on Turkish metal production industry and the effects of Turkish basic metal production industry to global basic metal prices. The thesis also investigates the volatility impact of global variables on basic metal production in Turkey. The methodology starts with the vector autoregression models, proceeds with the interpretation of impulse response functions, and the evaluation of forecast error variance decompositions. Examination period is considered as from January, 2005 to December, 2016. The thesis concludes that there is a significant effect of global metal prices on Turkish basic metal production. In addition, Turkish basic metals export volume affects global scrap prices. It is also concluded that the basic metal prices are the main driver on scrap price changes. Also, evidence is found on the volatility effect of the exchange rate and basic metal price on Turkish basic metal production.

Keywords: Basic Metal Production Sector, Export, Vector Autoregression, Impulse Response Function, Variance decomposition

ÖZ

GLOBAL METAL FİYAT DEĞİŞİKLİKLERİNİN TÜRK METAL ENDÜSTRİSİNE VE İHRACATINA OLAN ETKİLERİNİN İNCELENMESİ

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Mart 2018, 107 sayfa

Metal üretim endüstrisi Türkiye üretim sektörünün %11'ini oluşturmakta ve %15.6'lık paya sahip olan gıda üretiminden sonra ikinci sırada gelmektedir. Ana metal üretim endüstrisi ihracat ve ithalat hacminde sırasıyla %11 ila %13, ve %11 ila %14'lük paylar ile Türkiye'nin ihracat ve ithalat pazarlarında ikinci büyük endüstri olmaktadır. Fakat, buna rağmen literatür küresel fiyat değişikliklerinin ana metal üretimine etkilerini incelemede yetersiz kalmaktadır. Bu tez metal fiyat değişikliklerinin Türkiye ana metal üretimine ve aynı zamanda Türkiye ana metal üretiminin küresel fiyatlara olan etkilerini incelemektedir. Çalışma aynı zamanda küresel değişkenlerdeki dalgalanmaların ana metal endüstrisi üzerindeki etkilerini de incelemektedir. Bunları incelemekte kullanılan metodoloji vektör otoregresif süreçler ile başlayıp, etki tepki fonksiyonlarının değerlendirilmesi ve varyans dağılımı metotlarını kullanmaktadır. Çalışma dönemi 2005 Ocak ile 2016 Aralık arasındadır. Yapılan çalışma küresel fiyatların Türkiye ana metal üretimini etkilediğini göstermektedir. Aynı şekilde Türkiye ana metal sanayi ihracatının da küresel hurda fiyatını etkilediği gözlenmiştir. Ayrıca, ana metal fiyatlarının hurda fiyatı üzerinde direkt bir etkisi olduğu belirlenmiştir. Ek olarak, döviz kuru ve global ana metal fiyatlarındaki dalgalanmaların Türkiye ana metal sanayine anlamlı bir etkisi olduğu görülmüştür.

Anahtar Kelimeler: Metal Üretim Endüstrisi, İhracat, Vektör Otoregresyon, Etki Tepki Fonksiyonu, Varyans dağıtma

To my parents, my uncle and my wife,

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LIST OF ABBREVIATIONS

VAR	Vector Autoregression
VECM	Vector Error Correction Model
ADF	Augmented Dickey Fuller Test
PP	Phillips Perron Test
IMF	International Monetary Fund
AIC	Akaike Information Criterion
HQIC	Hannan-Quinn Information Criterion
SBIC	Bayesian information criterion
USGC	United States Geological Survey
INSG	International Nickel Study Group
CBRT	Central Bank of the Republic of Turkey

CHAPTER 1

INTRODUCTION

One of the key drivers of the economic strength of a developing country is the manufacturing industry growth. The manufacturing industry is a wide definition, which is composed of many sub-sectors from high value-added ones such as machinery, automotive etc. to quite basic products such as chemicals. However, despite whether a high value-added product or not, commodities are frequently used as an input for majority of these sub-sectors.

As being the raw material for majority of the industries, price movements of the commodities are often analyzed and studied in the economics literature. Price movements of the commodities and the correlations between each other, the analysis of the reasons behind the price movements in terms of interest rate and fuel prices are important studies, which are very common in economics. As understood from the studies, the prediction of commodity price trends is vital for many industries. Hence, many of the studies are used to predict the price movements.

Within those commodities, besides gold, silver, or oil, other major inputs such as iron, copper, nickel etc. have important place since they are used initially for the metal industry and afterwards those products are reused for many other industries. From fork to automobile and, from buildings to computers; the metal industry outputs are utilized. As a result, the metal outputs can be observed every day and everywhere in our environment.

The metal industry itself already has a critical role in the economic growth of the major steel producer countries like China, Japan, and the US. Besides the basic metal industry, since the outputs of basic metal industry are used in many other industries,

they are also important for the countries such as Germany, and UK in which automobile production is an important part of the economy. Reason behind that is the major part of an automobile is steel, aluminum, and plastics with 70%, 6% and 7% respectively. (Kishida). Hence, metal price movements might have important effects on the manufacturing industry in general.

In literature, impact of a change in the input price on a country's production or the production related variables are not commonly analyzed. This thesis creates a significant difference by being the first study examining those effects on basic metal industry of Turkey and outcomes of the changes in the global metal prices or the volatility in global basic metal price levels.

In order to reach a concrete outcome, the thesis starts with introductory sections explaining the definition of basic metals, how they are produced and what their usage areas are. Next, the importance of basic metal production industry for Turkey's GDP, manufacturing industry and net exports are evaluated; the role of Turkey in metal production is assessed and it is followed by explaining the importance of the scrap metal discussion. Finally, short summary of outcome is delivered. Then the thesis proceeds with the literature review and the importance of this thesis for the economics literature for Turkey. In chapter "data, variables and methodology", initial hypotheses list is shared, the data is explained, the model is described and preliminary tests are run. Afterwards, results are shared in three sections as 'the effect of global basic metal price changes on Turkey', 'the effect of Turkey in the global price changes' and 'the effect of price volatilities on Turkey'. Finally, concluding remarks are shared.

1.1.BASIC METALS

Basic metals include industrial ferrous and non-ferrous metals except for precious metals. Basically, they can be defined as copper, lead, nickel, aluminum, iron and steel. In addition to those, there are metals which are low in volume such as tin, tungsten, molybdenum, tantalum, cobalt, bismuth, cadmium, titanium, zirconium, antimony, manganese, beryllium, chromium, germanium, vanadium, gallium, hafnium, indium, niobium, rhenium and thallium, and their alloys. Major focus of

this thesis will be mainly on iron and steel, secondly on aluminum, copper, lead and nickel. According to the data from Morgan Stanley, in the world, the production volume of aluminum is 197.1 Mt, followed by Copper 20.8 Mt, Zinc 13.7 Mt, Lead 5.2 Mt, Nickel 2.1 Mt in 2017, while the production is 1.629 Bt for crude steel and 45.8 Mt for the stainless steel in 2016 according to Credit Suisse and International Stainless Steel Forum.

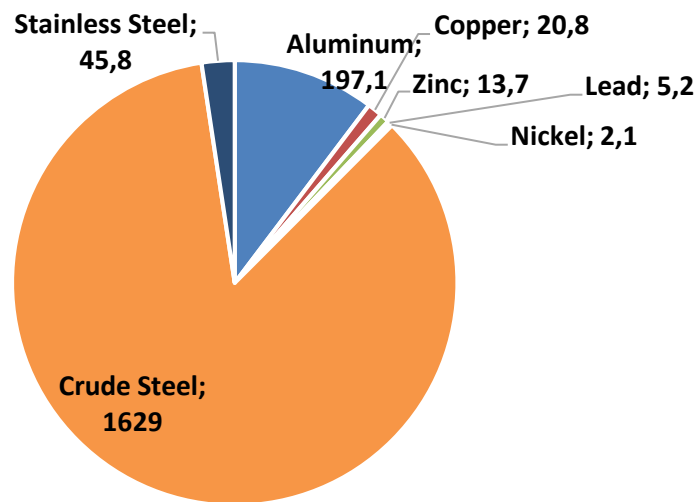


Figure 1. Distribution of Basic Metal Production in the World

Iron and Steel: Iron and steel are the most traded and produced metals in the world. Their usage area is so wide that many products in our environment contains iron and steel. Besides, steel is an iron alloy with combination of carbon, manganese, chromium.

Aluminum: Aluminum is the second most consumed and produced metal after iron and steel. Its end use area is very wide from transportation to consumer durables. Mostly China is mostly dominating aluminum production in the world. The production process is not simple like the other materials; aluminum cannot be used from its ore since it is very reactive. After a couple of processes, it is produced from bauxite which is a combination of different minerals. Bauxite is first turned into alumina then to aluminum.

Copper: Copper is a soft, malleable and ductile metal which is one of the metals that is directly usable in metallic form in its nature. It is a so good conductor of heat and the electricity that major usage areas are the building materials and electrical wires.

Zinc: Zinc is mainly used for galvanizing because of its corrosion resistance. It is a less dense material compared to iron. It is not only used as an individual metal but also used as an alloy, 'brass' which includes 3-45% zinc.

Lead: Lead is a soft metal with high density and low melting point. It is the metal with highest recycling rate, which means not only primary ore is used but also scrap is used to produce final product. Lead is mostly used in batteries.

Nickel: Nickel is one of the four ferromagnetic elements in room temperature. Nickel is used to produce alloys especially the stainless steel. In addition, it is common to use Nickel in corrosion resistant plating.

1.2. THE BASIC METALS IN PRODUCTION

1.2.1. The General Production Process & Supply Chain

The main raw materials of the basic metal industry are iron ore, copper, aluminum, lead, zinc and nickel for integrated plants and the scrap for semi integrated plants. Integrated plants can use basic metals directly to produce their output while semi integrated plants do not have the capability to use basic metals but instead they use scrap. So like iron ore, nickel or copper, the scrap is another important input for the metal industry. Despite it is a mixture of many metals, scrap has a completely different market in the world. Turkey is a major importer for scraps since there is no tax for it.

In metal market, there are three key players. Intermediate firms, final metal producers and purchasers. There are firms who supply basic metals like iron ore or scrap but those will be evaluated as the left side of the supply chain and will kept out of scope.

Supply chain of the market can be depicted as followed:

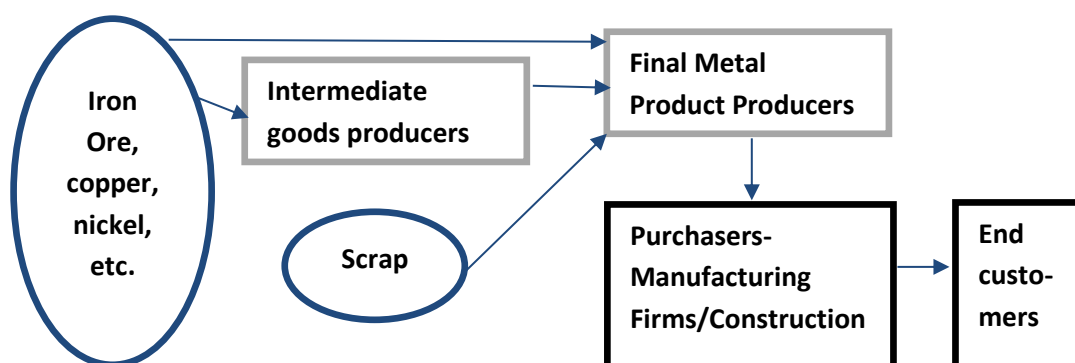


Figure 2. Supply Chain of the Basic Metal Production

Intermediate Firms: They purchase basic metals or scrap and produce intermediate product for final metal product producers like HRC (Hot rolled coil), CRC (Cold rolled coil) etc. HRC and CRC are main input for steel, pipe and profile producer firms which do not have their own facility to produce HRC or CRC, in other words, firms with semi integrated plants.

Final Metal Product Producers: For the integrated plants, they either purchase the basic metals from the firms who have basic metal reserves or they process basic metals if they have reserves for themselves. If they are semi integrated, they purchase scrap and produce final product like pipes, profiles, rebar etc.

Purchasers: Those are the firms who purchase final metal product and produce the final product to be sold to the end customers such as cars, machinery, durable goods etc. Output of those firms are generally the consumers.

As a result, the output is produced in three ways: the first one is by using raw metals such as iron ore, the second is by using scrap and third is by using both. The plants which use raw metals can produce intermediate goods such as billets and sell it to final metal producers or they can directly produce the final output such as rebar. Semi-integrated plants can only use scrap and produce rebar, billets, other semi-finished or finished output. Then, finished products are purchased from the manufacturing firms and reprocessed and sold or directly used.

Depending on the type of output, the final products are used in the manufacturing firms or in the constructions. At the end, the households are the main purchaser from those manufacturing or construction firms. The houses, cars, durable goods such as refrigerator, machines are the final outputs that are purchased by the end customers.

1.2.2. Steel production process

Comparing the production rates and the shares of basic metals, the steel has a huge share in the world's basic metal production. That is why some detail on the steel production would be helpful to understand its process.

The steel production includes 5 main steps; raw material processing, steel making and casting, hot rolling, cold rolling and strip processing. Last three steps are to differentiate steels into different usage types. Majorly the steel is already produced at the end of step 2. The steel production processes are not similar in every plant, and the differentiation results from step 1. Before steel making and casting, the iron ore is melted in basic oxygen furnace or in electric arc furnace. However, there are companies that does not have the basic oxygen furnace. Such firms usually produce steel out of scraps because the scrap can be melted in the electric arc furnaces. Plants that can use iron ore are called integrated, the rest are called semi-integrated plants as mentioned in the thesis before. This differentiation is highly important because the iron ore and scrap markets are different so that it can lead to high profitability differences between plants.

1.3. THE USAGE AREAS OF BASIC METALS

Copper is the mostly used in wire and cables which includes numerous electrical equipment, it is also an important input for the buildings which are mostly used as corrosion resistant in roofs, flashings, rain gutters, domes, spires etc. This is the reason of being the most common usage areas are equipment and the building construction. Other usage areas are infrastructure, industrial and transportation especially in electrical engines.

As it is stated before, Zinc is not used individually for an end product, but they are mostly used to create alloys and also galvanizing the final products of other mines. Half of the zinc produced is used in galvanizing.

Lead is not widely used for different type of products. In industry, its main usage is lead acid batteries. It can be also used for corrosion resistant coating for iron and steel.

Nickel is mostly used in engineering, metal goods such as stainless-steel production, transport and tubular products, electronics such as batteries, and the construction industry.

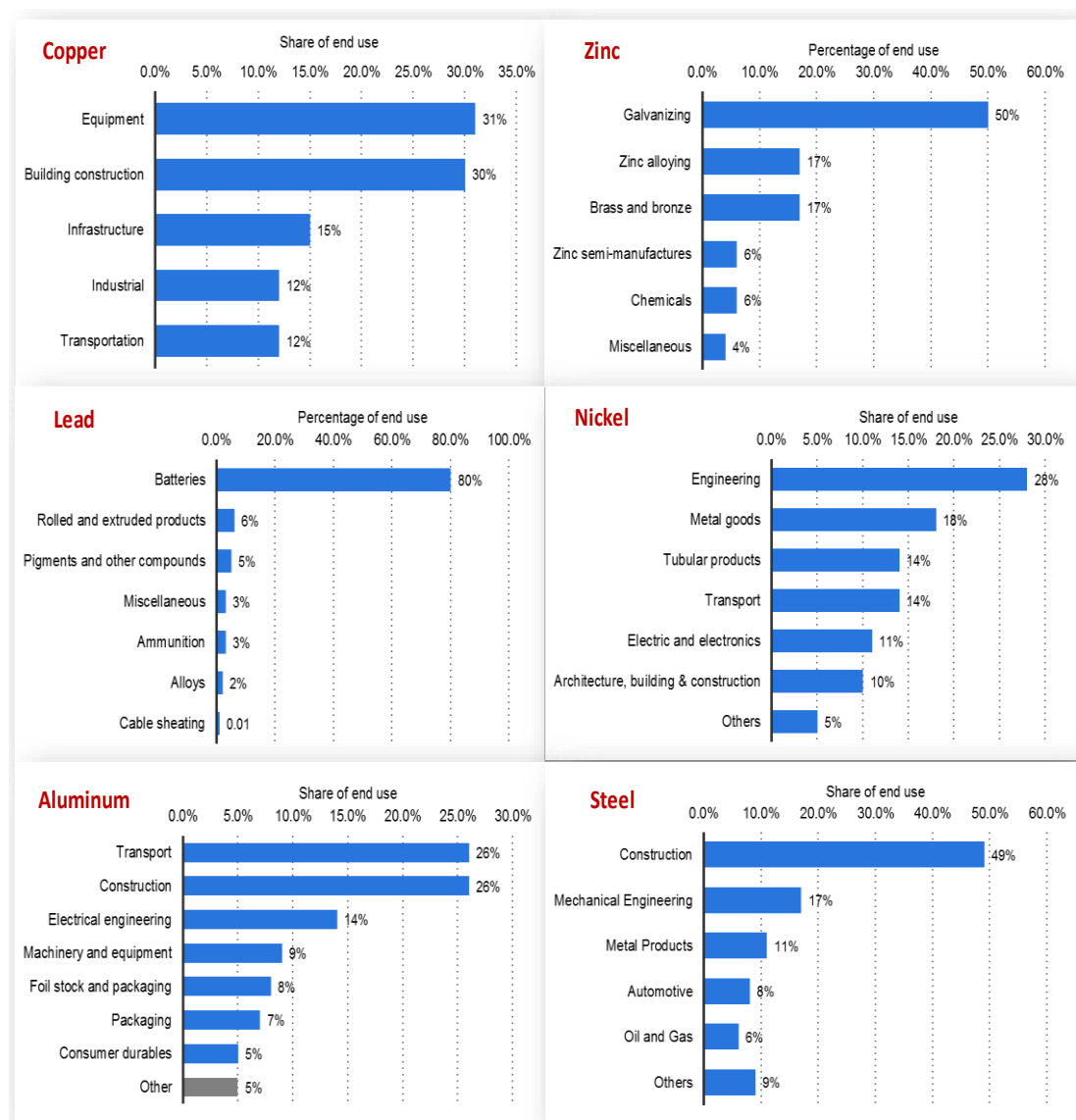
Aluminum usage is highly common in many production lines. Major usage is in transportation and construction, while the electrical engineering products are also important end use market for aluminum.

Steel is differentiated in three products, flat, long and tubes. 50% of total demand is for long, 40% for flat and 10% for tubes in 2016.

Construction is the most important area for steel. However, percentage of usage in industries varies depending on the type of steel. Long products are used in construction in 75% of the time. On the other hand, the ratio of flat products used in automotive is 15% compared to 7% for long products.

Additionally, 94% of total steel is carbon steel, while 2.5% is engineering and 2.5% is stainless steel.

Figure 3 shows the details of the usage areas for every basic metal. Due to the timing of the reports for individual basic metals, data is not gathered from the same year. Data for copper is from ICSG for 2014. Data for zinc is from International Lead & Zinc Study Group for 2017. Data for lead is from International Lead & Zinc Study Group for 2011. Data for nickel is from Nickel Institute. Data for aluminum is from CRU group for 2016 and data for steel is from world steel association.



**Figure 3. Share of End Use of Basic Metals (Copper,2014-Zinc,2017-
Lead,2011-Aluminum, Steel, 2016 and Nickel 2014)**

Details on the leading miner, producer countries for basic metals and the leading firms can be found in the Appendix.

1.4. THE IMPORTANCE OF THE BASIC METALS FOR TURKEY

1.4.1. Importance in the Manufacturing Industry, and GDP

Industrial production and the manufacturing is an important factor in GDP not only for major industrialized countries' but also for Turkey. Considering that Turkey is still a developing country, the investments and the changes in the manufacturing industry have an important role for further growth. That is why the improvements or the developments in the manufacturing industry directly affect GDP through an effect of per capita consumption, earning, savings and many more important factors for a country.

GDP generated by the manufacturing industry explains the importance of this industry in Turkish economy. Figure 4 shows the share of the manufacturing in Turkish GDP from 2003 to 2015. Share of the manufacturing in Turkey's GDP is quite stable and in between 27 to 31% through these years. There is an increase from 2009 to 2011 in the share of manufacturing while it stabilizes around 29% after 2012.

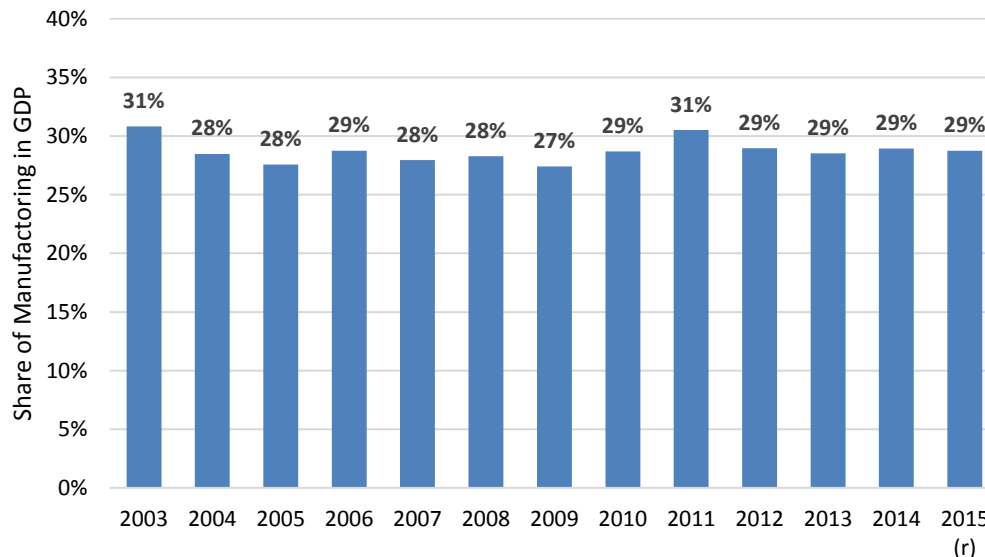


Figure 4. Share of Manufacturing in Turkish GDP (Turkstat)

From Figure 5, the share of the manufacturing in European countries can be seen for 2015. While Czech Republic, Finland, Germany and Italy has an important

share of manufacturing in GDP, there are countries with low share such as Norway, Denmark, and Netherlands etc.

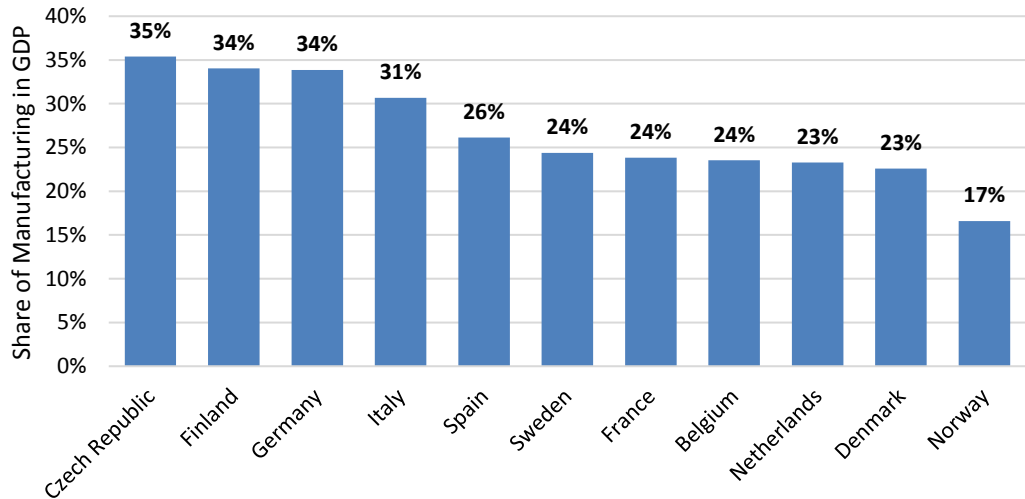


Figure 5. Share of Manufacturing in GDP in European Countries in 2015 (Eurostat)

Due to the size of manufacturing in GDP, the forecast and the examination of variability in production in the manufacturing is a critical aspect. One of the most important components in manufacturing is the basic metal production sector with approximately 11% of total manufacturing business in Turkey; which can also be seen in Figure 6.

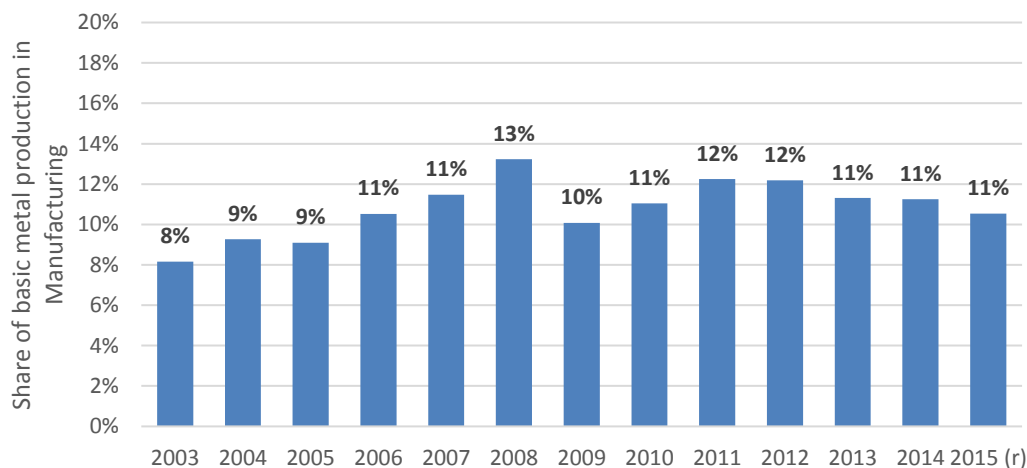


Figure 6. Share of Basic Metal Industry in Manufacturing Industry (Turkstat)

However, the share of basic metals in the manufacturing industry in European countries is not as large as Turkey. While Norway and Finland have a large share in their manufacturing industry: Netherlands, Denmark and France have quite small share of basic metal production in the total manufacturing industry.

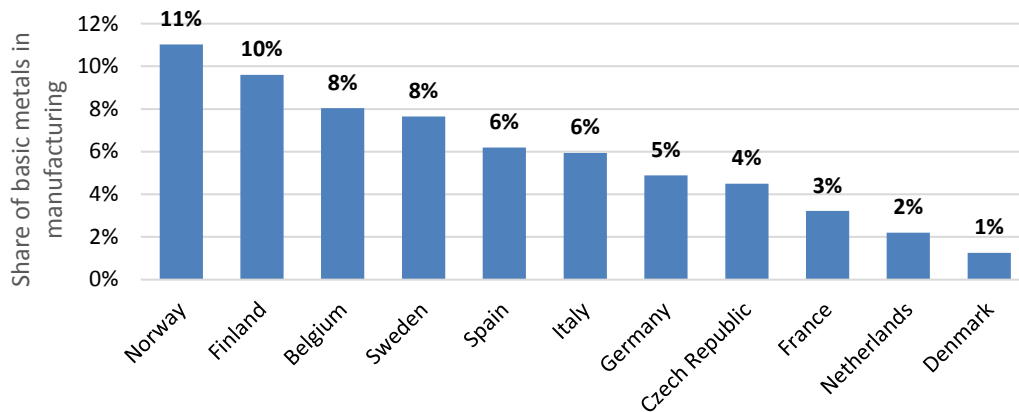


Figure 7. Share of Basic Metals in Manufacturing in Some of European Countries in 2015 (Eurostat)

In addition, basic metal production is the second largest industry in the manufacturing after food production with a share of 15.4%. Motor vehicle production is at third place with 9.5%, textile production as fourth place with 8.4% and clothing products is fifth with 6.1%.

Figure 8 shows the share of different industries in manufacturing in Turkey. 5 industries constitute up the 50% of the manufacturing industry in Turkey.

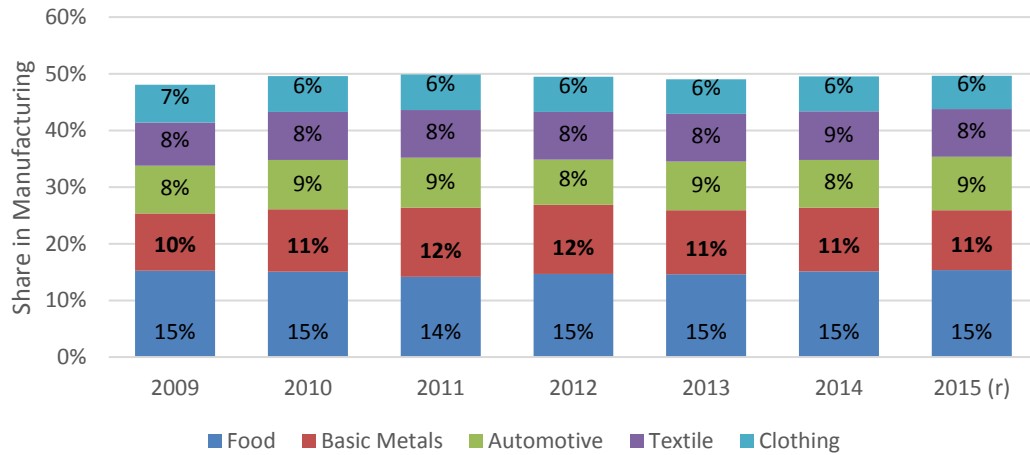


Figure 8. Share of Industries in Manufacturing Industry (Turkstat)

Additionally, to see which industries use the output of basic metal industry, below figures are depicted. Figure 9, shows the distribution of industries in terms of usage of basic metal industry outputs in Turkey and in the world. For both in the world and in Turkey, construction industry is the major purchaser of steel products. However, share of construction differs. Additionally, in the world automotive, machinery has a higher share.

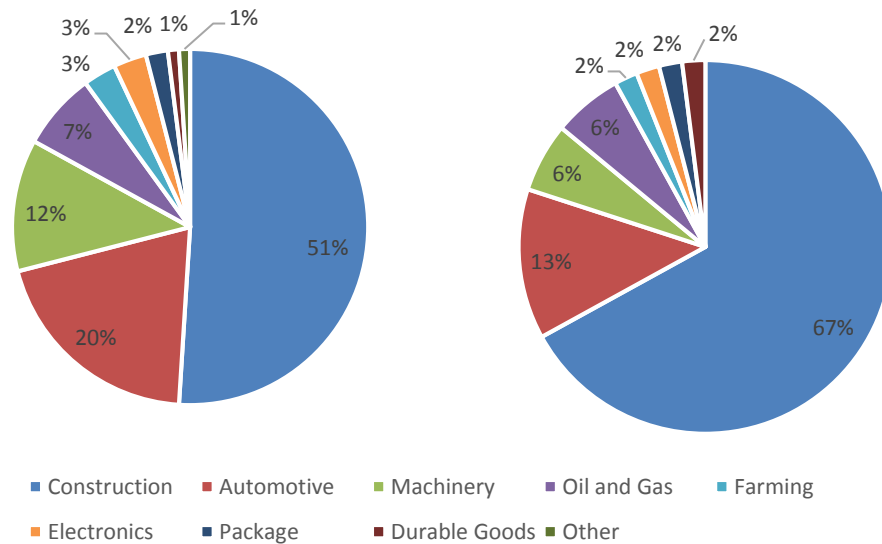


Figure 9. End use distribution of basic metal industry outputs in 2010 (Turkish Steel Association) (Left – World, Right – Turkey)

As a result, construction sector is a major purchaser for the metal outputs especially for rebar which is a metal output that must be used to strengthen the building. Knowing that 7% of Turkish GDP is the construction sector, metal industry can be proved to be vital for Turkish economy again.

Besides, large industries such as machinery and automotive are also purchaser for metal outputs in Turkey. And the usage by machinery and automotive can increase steadily in the following years.

To understand that point, Construction industry major uses long steel, while automotive and machinery use flat steel. Figure 10 below shows the trend in production of flat and long products. It can be concluded that share of flat products grew faster than long products.

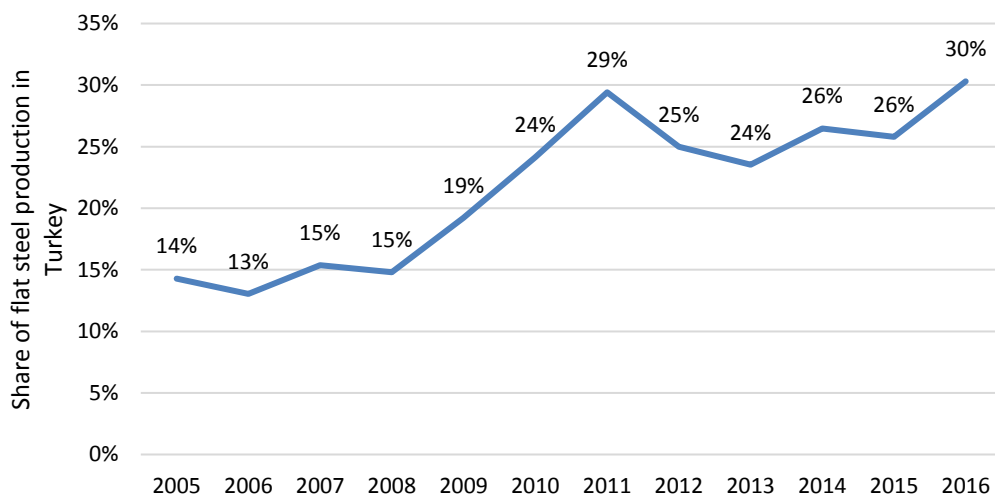


Figure 10. Share of flat steel production in total steel production (Turkish Steel Association)

Increase in share of production of flat steel is important for Turkey, because while Turkey has excess production in long steel, consumption is higher than production in flat steel. Figures below shows the production and consumption figures.

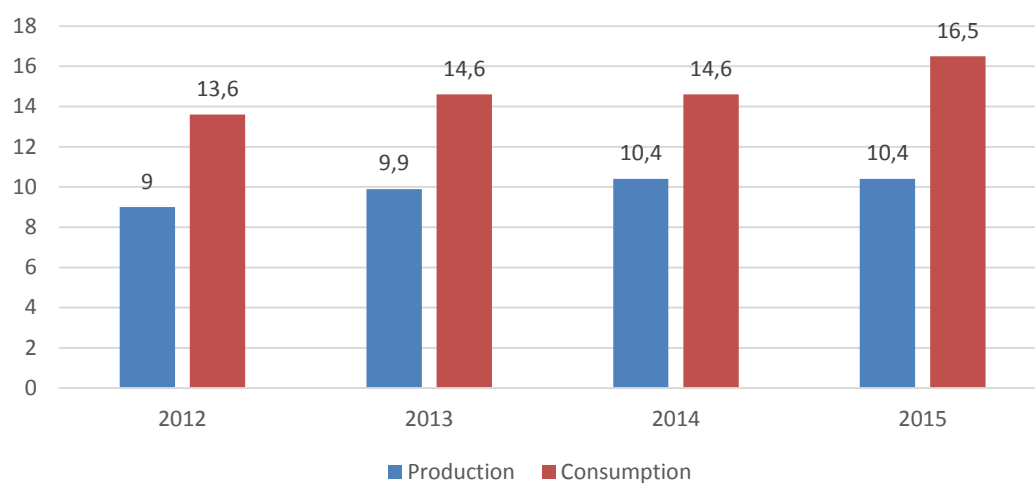


Figure 11. Production and consumption of flat steel in Turkey (in million ton)
(Turkish Steel Association)

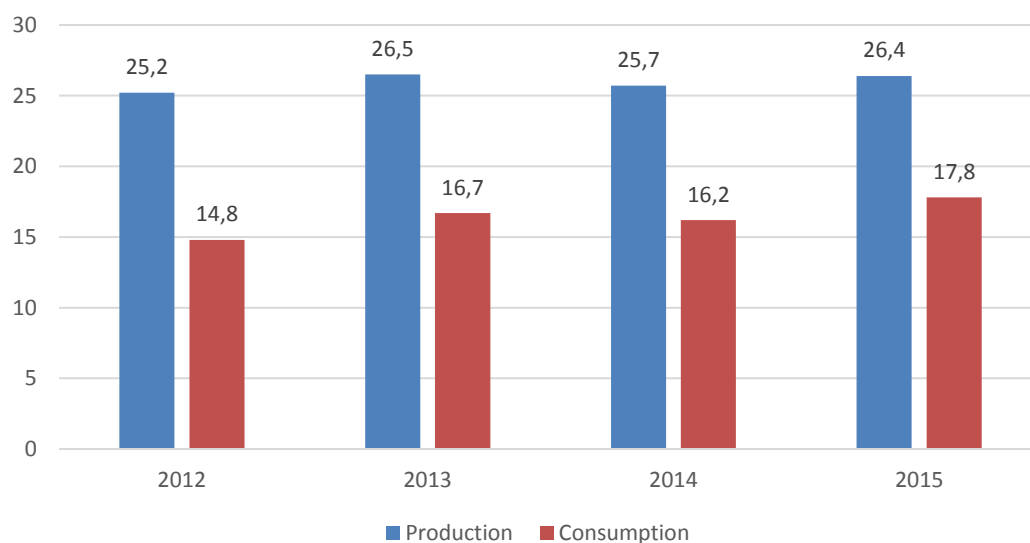


Figure 12. Production and consumption of long steel in Turkey (in million ton)
(Turkish Steel Association)

Analyzing the total steel consumption, in terms of consumption within the country, Turkey keeps its increasing trend in per capita consumption, while Japan, the US, EU and England are in decreasing trend. Table 1 from world steel association shows the trend below.

Table 1. Per Capita Steel Consumption (in million tons) (World Steel Association)

	2000	2005	2010	2011	2012	2013	2014	2015
S. Korea	854	1.021	1.133	1.214	1.159	1.082	1.155	1.156
Japan	628	656	533	550	544	558	575	536
China	109	277	456	496	508	562	541	509
Germany	512	468	500	520	481	517	530	524
Turkey	202	269	341	384	400	434	421	464
US	473	382	280	308	323	335	381	337
EU	380	368	320	338	302	312	322	332
England	255	202	164	179	177	182	183	183
World	150	189	221	236	238	234	234	224

Up to now, importance of the basic metal industry for a country's GDP or importance for Turkey is discussed. However, to understand the reason of the importance of an analysis from global metal prices to Turkish basic metal industry, value added of the industry can be discussed as well. Figure 13 makes the value added of industries clear for 2015: Within largest 5 industries, basic metals are the second worst in terms of value added. This fact does not imply that basic metal industry is an industry not to invest; however, it means how critical a price change of an input can be, since it can result in even negative margins. This value added can only be an anchor for gross margin; however, generally basic metal producers have 3-4% net profitability in Turkey which strengthens the importance of analyzing the effects of an input for this industry.

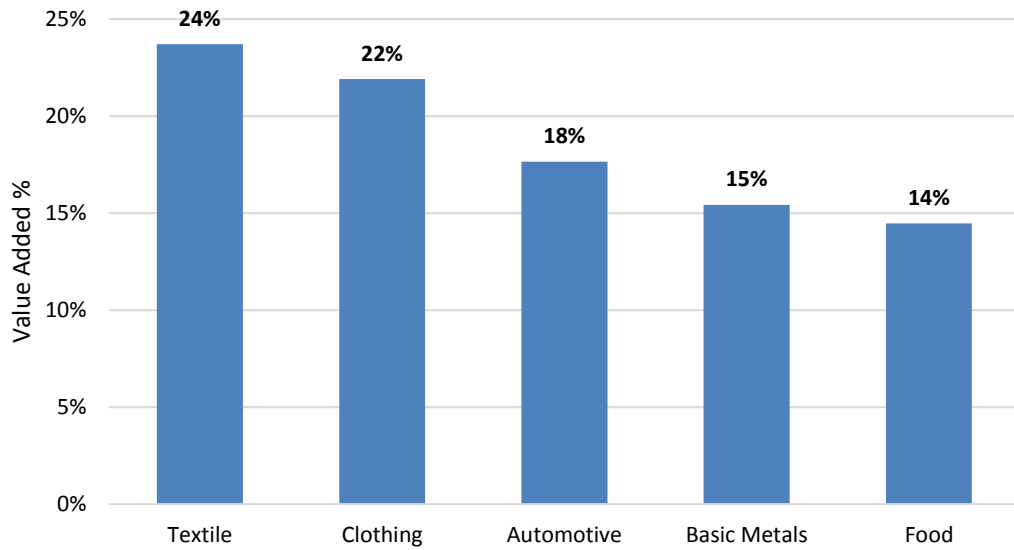


Figure 13. Value Added of Different Industries in 2015 (Turkstat)

Finally, examining the value added % of European countries it can be seen that there are countries such as Denmark and Netherlands with high value-added ratio and there are also countries with very low value added ratio such as Finland. The figure 14 shows that there are still room for improvement in basic metal industry in Turkey. Understanding the effects of global price changes is one of the topics to begin for the improvement.

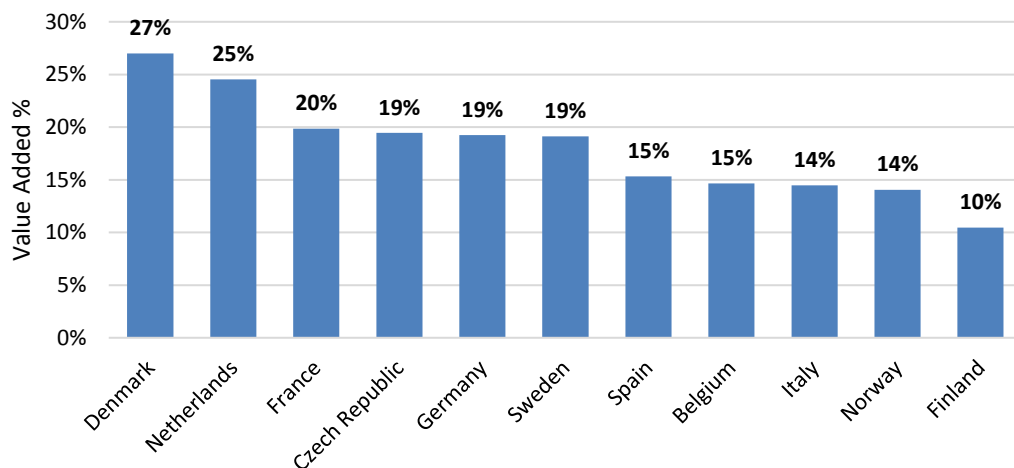


Figure 14. Value Added of Basic Metal Industry in 2015 (Eurostat)

As a summary, the metal production industry has an important share in total manufacturing industry, and manufacturing industry is one of the key drivers of GDP growth. However, value add ratio of this industry is low compared to other industries in Turkey. These information helps to understand the significance of an analysis in basic metal production industry which is an industry open for improvement.

However, in terms of employment, basic metal industry does not contribute much since it is a capital intensive process. Figure 15, shows the share of employment in manufacturing industry in Europe.

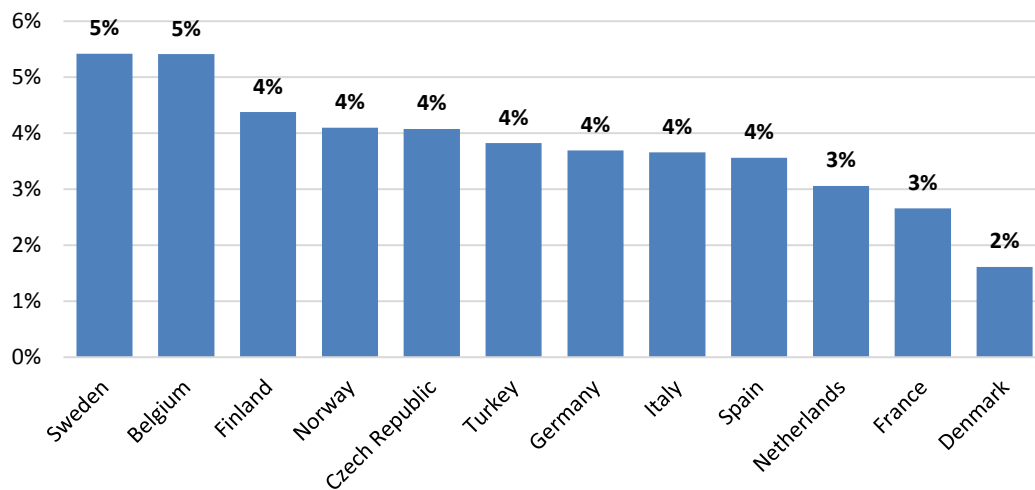
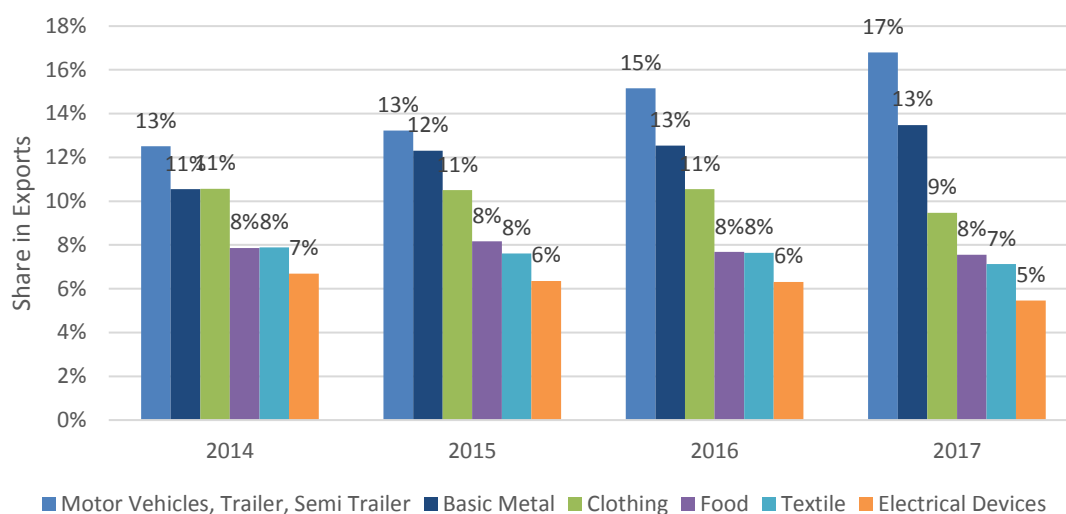


Figure 15. Employment share of basic metal industry in total manufacturing industry in 2014 (Eurostat)

1.4.2. Importance in Net Export of Turkey

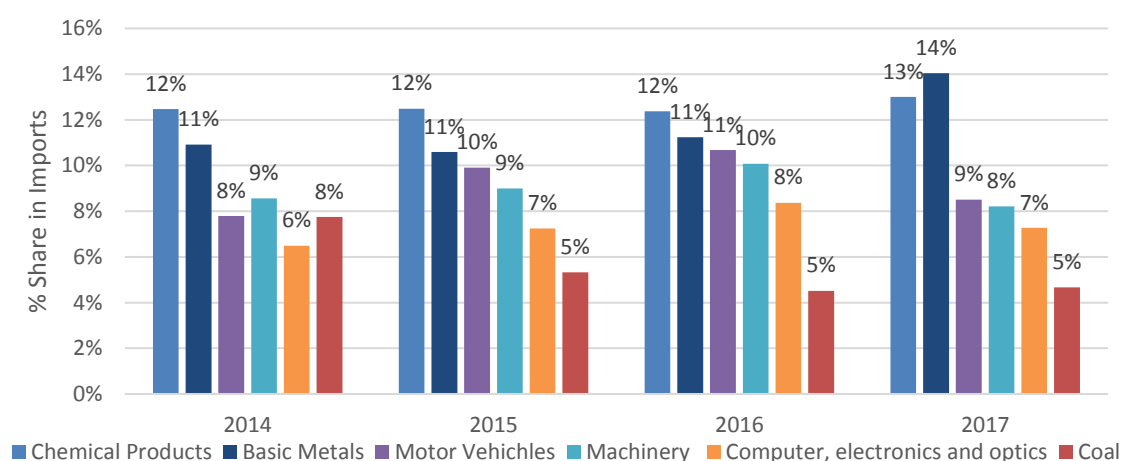
Importance of the basic metal production is not limited with domestic factors. Basic metal production also plays an important role in export and import of Turkey. Basic metal is the second largest sector in Turkish exports. Considering Turkey's export plans for future, the importance of the basic metal sector reveals again.

Figure 16 depicts the importance of the share of basic metal production in Turkish exports from 2014 to 2017.



**Figure 16. Share of Basic Metal Industry Exports in Total Turkish Exports
(Turkstat)**

In addition, Turkey is not only an important exporter but also an importer for basic metals. Figure 17 shows the trend in the basic metal imports from 2014 to 2017. These facts give a clue how Turkish metal production, as a result export or import of basic metals can be effective on global price levels for the inputs for basic metal production such as scrap and basic metal prices.



**Figure 17. Share of Basic Metal Industry Imports in Total Turkish Imports
(Turkstat)**

1.4.3. Importance of Basic Metal Production for Turkey as a Global Player

Starting from 1967 with a production of 1M tone, Turkey became 8th steel producer with 33.2M tone in the world. While Turkey was playing a small role in global metal production, today, Turkey has significant role with being 8th largest steel producer. Table 2 shows the evolution of the steel production in million tons in the world. Therefore, not only the global prices can be effective on the metal production in Turkey, but also Turkey can affect global prices with its export amount. This also will be a hypothesis to be tested through the thesis.

Table 2. Global steel production (in million tone) (World Steel Association)

Countries	1967	1980	1990	2000	2010	2016
China	14	37.1	66.4	128.5	626.7	808.4
EU		208	191.8	193.5	172.8	162.3
Japan	62	111.4	110.3	106.4	109.6	104.8
India	6.3	9.5	15	26.9	68.3	95.6
US	115	101.4	89.7	101.8	80.6	78.6
Russia				59.1	66.9	70.8
South Korea	0.3	8.5	23.1	43.1	58.5	68.6
Germany	41.3	51.1	44	46.4	43.8	42.1
Turkey	1	2.5	9.4	14.3	29	33.2
Brazil	3.6	15.3	20.6	27.9	32.8	30.2
Ukraine		52.3	54.6	31.8	33.6	24.2

In addition, Turkey has a role in total exports and imports of basic metals globally. In 2013 while Turkey is one of the major net exporters in the world, in 2015 with a trend change Turkey is one of the major importers in the world due to a decrease in exports and an increase in imports. However, in 2016 it is observed that Turkey is becoming a net exporter again. Table 3 depicts the rankings.

While US is a major importer, China is the major exporter due to its high production increase from 1967 to today. This ranking also explains why China has so strong effects on the global metal prices. However, this ranking or amounts in imported or exported materials also shows the importance of Turkey in world steel market. Turkey's export or import amount can be effective for final output but also on input prices due to the supply and demand change resulting from an increase or a decrease in the total exported or imported amount by Turkey.

Having such an important part in export and import of metal industry, examination of the effect in changes in Turkey's export amount is worth of studying. As a result, the effect of Turkey's exports on global price levels will be another important topic to be examined through the thesis.

Table 3. Net Import of Countries and Net Export of Countries (Mt) (World Steel Association)

Net Import in 2015			Net Export in 2013		
Rank	Country	Rank	Rank	Country	Rank
1	US	26.5	1	China	61.5
2	Vietnam	14.9	2	Japan	42.5
3	Thailand	13.4	3	EU	38.7
4	Indonesia	9.4	4	South Korea	28.9
5	Mexico	8.6	5	Ukraine	24.7
6	Egypt	7.7	6	Germany	24.3
7	Saudi Arabia	6.4	7	Russia	23.6
8	Algeria	6.4	8	Turkey	17.3
9	UAE	6	9	Italy	16.9
10	India	5.7	10	France	14.2
15	Turkey	3.7	11	Belgium	13.9

A summary of exports of Turkey in 2016, according to TÇÜD;

16.7 Mt steel is exported by Turkey. 56% of the exported amount is to MENA, 19% to EU and 14% to US. In addition, 59% of exported steel is long products.

A summary of imports of Turkey in 2016, according to TÇÜD,

17.5 Mt steel is imported by Turkey. 25% of import is from Russia, 12.5% from Ukraine, 12.5 from China. Basically 49% of imported steel is flat products.

1.4.4. The Importance of Scrap for Turkey's basic metal production

Turkey is the largest importer of scrap. Figure 18 by Bureau of International Recycling shows that Turkey imports 2 times more than India. This is because the plants in Turkey are not integrated plants instead they are mostly semi-integrated plants.

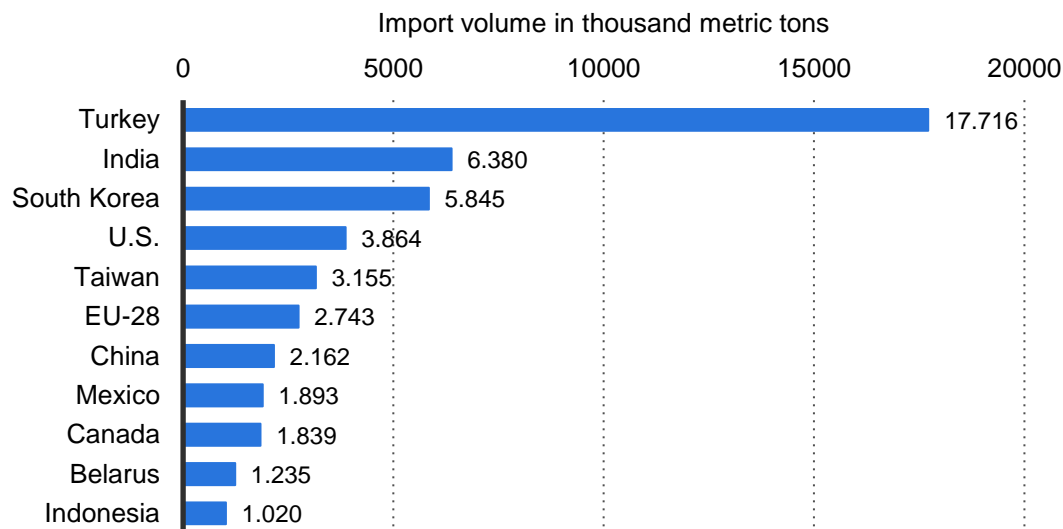


Figure 18. Top Scrap Importers in 2015 (Bureau of International Recycling)

According to TÇÜD, while in 1980, there is a 4.2 Mt total steel production capacity while 1.2 Mt was coming from semi-integrated plants. However, in 2016, there is 51.5 Mt total steel production capacity in Turkey while 39.2 Mt come from semi-integrated plants which makes up 69% of total production capacity. According to world steel association, this level is 25% for world in 2015.

Major problem here is that the quality of local scrap is not as good as imported scrap material. That is why Turkey is dependent on the scrap which should be imported from Russia, Ukraine or China.

As a reminder, since majority of the plants in the world are integrated plants in contrary to the plants in Turkey, they have a power to control the final prices in the world since their profit margin is higher. This means their raw material is highly effective on final price compared to raw material of non-integrated plants. However, since Turkey is a large importer of scrap, it can be a key input for Turkish basic metal industry which can be an important fact that would be tested through the thesis.

Figure below shows the steel producers in Turkey. In Turkey out of those producers, only Erdemir, Isdemir and Kardemir can use iron ore instead of scrap.



Figure 19. Steel Producers in Turkey in 2015 (Turkish Steel Producers Association)

1.4.5. Steel Players in Turkey

Steel producers in Turkey are mostly located in 3 different regions and cities; Marmara regions due to the high demand in especially in Istanbul, İzmir due to demand in Aegean region and also closeness to port for exports and Hatay due to the demand in Anatolian cities and its closeness to port in İskenderun. Figure 20, shows the locations of producers in Turkey.

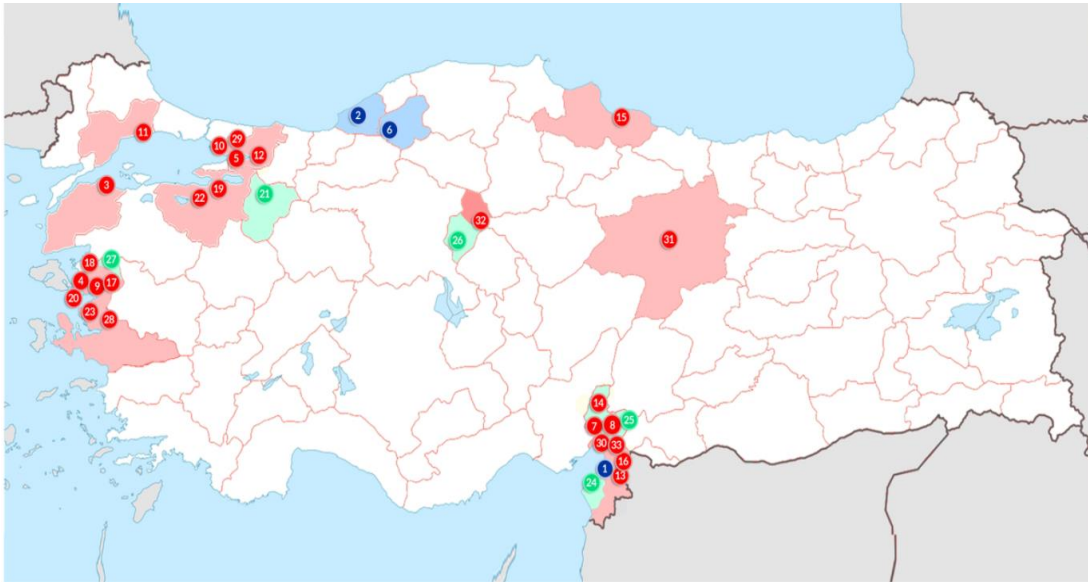


Figure 20. Steel Producers in Turkey in 2016 (Matil)

There are 16 producers which produce higher than 0.5 Mt, 12 producers which produce higher than 1 Mt, 6 producers which produce higher than 2 Mt.

Largest firm in Turkey is İsdemir with a volume of larger than 5.5 Mt, and they produce long and also flat products and it is located in İskenderun. İsdemir is the only integrated plant which can produce flat and long steels. İsdemir was a state owned company until 2002, then it was sold to Erdemir. Then Erdemir was acquired by Oyak group in 2006.

Second largest firm is Erdemir which only produces flat products with a volume of 3.5 to 4.5 Mt. Erdemir was a state owned company which was founded in 1954 and it was acquired by Oyak in 2006.

Third largest is İçdaş which is located in Çanakkale but can supply its products to all Marmara by sea shipments. It only produces long products. İçdaş has been a private firm since its foundation in 1969.

An important fact for Turkish steel industry is that, only three firms (Erdemir, İsdemir and Kardemir) have integrated plants. The rest can produce by semi-integrated plants. This explains the high percentage of scrap usage by Turkey.

Another important fact is that only 5 out of 33 plants produce flat products. This again explains gap between consumption and production in flat steel in Turkey.

Table 4. Steel Producers in Turkey in 2016 (Matil)

Number	Supplier	Plant Type	Product	Yearly Production Tons
1	İsdemir	Integrated	Long + Flat	>5.5 Mt
2	Erdemir	Integrated	Flat	3.5-4.5 Mt
3	İçdaş	Semi-integrated	Long	3.0-3.5 Mt
4	Habaş	Semi-integrated	Long + Flat	3.0-3.5 Mt
5	Çolakoglu	Semi-integrated	Long + Flat	2.0-2.5 Mt
6	Kardemir	Integrated	Long	2.0-2.5 Mt
7	Baştuğ	Semi-integrated	Long	1.5-2.0 Mt
8	Tosçelik	Semi-integrated	Long + Flat	1.0-1.5 Mt
9	İzmir D.Ç.	Semi-integrated	Long	1.0-1.5 Mt
10	Kroman	Semi-integrated	Long	1.0-1.5 Mt
11	Kaptan	Semi-integrated	Long	1.0-1.5 Mt
12	Diler	Semi-integrated	Long	1.0-1.5 Mt
13	Yazıcı	Semi-integrated	Long	0.5-1.0 Mt
14	Koç Çelik	Semi-integrated	Long	0.5-1.0 Mt
15	Yeşilyurt	Semi-integrated	Long	0.5-1.0 Mt
16	Ekinciler	Semi-integrated	Long	0.5-1.0 Mt
17	Özkan D.Ç.	Semi-integrated	Long	<0.5 Mt
18	Ege Çelik	Semi-integrated	Long	<0.5 Mt
19	Asil Çelik	Semi-integrated	Long	<0.5 Mt
20	Sider	Semi-integrated	Long	<0.5 Mt
21	Bilecik D.Ç.	Semi-integrated	Long	<0.5 Mt
22	Çemtaş	Semi-integrated	Long	<0.5 Mt
23	Çebitaş	Semi-integrated	Long	<0.5 Mt
24	Egemen Metalurji	Semi-integrated	Long	<0.5 Mt
25	Platinum	Semi-integrated	Long	<0.5 Mt

Table 4 (Continued)

26	Kirdemir	Semi-integrated	Long	<0.5 Mt
27	Ege Demir	Semi-integrated	Long	<0.5 Mt
28	Ede Çelik	Semi-integrated	Long	<0.5 Mt
29	Siddik Kardeşler	Semi-integrated	Long	<0.5 Mt
30	Nursan Çelik	Semi-integrated	Long	<0.5 Mt
31	Sivas D.Ç.	Semi-integrated	Long	<0.5 Mt
32	MKE	Semi-integrated	Long	<0.5 Mt
33	MMK	Semi-integrated	Long	<0.5 Mt

1.4.6. Incentives & Pain Points of Turkish Metal Industry

Major incentive for metal producers in Turkey is the no tax application on scrap. So that this ease producers to import cheaper scrap and produce their output. However, this application is questionable in terms of benefit for Turkey steel industry since this encourages semi-integrated plants which are less profitable compared to integrated plants. The ratio of semi integrated plants is the first pain point of Turkey steel production.

Second pain point in steel industry in Turkey is the excess capacity and its inaccurate distribution in flat and long steel. With no tax application in scrap, number of semi integrated plants increase, however this increase are mainly on long products. As a result, Turkey has excess production in long products so that producers should export and has lower production in flat products so that Turkey has to import. However, flat products are more value added products. As a result, Turkey exports low value added products and imports high value added products.

Thirdly, like flat/long ratio, Turkey does not produce high value added products instead it produces low value added ones. For example, automobile pipes, stainless steel are the most important ones, however, they are not commonly produced in Turkey.

There are also two negative recent occurrences for Turkish steel industry; one is anti-dumping campaign in USA (section 232 application) which will affect export negatively, second is the decrease of tax in import of rebar. Rebar is the main product

for construction industry. Due to the increase in price levels of rebar in Turkey, profit in construction industry has been decreasing. To stop this decrease, government decreased tax of rebar imports from 10% to 0. This probably will increase imports and decrease in production.

In contrary to those negative occurrences, there will be also additional tax on flat product imports in 2018. This is mainly for encouraging flat production within Turkey. However, this may result in increase in flat steel however it can get to steady state in midterm.

1.5. SUMMARY

Basic metals consists of steel, iron, aluminum, copper, zinc and nickel. There are other basic metals; however, they are very low in terms of volume in production and foreign trade.

The usage area of the basic metals varies; however, they are mostly used in construction, machinery, transportation, automotive, batteries and galvanizing. Steel and Iron are the most produced and traded basic metals which almost 90% of total production of the basic metals.

The basic metals have important share in manufacturing industry in Turkey. From 2003 to 2015 on the average, its share is almost 11%. It is the second largest industry in manufacturing after food industry. This ratio is higher compared to almost all European countries.

The importance of basic metal industry is not only its share but also its usage as an input for other industries such as automotive, machinery etc. It is also an important input for construction industry which is the 7% of Turkish GDP.

The basic metal production in Turkey also has a valuable share in exports and imports. It is again the second largest industry in exports and imports of Turkey. This shows the importance of basic metal industry in the international trade of Turkey.

However, value added of basic metal production is low compared to other industries. This means that profit margin of the basic metal producer companies is low. As a result, examining the effects of global basic metal prices on basic metal industry in Turkey is an important starting point to improve their profit margin.

Not only basic metal prices are important for Turkey but also Turkey's production in basic metal production is important for basic metal prices and the scrap prices because Turkey is the 9th largest steel producer and has an important share in international trade.

In addition, the quantity produced had grown up to 33 million tons from 1 million tons from 1967 to recent years. It means that Turkey's role in the world had been changing, while basic metal production industry also keeps its importance in Turkish manufacturing industry.

However, there are some pain points in Turkish basic metal industry. First of all, there are only three integrated plants, as a result, Turkey is a major scrap importer. Secondly, Turkey mostly produce and export low value added products such as long steel and imports high value added products such as flat steel. Additionally, there are some recent negative occurrences such as decreases in tax on rebars, and anti-dumping of USA for steel import.

The information summarized shows that relationship of global basic metal price with basic metal production in Turkey is a crucial topic and worth studying. In this thesis, those relationship will be evaluated and outcomes will be derived accordingly.

As a result, to develop further, and to have a clear strategy and vision, accuracy of forecasts is vital. Turkish manufacturing industry players must understand the effects of global changes in basic metal dynamics. Many study examines the dynamics between commodity prices; however, this thesis is the first one focuses on real sector effects of commodity price change in Turkey.

CHAPTER 2

LITERATURE REVIEW

The commodities are widely used in the manufacturing industry as an input for other manufacturing industries. That is why price fluctuations are critical for commodity importers and exporters. In addition, commodity price fluctuations have important effects on worldwide economic activity. (Labys,2006) In addition, the commodity price levels and its fluctuations have a major effect on macroeconomic situations and living standards (Deaton,1999; Cashin et al.,2002). Within those commodity products, basic metals are highly important for production sector not only due to its share in production but also due to its importance as an input for many industries.

Findings suggest that companies will be highly affected by price jumps. Additionally, metal price fluctuations have a significant impact on project valuation for capital budgeting. (Dooley and Lenihan,2005)

Considering the vital effects of price changes in commodities, numerous studies focus on understanding the dynamics and forecast of commodity price levels. Parallel movement of commodity price levels was discovered by the study of Pindyck and Rotemberg (1990). Roberts (2009) focuses on understanding of duration and characteristics of metal price cycles. Rossen (2015) examines the co-movement of commodity prices and discovers price cycles and long run trends. Similarly, Fernandez (2015) measures co-movement of commodity prices. Additionally, Winkelried (2016) examines piecewise linear trends and cycles in commodity prices.

For the effects of commodity price changes on economic variables in a country, Cordon (2012), discusses consequences of commodity shocks. And it is found out that the appreciation of real exchange rate, rise in terms of trade, capital inflow and

decrease in the competitiveness are results from the analysis for Australian economy. Lee and Ni (2002) discussed the effects of oil price shocks in the US and discovered that the output decreases for most of industries.

Guidi (2010) examines the oil price shocks in UK for manufacturing and service sector. It is concluded that manufacturing sector is highly affected significantly however service sector is unaffected. Similarly, Fukunaga (2010) found out that there is positive impact in terms of output in Japan due to an oil price shock. Knop, Vespignani (2014), examines the effect of commodity shocks in Australian economic variables with SVAR model. Variables are analyzed quarterly and the effects of bulk commodity index and the metal price index on profits of different industries are discovered. 1% base metal shock affects mining industry profits negatively for 4 quarters, while it has positive impact on manufacturing industry profits on second quarter while in longer term it has negative impact. Positive profit impact is also present for 4 quarters for construction sector, however in the long term it affects negatively again.

In addition, there are studies examining price pass through between scrap and primary metal prices. For example, Fisher and Owen (1981) found out that primary prices influence scrap prices for aluminum. Again, in a short run disequilibrium model for copper by Labys and Kaboudan (1980), the direction is again from primary price to scrap price. These are basically due to demand pull theory. First macroeconomic factors influence the demand of final goods, then this changes the demand for inputs. The price pass through will also be examined through this thesis with VAR model.

2.1.2. The Studies in Turkey

Other than the mentioned studies, for economic impacts of commodity especially metal prices, there is no significant literature. Also, there is no study examining these effects on metal manufacturing industry in Turkey. Since commodity production can be highly related to its price which is understood from previous studies on this topic, in this thesis effects of rate of change in price in basic material production will be examined. As a result, examining the changes in basic metal production, will reveal

important facts about metal production industry, and the effect of basic metal price change can be used to predict exports, imports, manufacturing business and at last Turkish GDP. This thesis will be the first to examine those effects that is why results will be very valuable.

The basic metal industry has 11% share in manufacturing sector and it is an important input for construction (7% of GDP), for automotive industry (9% of GDP) and for many more industries like durable goods. In addition, it makes up to 17% of exports. That is why understanding the effects of prices on the trend of metal production industry is vital for Turkey.

This thesis contributes to literature in analyzing the effects of global metal rate of change in price in Turkish metal production and in turn exports and GDP. Thesis examines the effect with VAR approach and derives the impacts with impulse response function. Then using forecast error variance composition, the reasons for variance in variables explained. Results can be used to forecast and predict effects in metal production from any rate of change in prices.

Results found will be enlightening for understanding basic metal production dynamics, and their inputs dynamics. Also, it is important to see how effective Turkey can be with its increasing production capacity.

Thesis will be an introduction study to price and basic metal industry relationships, and the studies can continue to discover the dynamics of changes in metal prices to foresee the changes in price.

CHAPTER 3

DATA, VARIABLES AND METHODOLOGY

In this chapter of the thesis, firstly some hypotheses are constructed from the analyses of the variables and the market information. Then data and variables are introduced and their time lengths or the characteristics are evaluated. Then, stability tests are run and explained by ADF and PP. Next, the volatility of variables is evaluated and analyzed with the ARCH models. Finally, before constructing econometric model, cointegration tests are applied and then VAR models that are used in the analysis are explained.

3.1. HYPOTHESES

Considering the basics of supply and demand analyses for a commodity market, some hypotheses will be presented in this part. In the production processes of the metal industry there are two types of inputs: basic metals and scrap metals. These inputs they have their own markets. Scrap can be substituted for basic metals and hence their markets are interdependent. Final metal products produced by using these inputs can become intermediary goods in different segments of manufacturing sectors like automotive sector, machinery and durable goods producing sectors and construction sector. In terms of the firms assuming different roles, the profit functions roughly can be considered as follows:

Supply Side: Supply of Metal by Metal Producers (Producer Firms-B2B):

$$Profit_t = Final\ Metal\ Product\ Price_t * Amount\ of\ Metal_t - Labor\ Cost_{ts} - Raw\ material\ Cost_{t-2} \quad (1)$$

For the supply side firms producing metal, current profit can be calculated by the final metal product price times the quantity of metal production minus labor costs and costs of inputs from previous periods. Metal producers purchase their raw materials 2-3 months before their production because of the lead time of the order and hence

Demand Side: Demand for the Final Metal Product as an Intermediate Good in Other Manufacturing Sectors (Purchasers-B2C):

$$Profit_t = Price \text{ of the Manufactured Good} * Amount \text{ of the Good} - Metal \text{ Product Price} * Amount \text{ of the Final Metal Product Used as an Input} \quad (2)$$

In the demand side for metal, metal price is very important as an input price. Construction industry and other manufacturing industries use metal as an important intermediate input in their productions.

As a result, the producers want to sell their product at the highest current price or minimize their raw material cost which they purchase 2 months in advance. The purchasers want to buy the final product from metal producers at the lowest price and sell it to the final customers at the highest price. However, the margin of purchasers depends mostly on the cost since they sell to the final customer and the final price level does not vary too much. That is why they want to minimize their cost.

A couple of hypotheses can be derived from those facts.

Supply Side Hypotheses

The metal producers use forward contracts and order their inputs (basic metals and scrap) a couple of months (like two months) before their productions take place. However, when they supply their metal products they sell them in spot markets. These play an important role in the quantity and price dynamics in the metal market as the following hypotheses indicate.

Hypothesis 1: If there is a shock that increase the input prices (basic metals and scrap), the metal producers decrease their purchase volumes of inputs (basic metals

and scrap) in the spot markets. This will lead to decreases in the amounts of metal products available in future months in the metal markets.

Hypothesis 2: The metal producers use forward contracts and order their inputs (basic metals and scrap) a couple of months (like two months) before their productions take place. A shock that increases the input prices at the time of ordering might dissipate over time and the input prices might return to their normal levels when the metal products (produced with high input prices) are ready to sell. Accordingly, metal producers might prefer to supply high amounts of metal in the markets, since their products have high present prices associated with high input costs of earlier months, before the expected price drops of their products following present low input prices. Here the motivations of the metal producers are clear: sell the own product now at the present high price while it is high due to high past input costs and buy the inputs now at the present low input prices.

Demand Side Hypotheses

As mentioned above, the buyers of final metal products operate in spot markets.

Hypothesis 3: If the metal prices are high at the metal spot markets, then the purchasers may prefer to postpone their demands until the metal prices drop to lower levels. This might lead to low capacity usages by manufacturing firms using metal products intensively and hence a contraction in manufacturing sector.

Hypothesis 4: The metal purchasers know that the metal suppliers purchase their inputs (basic metals and scrap) two months in advance. Hence, if a metal input price increasing shock happens now, this might alert them to increase their demand for final metal products now before the increased metal input costs are reflected in future metal prices on the future spot markets. Then this might lead to increased production in the metal sector.

Other Hypotheses

Hypothesis 5: Due to the fact that Turkey plays an important role in the global steel production, an increase in final metal products' exportation by Turkey might lead to decreases in the price of raw materials

Hypothesis 6: Since scrap is a major input for Turkish metal production, the effect of changes on the import prices of the scrap will be significant on Turkish metal production growth rates.

Hypothesis 7: The global input price changes in basic metals and scrap directly affect Turkish production sector's future output levels and revenues per volumes (as an approximation to the price of the final metal product) by causing variations in forward input prices (basic metals and scrap).

Hypothesis 8: Any price change in the basic metal prices will be reflected into the scrap price. This fact is mainly due to the substitution effects between these two inputs for the plants. When there is an increase in the basic metal prices such as iron ore, the demand for scrap will increase. This is expected to push the price of scrap to higher levels.

Hypothesis 9: Volatilities of exchange rate, oil price or the basic metal price have significant effects on Turkish basic metal production industry.

Hypothesis 10: Volatility of the oil price has significant effects on the basic metal prices.

3.2. VARIABLES AND DATA

To understand the relationship between the metal production in Turkey and the global price levels, ten major variables are used. First variable is the basic metal production index in Turkey which is published by Turkstat. Second variable is the metal price index for basic metals (iron ore, copper, nickel etc.) obtained from IMF. The third one is the scrap import price level for Turkey taken from Platts. The fourth variable is export revenue for metal production from Turkstat, while the fifth and sixth ones

are the price index for the basic metal production and steel production from Turkstat. The seventh variable is the exchange rate between US dollar and Turkish Lira from the Central Bank of the Republic of Turkey (CBRT). Eighth variable is the oil price index from investing. There are also two other variables which are production index for steel from Turkstat and export revenue from steel production from Turkstat.

The reason for using exchange rate is due to the volatility in exchange rate in Turkey especially after 2013. This change affects price levels of basic metal since global prices are in dollars. Data set is used from 2005 until 2016 as monthly data while scrap price is from 2010 to 2016 due to its availability.

Figure 21 shows the trend and change in the metal production index from 2005 to 2016. Plot indicates that the metal production was affected majorly in 2009 and then there is a recovery period until 2013. After 2013, the production of basic metals fluctuates monthly even though on average it stays same for 3 years ahead.

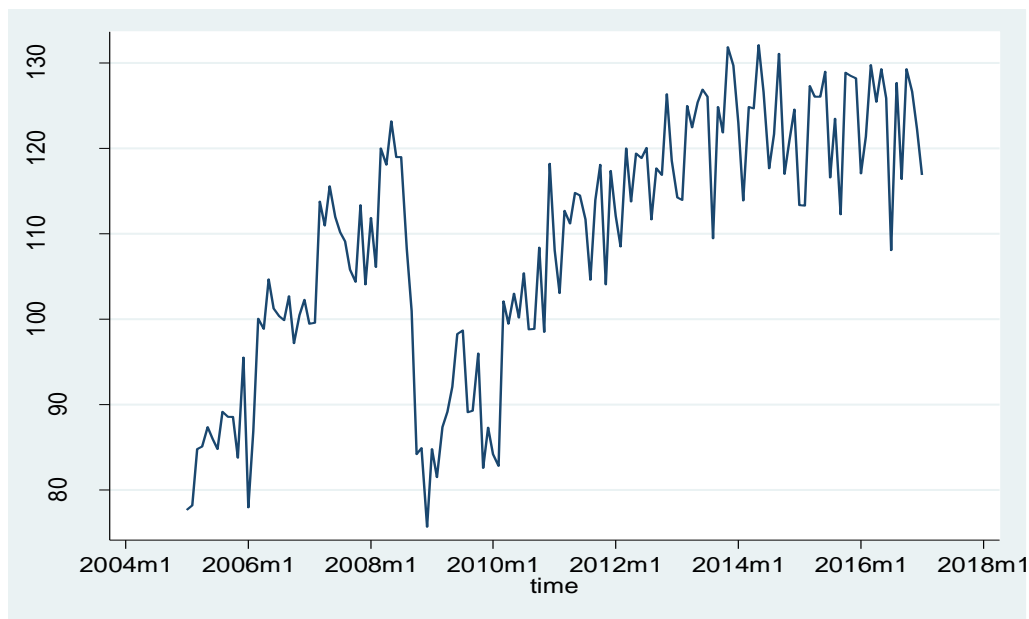


Figure 21. Metal Production Index Turkey 2005-2016 (Turkstat)

To show the correlation between metal production and industrial production in Turkey, Figure 22 is depicted. Plot indicates that production in general and

production of metal follows a very similar trend from 2005 to 2017. Correlation coefficient between two variables is 97%.

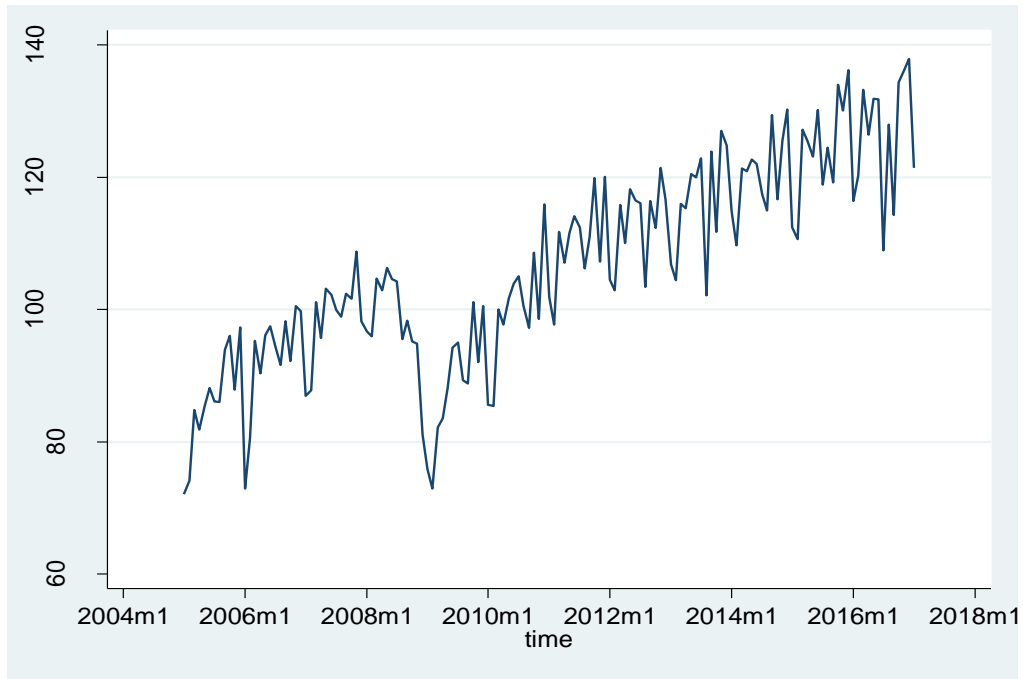


Figure 22. Production Index Turkey 2005-2016 (Turkstat)

To examine price trends in basic metals, Figure 23 is drawn. It shows the trend and rate of change in global metal prices in US dollars from 2005 to 2016. Plot indicates that there is an increasing trend until “2009 crisis”. After a large drop in 2009, there is a significant increase in the metal prices even to a higher level than pre-2009 period. It should be noted that despite the increase in metal prices, production also increases. After a recovery period with a significant increase in 2011 price levels have a decreasing trend until 2016. From the plot, it should be also noted that volatility of price level is high and it may indicate a non-stationary process which will be analyzed later in the thesis, and a need for volatility analysis will be considered throughout the thesis.

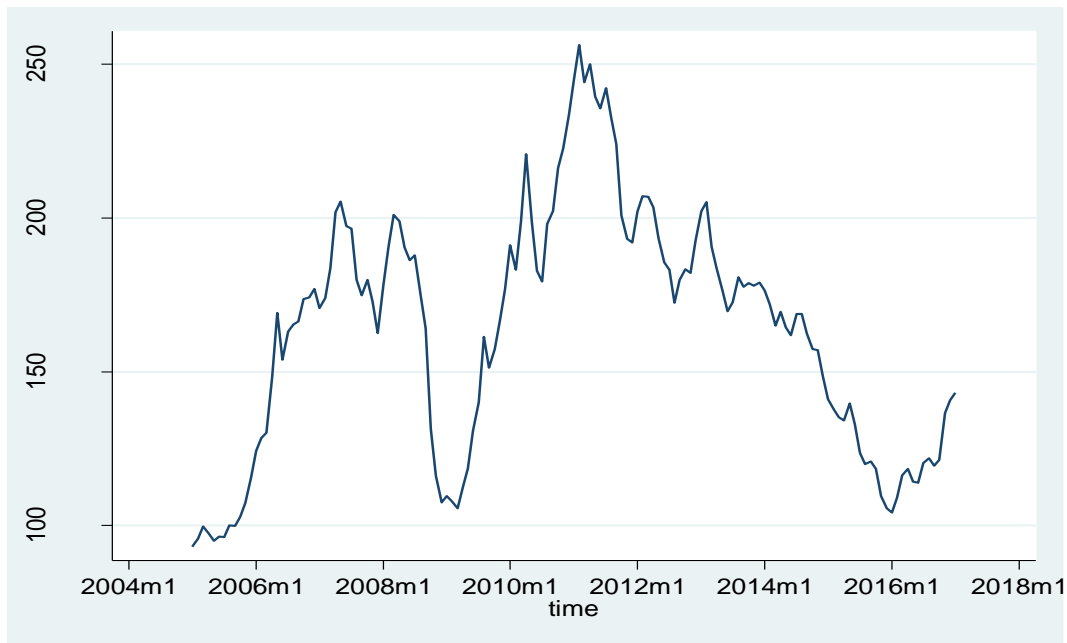


Figure 23. Basic Metal Price Index in USD 2005-2016 (IMF)

Figure 24 shows the trend in exchange rate from 2005 to end of 2016. Plot indicates that there is an upper jump in the crisis year, and then it stays almost constant until 2012. Especially after 2013 there is an increasing trend in the exchange rate between US dollars and Turkish Lira which might have affected Turkish metal production after 2013.

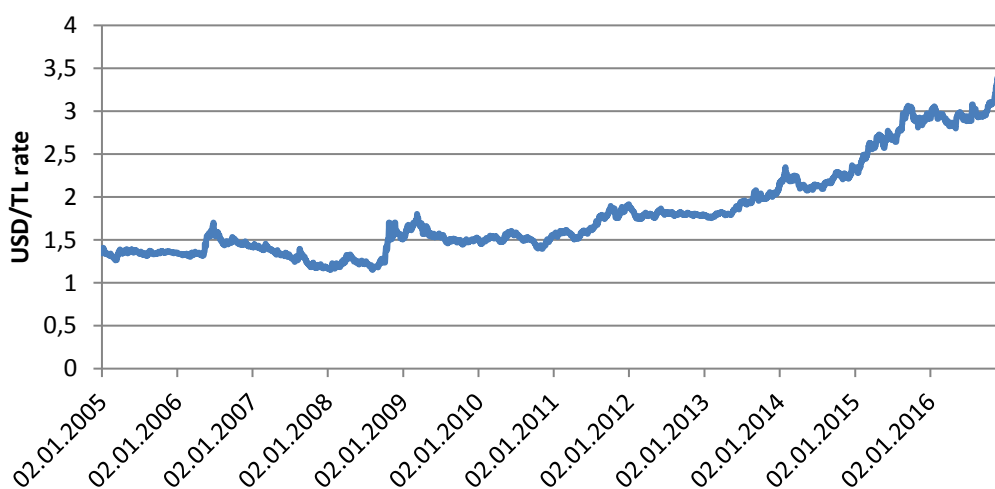


Figure 24. US/TL Exchange Rate 2005-2016 (CBRT)

To examine the price level of metals in Turkish Lira, exchange rate is multiplied by metal prices in dollar. Figure 25 shows the trend in price levels of basic metals in Turkish Lira. It should be noted that despite the decline in price level in dollars, price level in Turkish Lira does not decrease after 2013. This trend can explain the stationary trend after 2013 in Turkish metal production.

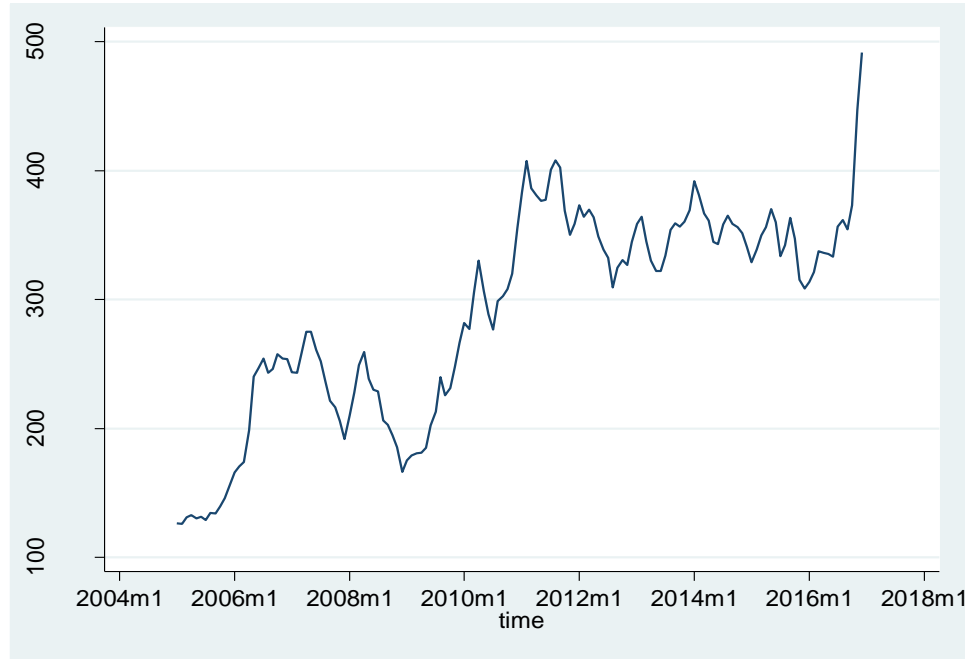


Figure 25. Basic Metal Price Index in Turkish Liras 2005-2016 (IMF, CBT)

3.3. UNIVARIATE TIME SERIES PROPERTIES OF THE VARIABLES

In this part, before establishing volatility and VAR models, the time series properties of the variables are analyzed. For testing the stationarity properties of the series, two unit root testing methodologies are applied: firstly augmented Dickey-Fuller test (ADF test) then Phillips-Perron (PP test) for validation.

The statistic used in the ADF test is expected to be a negative number for the rejection of the null hypothesis that there is unit root. Basically, two equations are used to test their stationarity:

Y_t : Production index at time t

P_t : Price index at time t

$$\begin{aligned} P_t &= \beta P_{t-1} + v_t \\ Y_t &= \beta Y_{t-1} + u_t \end{aligned} \quad (3)$$

$$u_t = \rho u_{t-1} + \varepsilon_t \quad \text{for metal production index} \quad (4)$$

$$v_t = \rho v_{t-1} + \varepsilon_t \quad \text{for price index} \quad (5)$$

Phillips Perron Test has a very similar approach to test stationary of a variable, Phillips Perron test named after Peter C.B. Phillips and Pierre Perron. Major difference between ADF and PP is that PP test ignores any serial correlation.

In addition, ARCH test is conducted to check the presence of conditional heteroskedasticity in error terms.

After applying the unit root tests, taking into account the nonstationary variables integrated to degree one (I(1) variables) Johanssen cointegration test is applied. Since this test is highly dependent on the lag length of the model, correct selection of lag length is critical. Methodology of Tsay (1984) and Paulsen (1984), Nielsen(2001) is used to determine approximate lag length.

3.3.1. Unit Root Tests

3.3.1.1. Augmented Dickey Fuller Test

To evaluate whether variables include a unit root or not, ADF model is ran with constant term and constant & trend term. To detect the appropriate lag length, methodology is selecting a maximum lag length of 12 and running regression 12 times by decreasing lag one by one. This process is continued until every lag is significant.

In our case, only lag 1 is remained significant. As a result, two types of ADF is calculated; one constant with no lag, second with constant and trend and lag 1.

Results for the period of 2005 to 2016 are summarized in Appendix A.1.a., while results for 2011 to 2016 is not conducted since PP and ADF gives similar results. So, unit root test results for variables 2011-2016 can be seen under the next section.

3.3.1.2. Phillips Perron Test

To evaluate whether the variables include unit root or not, also PP model is run with the constant term and constant & trend term. Here maximum lag length is selected as default of 3. As a result, two types of PP are calculated; one constant with lag 3, second with constant and trend and lag 3.

Results for basic metal production index, per volume revenue and basic metal prices are for the period of 2005 to 2016 while results for scrap and export of basic metals are from 2012 to 2016. Results are summarized below in Table 5.

Table 5. PP results for level of the variables

PP					
Variable	Condition	Test Statistics	%1 Critical Value	%5 Critical Value	%10 Critical Value
Production Index for basic metals	Default lag of 4	-3.225	-3.495	-2.887	-2.577
Production Index for Steel	Default lag of 4	-3.547	-3.495	-2.887	-2.577
Price Index in TL	Default lag of 4	-2.188	-3.495	-2.887	-2.577
Export of basic metals	Default lag of 4	-4.044	-3.495	-2.887	-2.577

Table 5 (Continued)

Export of steel	Default lag of 4	-3.641	-3.495	-2.887	-2.577
Domestic price	Default lag of 4	-0.776	-3.495	-2.887	-2.577
Scrap price in TL	Default lag of 3	-2.554	-3.538	-2.906	-2.588

Results suggest that while the production index and export are I (0) processes, price level index, per volume revenue and the scrap prices are not.

Instead, for the variables which are not stationary in levels, differencing is applied by calculating their rate of changes: $Y_t / Y_{t-1} - 1$. The unit root tests for the differenced series are given below.

Table 6. PP results for the growth rate of the variables

PP					
Variable	Condition	Test Statistics	%1 Critical Value	%5 Critical Value	%10 Critical Value
Growth of Basic Metal Production Index	Default lag of 4	-4685	-3.496	-2.887	-2.577
Growth of Steel Production Index	Default lag of 4	-17.599	-3.496	-2.887	-2.577
Rate of change in basic metal price in TL	Default lag of 4	-7.772	-3.496	-2.887	-2.577

Table 6 (Continued)

Growth in export of basic metals	Default lag of 4	-15.004	-3.496	-2.887	-2.577
Growth in export of steel	Default lag of 4	-17.153	-3.496	-2.887	-2.577
Growth in domestic price	Default lag of 4	-16.943	-3.496	-2.887	-2.577
Rate of change in scrap	Default lag of 3	-7.606	-3.539	-2.907	-2.588

As it can be seen from table 6, the growth rates of all variables are stationary process of $I(0)$. So growth rates of variables can be used in VAR analyses further in the thesis.

3.3.2. Cointegration

Cointegration is used to analyze the long-term relationship between two variables. Even though variables are not stationary, if the variables are cointegrated then the variables can be estimated by a vector error correction model (VECM). However, the finding of different orders of integration between variables led the analyses to be carried out using VAR models with stationary variables rather than using VEC models. . As a result, a VAR model will be constructed to analyze the data. Cointegration results are summarized in Appendix.

3.3.3. ARCH test

To understand whether previous terms' volatility explain current period's volatility ARCH/GARCH models can be run. Before going into these models, ARCHLM test will be applied on the regression of the growth rate of production and the rate of return in basic metal.

Table 7. ARCH LM test for the rate of return in basic metal and the growth rate in production

Chi square	P-value
2.837	0.0921

ARCH LM test suggest H_0 : no ARCH effects while H_1 : ARCH(p) disturbance. As a result, it can be concluded that the residuals of the regression between the growth rate of production and the rate of return in basic metal do not include ARCH effects. Therefore, there is no need to further deep dive on GARCH and ARCH models between on this relation.

3.4. VOLATILITY MODELS

Production decisions of firms do not only depend on current economic conditions but also expectations about future conditions. The degree of uncertainty about future economic conditions are very effective in forming expectations. If the degree of uncertainty is very high about future prices, demand and supply quantities, producers might reduce their production levels, reduce capacity levels or even sell or close their factories. Generally, volatility levels of main macroeconomic variables are used to measure the degree of economy wide uncertainty. Highly volatile macroeconomic variables may be taken as an indication low predictability of future economic conditions leading to less production. To take these facts into account from the point of view of the metal sector, the volatilities associated with the foreign exchange rate, the basic metal prices and the oil prices are estimated with GARCH (general conditional heteroscedasticity) models. Turkey's high dependency on energy and intermediate goods' imports in its domestic production make the volatilities of these variables very important in the production and consumption decisions related to the metal sector.

Figure 27 shows the line graph of exchange rate and Figure 28 shows the line graph of the rate of change in basic metal price. Volatility can be observed within both variables.

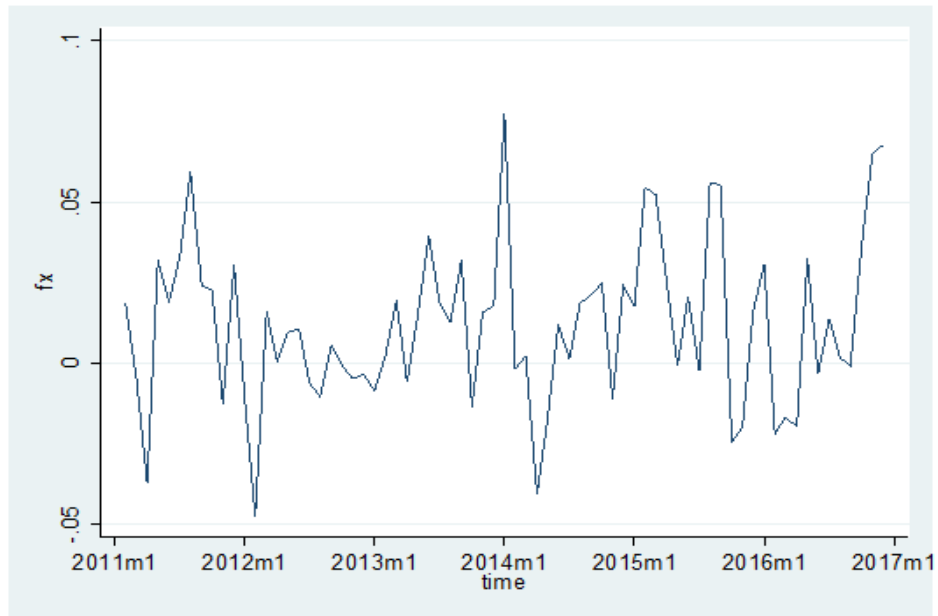


Figure 27. The Rate of Change in Exchange Rate (CBRT)

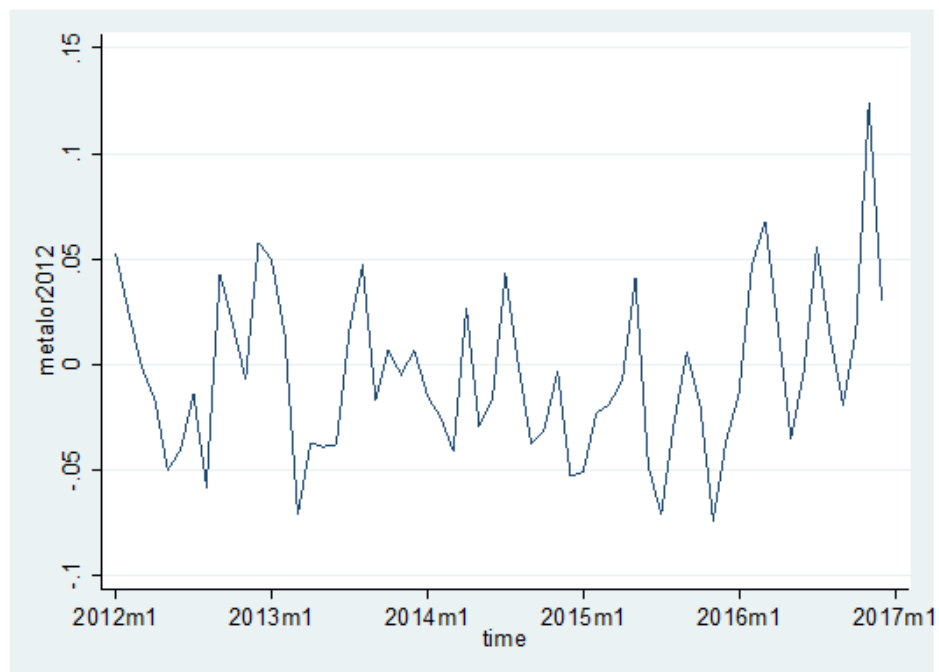


Figure 28. The Rate of Change in Basic Metals (IMF)

To test whether there is an effect of volatility of rate of return in basic metal, ARCH/GARCH model will be used to predict volatility of the rate of return. Then with similar manner VAR model is structured to understand the size of the effect.

To predict the volatility of rate of return, ARCH (1) model is run and the variances are predicted. Then, a VAR model is applied.

ARCH model is introduced by Engle (1982). Equation of ARCH model is basically:

$$\sigma_t^2 = \beta + \sum \alpha_i \varepsilon_{t-1}^2 = \beta + \alpha(L) \varepsilon_{t-1}^2 \quad (6)$$

Here the condition is for all i values β and α_i must be greater than zero. Equalizing $\varepsilon_t^2 - \sigma_t^2 = k_t$, then ARCH (q) model can be written as:

$$\varepsilon_t^2 = \beta + \alpha(L) \varepsilon_{t-1}^2 + k_t \quad (7)$$

Variances are estimated with ARCH (1) process for rate of change in basic metal price, exchange rate and oil price. Figures below show the estimated variances.

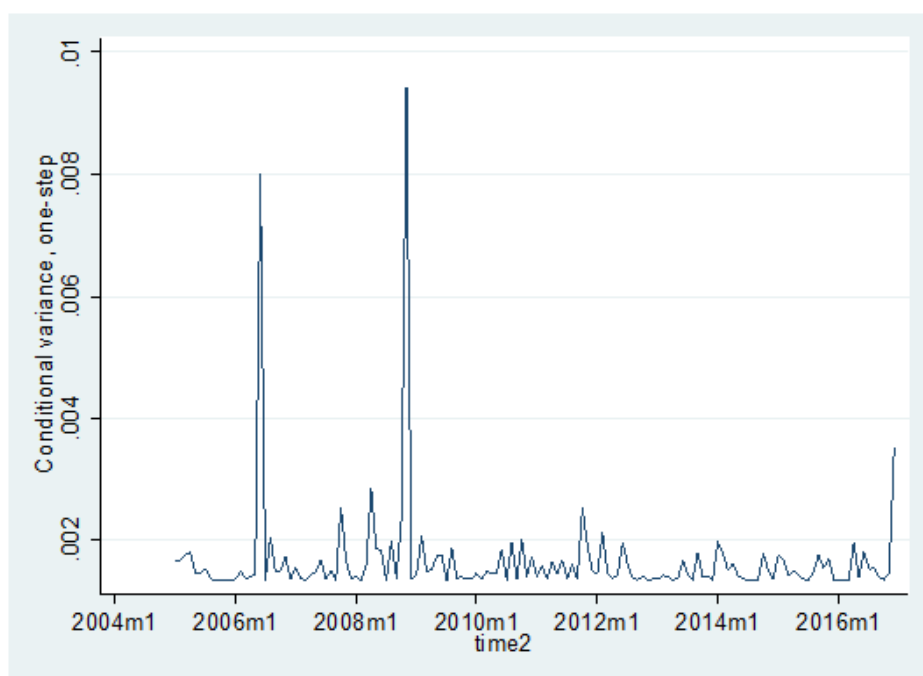


Figure 29. The Predicted Variance of Exchange Rate

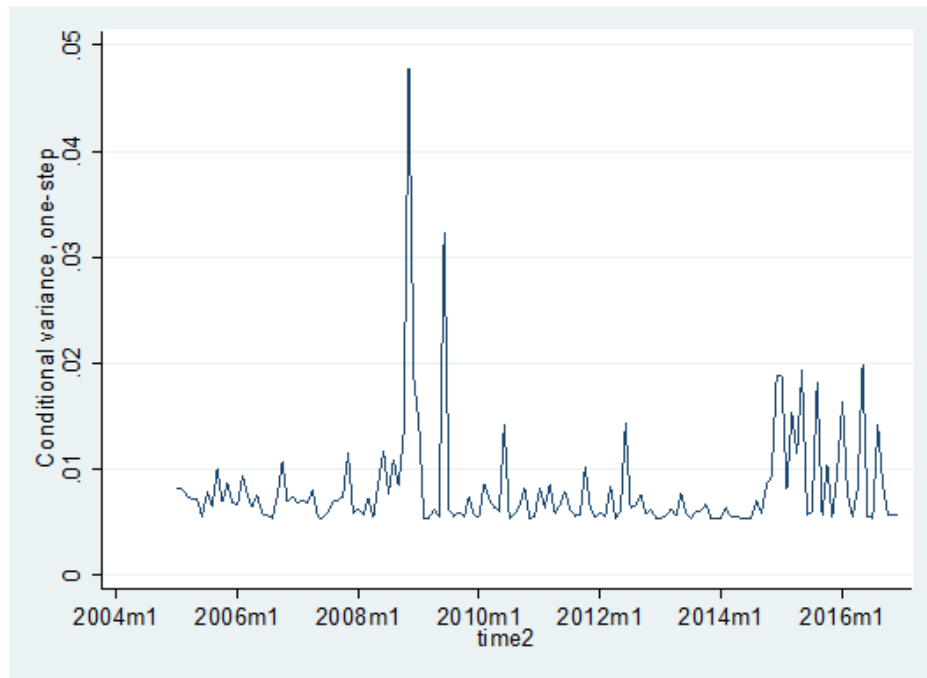


Figure 30. The Predicted Variance of the Oil Price

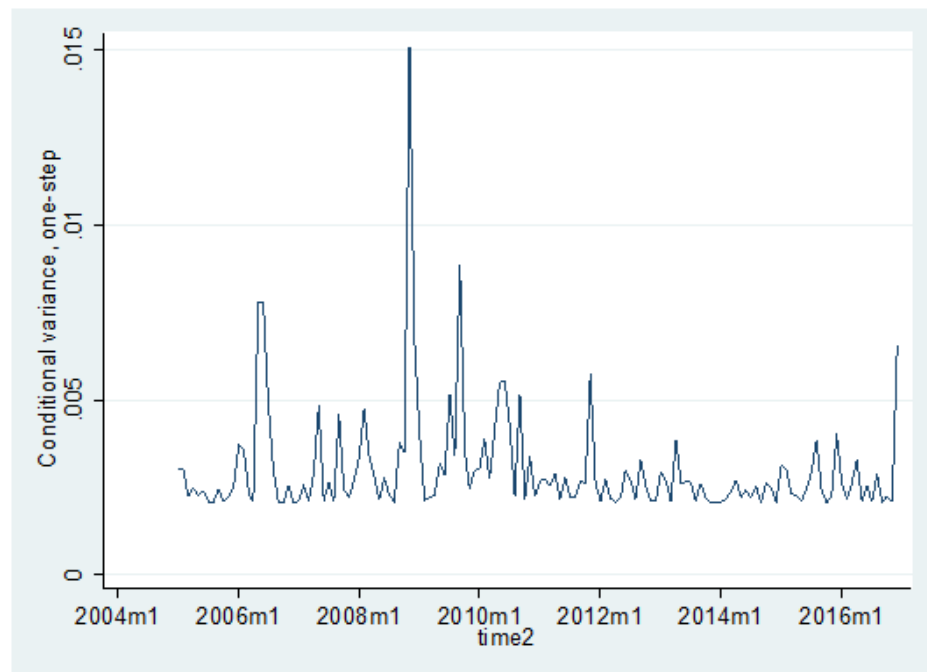


Figure 31. The Predicted Variance of the Rate of Change in Price

Also the volatility estimations for ARCH model show that lag 1 coefficients for all variables are significant, while for oil price arch lag 2 coefficient is also significant.

Table 8. Volatility Estimations

Exchange Rate Model – ARCH(1) – Monthly from 2005 to 2017		
Variable	Coefficient	P-value
Arch lag 1	0.197	0.003
Constant	0.001	0.000
Rate of change in basic metal price – ARCH(1) – Monthly from 2005 to 2017		
Variable	Coefficient	P-value
Arch lag 1	0.314	0.024
Constant	0.002	0.000
Oil Price Model – ARCH(1) – Monthly from 2005 to 2017		
Variable	Coefficient	P-value
Arch lag 1	0.352	0.005
Constant	0.005	0.000

The predicted variances are the estimated volatilities of the relevant variables. The effects of these volatilities on the basic metal production and the metal prices will be estimated and analyzed in the following parts.

3.5 MODELS AND METHODOLOGY

3.5.1. VAR model

The empirical analyses in the thesis are carried out by using vector autoregression (VAR) methodology. Started by Sims (1980), a VAR model is commonly used in economics to understand the linear dependencies between multiple variables. In a VAR model, given that there are n endogenous variables, each variable has its own equation with its own lagged variables, other variable's lagged values and an error

term. VAR models can include both endogenous and exogenous variables and such models are denoted with notation $VARX$.

Formally, let there be n endogenous variables, k exogenous variables with observations over sample period $(t = 1, \dots, T)$. A $VAR(p, q)$ process with p -th ordered endogenous variables and q -th ordered exogenous variables can be written as:

$$Y_t = A_0 + A_1 Y_{t-1} + \dots + A_p Y_{t-p} + B_0 X_t + B_1 X_{t-1} + \dots + B_q X_{t-q} + U_t \quad (8)$$

where $A_0 \in \mathbb{R}^n$ is a vector of intercepts, $Y_t \in \mathbb{R}^n$ is a vector of endogenous variables, $X_t \in \mathbb{R}^m$ is a vector of exogenous variables, A_j 's $n \times n$ coefficient matrices where $j = 1, \dots, p$, the B_i 's $n \times m$ coefficient matrices where $i = 0, \dots, q$, and $U_t \in \mathbb{R}^n$ is the vector of errors. In estimation, the errors are required to be white noise processes.

If a $VAR(p, q)$ process is stationary then its moving average representation can be derived. This gives powerful tools of the impulse response functions (IRs) and forecast error variance decompositions (FEVDs). While impulse response functions trace the impacts of a system shock on to the endogenous variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR (Lütkepohl (2005)). These analyses require the innovations not to exhibit any autocorrelation and correlation among their leads/lags.

VAR methodology also provides a means of conducting causality tests, or more specifically Granger causality tests. Granger causality indicates a correlation between the current value of one variable and the past values of others. Granger causality is determined by jointly testing the significance of the lags on the explanatory variables using an F-test. The direction of causality is the main interest with this method but Granger causality test can also be used as a test for whether a variable is exogenous.

In the analyses of the VAR models used in the thesis, impulse response functions (IRFs), variance decompositions and Granger causality tests are used.

In this study, endogenous variables are the rate of changes of the price of basic metals and scrap; growth rates of basic metal production, export growth, rate of change in scrap price, per volume revenue growth. The volatility variables are taken as exogenous variables.

Lag order selection for VAR models is basically done by evaluating Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz's Bayesian Information Criterion (SBIC). Results can be found in Appendix

3.5.2. Vector Error Correction Model (VECM)

Studies of error correction model starts before cointegration studies. Early work is conducted by Sargan (1964), Davidson, Hendry, Srba and Yeo (1978). Then without using cointegration wording, Lütkepohl (1982b) discussed cointegration feature. Today's VECM model, its discussion and studies are first presented by Johansen (1995).

Methodology starts with construction of such a VAR (p) process with N dimension:

$$Y_t = B_1 y_{t-1} + \dots + B_p y_{t-p} + u_t \quad (9)$$

Subtracting y_{t-1} from both sides and rearranging the terms to construct VECM model

$$\Delta y_t = \Omega y_{t-1} + \mu_1 \Delta y_{t-1} + \dots + \mu_{p-1} \Delta y_{t-p+1} + u_t, \quad (10)$$

where ,

$$\Omega = -(I_N - B_1 - \dots - B_p)$$

and ,

$$\mu_i = -(B_{i+1} + \dots + B_p), \quad i = 1, \dots, p-1$$

By using VECM model, short run and long run relationship between two variables can be detected.

CHAPTER IV

EMPIRICAL RESULTS

In this chapter, analyses are divided into three main topics. The first one is the effect of global basic metal price changes on Turkey's production volume and domestic price, the second one is the effects of Turkey's basic metal industry on global basic metal prices and the third one is the effects of the volatilities of basic metal prices, and some other commodity prices on Turkish metal production.

4.1 THE EFFECT OF GLOBAL BASIC METAL PRICE CHANGES ON TURKEY'S PRODUCTION VOLUME AND DOMESTIC PRICE

Possible effects of global price changes on Turkey are separated into two groups. One effect is on production volume of basic metals in Turkey. This will help having an insight about the reaction of Turkish basic metal industry to global basic metal price changes. Second effect is on domestic prices in Turkey. This effect is tried to be understood by using revenue per volume from basic metal industry as an anchor for domestic prices. Outcome will enlighten pass through pace of the global price changes in Turkish domestic price levels.

4.1.1. The Effect of the Rate of Change in Global Basic Metal/Scrap Price on Turkish Basic Metal Production

Production levels in many industries of Turkish economy are expected to be highly affected by the global price changes due to high importation of intermediate goods. Shocks in global metal prices can affect growth rates of metal production in Turkey. A VAR model is constructed to analyze these effects, Granger causality tests are run, IRF functions are derived and forecast error variance decompositions are shown to

see the size, length of these effects and to understand the relationship between two variables. Table 9-10 and figure 32-33 summarize the outcome of the analysis below.

Table 9. VAR model results for the rate of change in basic metal price and the growth rate of metal production

VAR		
Equation: Rate of change in basic metal price		
	Coefficient	p-value
Rate of change in basic metal price lag 1	0.424	0.000
Rate of change in basic metal price lag 2	-0.160	0.064
Growth rate of metal production lag 1	0.076	0.217
Growth rate of metal production lag 2	0.113	0.068
Equation: Growth rate of metal production		
	Coefficient	p-value
Rate of change in basic metal price lag 1	-0.014	0.893
Rate of change in basic metal price lag 2	0.303	0.008
Growth rate of metal production lag 1	-0.478	0.000
Growth rate of metal production lag 2	-0.101	0.221

Table 10. Granger causality results for the rate of change in basic metal price and the growth rate of metal production

Equation	Variable	χ^2	p-value
Rate of change in basic metal	Growth rate of metal production	3.56	0.169
Growth rate of metal production	Rate of change in basic metal price	7.66	0.022

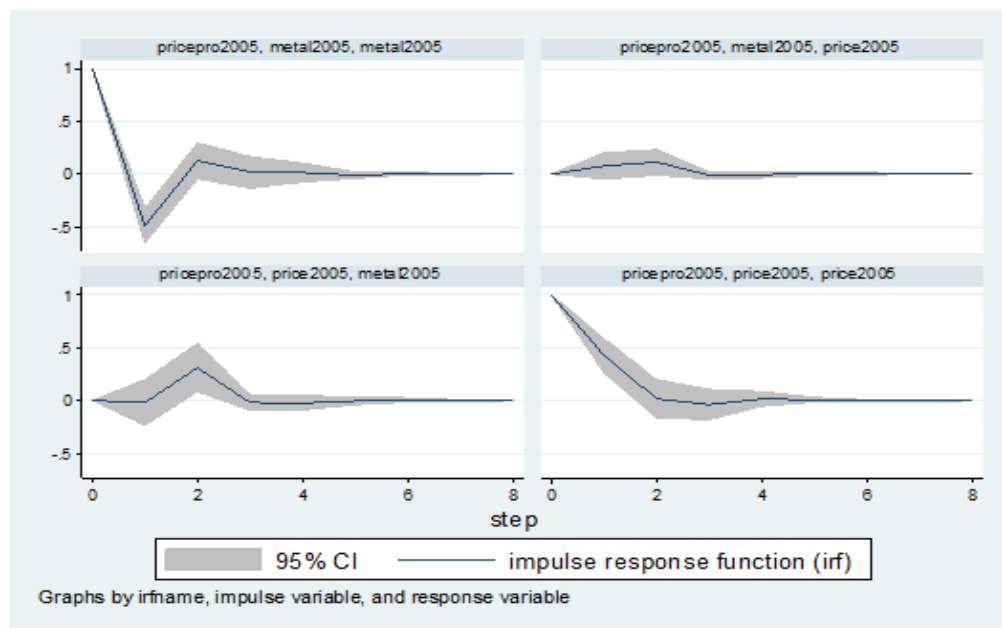


Figure 32. Impulse Response Function between the Rate of Change in Basic Metal Price and the Growth Rate in Basic Metal Production in Turkey

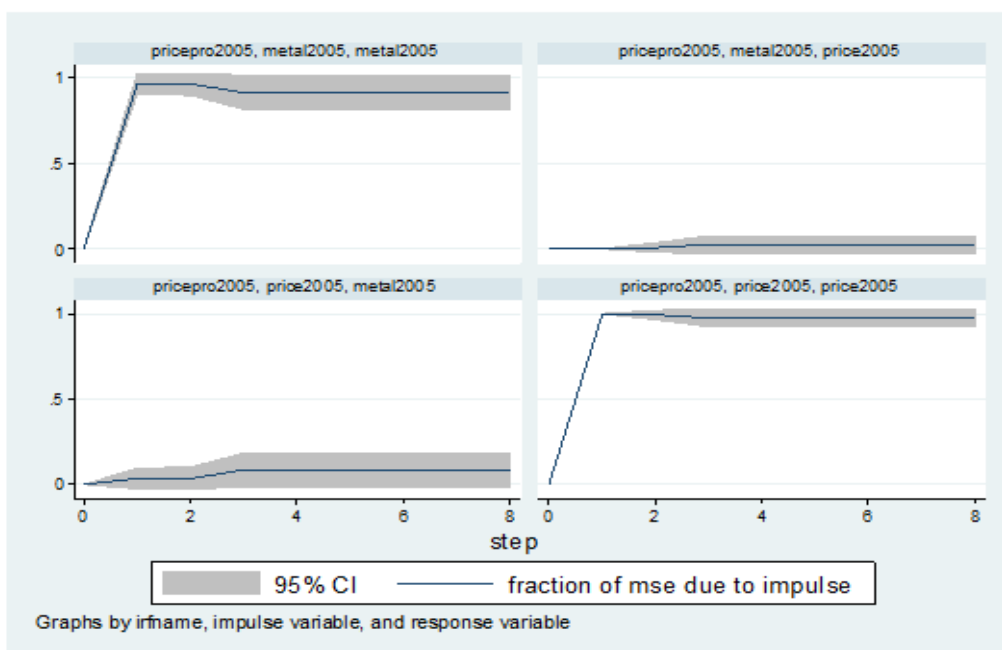


Figure 33. Forecast Error Variance Decomposition between the Rate of Change in Basic Metal Price and the Growth Rate in Basic Metal Production in Turkey

In order to understand the relationship, Granger causality test is applied. The null hypothesis (H_0) and the alternative hypothesis (H_1) for Granger causality tests are as follows: H_0 : There is no Granger causality H_1 : There is Granger causality.

Considering the causality from the growth rate of metal production to the rate of change in basic metal prices, it can be concluded that null hypothesis is failed to reject. However, in testing Granger causality from the rate of change in basic metal prices to the growth rate of metal production, the null hypothesis is rejected at 5% confidence interval. This indicated that there is a short run effect from prices to production level.

Basically, examining the north-east graph of Figure 32, it is observed that a shock in the growth rate in metal production does not have a significant effect on the rate of change in metal price level. However, examining south-west graph, it is observed that one unit deviation positive shock to the rate of change in price has a small negative effect at first period, while the effect in following period is positive.

This finding is important, it demonstrates that an increase in the rate of change in price decreases the growth rate in production in Turkey; which means that the demand of customers decreases, since it is known that producers already buy their raw materials 2 or 3 months before their use in production. This finding will be also validated in next chapter with the test of price pass through of inputs to final prices.

Another crucial point here is that, after two periods of a positive shock to input prices, the growth rate of production is positively affected. The explanation can be made as such: if metal producers purchased their inputs with higher input prices two, or three months earlier than the present sale of their final products this results in higher present metal prices. If the present input prices are lower, this puts a pressure on the metal producers to sell their expensively produced metal products as much as possible and purchase inputs at the lower prices of the present.

Finally, the Figure 33 demonstrates the forecast variance decomposition. In the south-west, it is seen that at the time of shock in growth rate in production, the variance is

mostly explained by itself for 2 periods, later about 15% of the variance can be explained by the rate of change in prices. However, the variance in the rate of change in price can only be explained by itself as it is seen from south-east of the figure.

Up to now, the effect of rate of change in basic material price is examined; however, it is a fact in Turkey that the most of the producers have semi-integrated plants. This means the scrap prices could be more important on Turkish basic metal production. As a result, same methodology is applied for the scrap prices and basic metal production. Again, a VAR model is constructed and Granger causality test is applied.

Table 11. Granger causality results for rate of change in scrap price and growth rate of steel production

Equation	Variable	χ^2	p-value
Rate of change in scrap price	Growth rate of steel production	0.87	0.64
Growth rate of steel production	Rate of change in scrap price	4.28	0.11

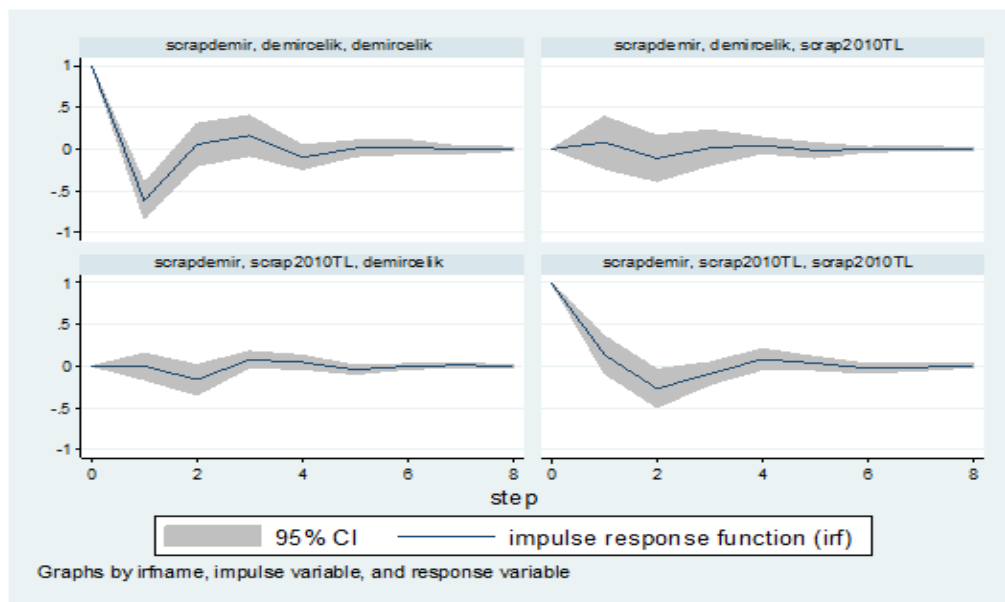


Figure 34. Impulse Response Function between the Rate of Change in Scrap Price and the Growth Rate in Steel Production in Turkey

However, by examining the effects of scrap prices on Turkish metal production, it is found out that there is short run relationship between them with a confidence level of 11%. This level can be acceptable since the period used is eight years.

As a result, metal production industry in Turkey gets affected by basic metal prices and also by scrap prices. The effect direction is similar to effect of basic metal price; negative in the first period then positive in the second period. However, the size of the effect differs between them. For basic metal price, effect of an impulse on production is -5% while it is -10% for scrap. In the second period, effect of an impulse on production is 35% while it is just 10% for scrap.

There is a fact that the majority of metal producers in the world have integrated plants, producing from ore. Therefore, the price of basic metals can directly affect final product prices for those integrated plants. Since the majority has integrated plants, any change in basic metal prices can directly affect final product prices in the world. As a result, basic metal price levels may drive the scrap price market up or down.

To test the hypothesis, another VAR model is run:

Table 12. Granger causality results for rate of change in scrap price and rate of change in basic metal price

Equation	Variable	χ^2	p-value
Rate of change in scrap price	Rate of change in basic metal price	16.0	0.00
Rate of change in basic metal price	Rate of change in scrap price	2.17	0.34

As Table 12 demonstrates, coefficient in ‘rate of change in scrap price’ equation is positive and significant, while in ‘rate of change in basic metal price’ equation, coefficient is not significant. This implies that there is a Granger causality from basic metal price to scrap but not vice versa.

Also as is depicted in figure below, in the north east graph, it is concluded that 70% a shock in basic metal price is reflected into scrap price in period 1. Then effect of the shock diminishes in 6 periods.

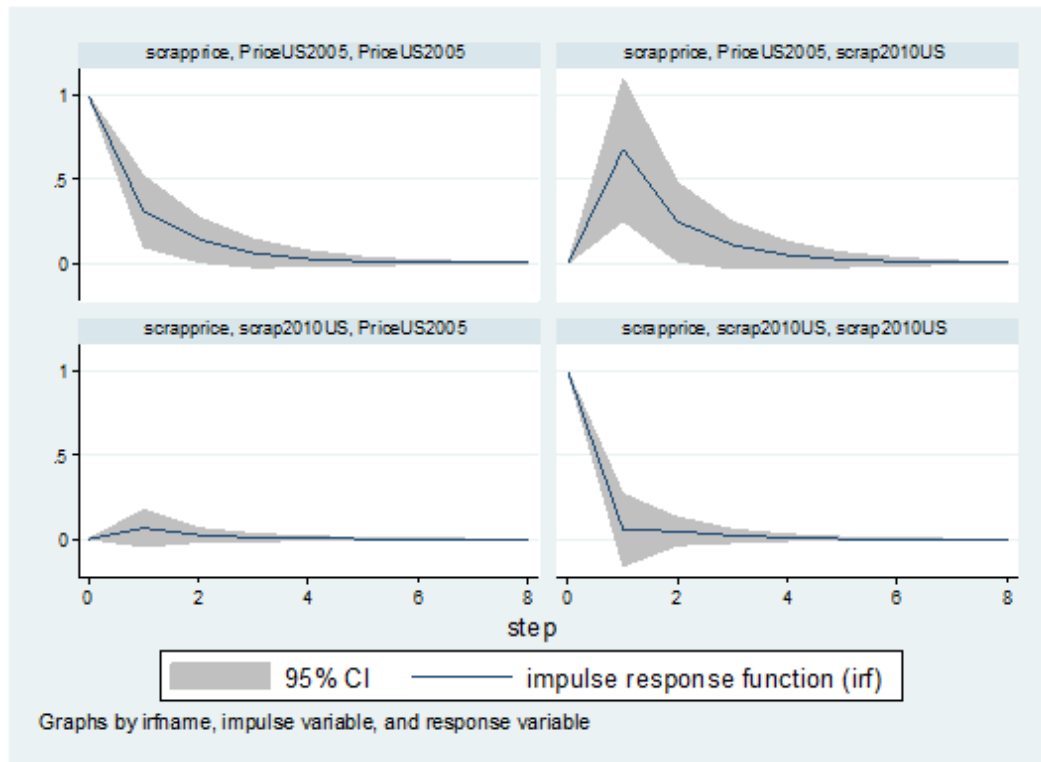


Figure 35. Impulse Response Function between the Rate of Change in Scrap Price and Rate of Change in Basic Metal Price

4.1.2. The Price Pass Through of the Rate of Change in Global Basic Metal Price on Turkish Basic Metal Industry Prices

Another crucial point to reveal about the effect of global prices on Turkish basic metal production is that how fast those price changes are reflected in Turkish end market of basic metals. To find out the effect, price index of Turkish basic metal industry is used as a price anchor for domestic basic metal prices.

Table 13. VAR model results for the rate of change in global basic metal price and the rate of change in domestic price e in Turkish basic metal industry

VAR		
Equation: Rate of change in domestic price in Turkish basic metal industry		
	Coefficient	p-value
Rate of change in domestic price in Turkish basic metal industry lag 1	0.42	0.00
Rate of change in global basic metal price lag 1	0.17	0.01
Equation: Rate of change in global basic metal price		
	Coefficient	p-value
Rate of change in domestic price in Turkish basic metal industry lag 1	-0.03	0.80
Rate of change in global basic metal price lag 1	0.40	0.00

Table 14. Granger causality results for the rate of change in basic metal price and the rate of change in domestic price

Equation	Variable	χ^2	p-value
Rate of change in domestic price	Rate of change in basic metal price	6.65	0.01
Rate of change in basic metal price	Rate of change in domestic price	0.06	0.80

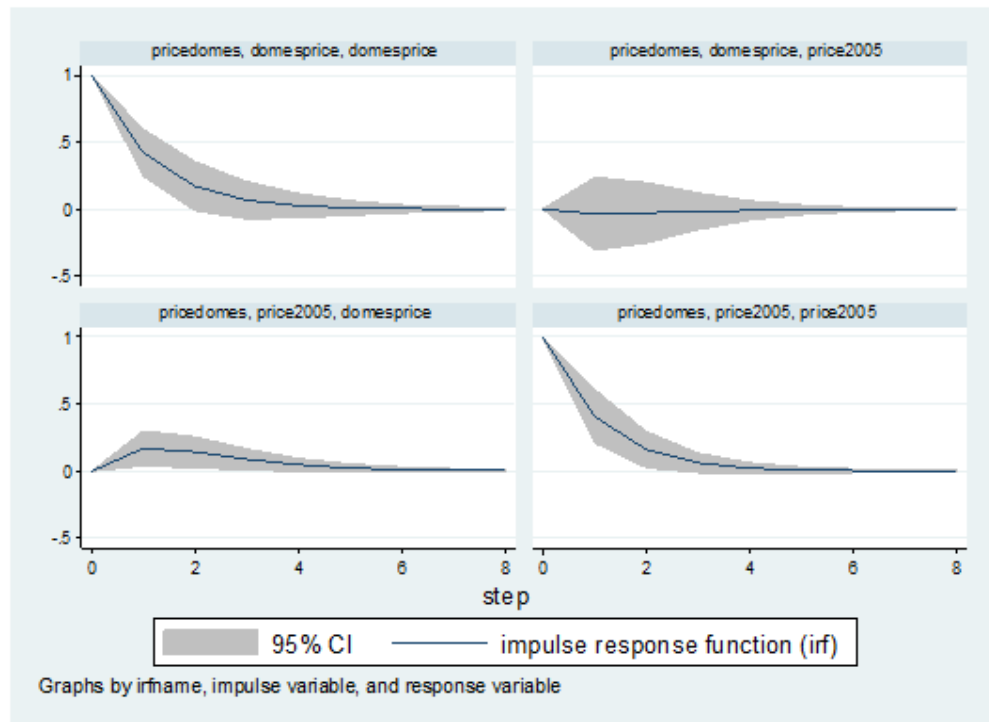


Figure 36. Impulse Response Function between the Rate of Change in Basic Metal Price and the Rate of Change in Domestic Price in Turkey

Granger causality tests suggest that the null hypothesis that the rate of change in basic metal prices Granger causes the rate of change in domestic price in Turkey can be rejected. However, inverse relationship does not exist as expected.

From IRF, there are two crucial points; one supportive result for 4.1.1, a positive shock in the rate of change in basic metal price affects the domestic prices in one period. This also explains the decrease in demand of customers in 4.1.1. Secondly, this positive shock starts diminishing in 2nd period. This result is also supportive for the idea in 4.1.1. The producers try to sell as much as possible to diminish their expensive stock and push their volume into the market at a lower price in the second period.

4.1.3. Summary of the Effects of Global Basic Metal Price Changes on Turkey's Production Volume and Domestic Price

Through the analyses conducted in sections 4.1.1 and 4.1.2, it is concluded that:

-The rate of change in basic metal prices has negative and positive effects on the production in period 1 and 2 respectively, while it also has a positive and negative effects on the domestic prices in period 1 and 2 respectively. This means that when there is a positive change in the rate of change in basic metal prices, it increases the rate of change in domestic prices which results in a demand decrease and a decrease in growth rate in production. However, in period 2, producers decrease the prices, since they try to sell their volumes in the market. The effect of rate of change in scrap prices is similar however the size of the effect is larger in first period and smaller in period 2.

-Basic metal prices directly affect the scrap prices in the same direction

4.2. THE EFFECTS OF TURKEY'S BASIC METAL PRODUCTION INDUSTRY ON GLOBAL BASIC METAL PRICES

In this part of the chapter, possible effects of Turkey's basic metal production volume on the global prices will be analyzed. Since Turkey is becoming a large player in the basic metal industry, such an effect is worth to be studied.

4.2.1. The Effect of Turkish Basic Metal Export on the Global Basic Metal Prices

Up to the current analysis, it is observed that metal production changes in Turkey do not have significant effects neither on the global basic metal nor on the scrap prices. However, knowing that Turkey is one of the largest producers and an important exporter of metals, an increase in the metal exportation of Turkey might have an impact on the raw material prices. In order to understand this effect again the VAR model is used. Then Granger causality test is conducted:

Table 15. Granger causality results for rate of change in basic metal price and growth of Turkish basic metal export

Equation	Variable	χ^2	p-value
Rate of change in basic metal price	Growth in export of basic metal production	1.36	0.242
Growth in export of basic metal production	Rate of change in basic metal price	0.11	0.734

Basically, both null hypotheses here are failed to be rejected so that no IRF or FEVD is needed. It can be concluded that there is no Granger causality from the growth in exportation of metals produced to the rate of change in global basic metal prices nor vice versa.

However, the same analysis is conducted for the scrap instead of basic metal. The results indicate that Turkish steel production exports have an impact on scrap prices.

Table 16. Granger causality results for rate of change in scrap price and growth of Turkish steel export

Equation	Variable	χ^2	p-value
Rate of change in scrap price	Growth in export of steel production	16.899	0.001
Growth in export of steel production	Rate of change in scrap price	8.777	0.032

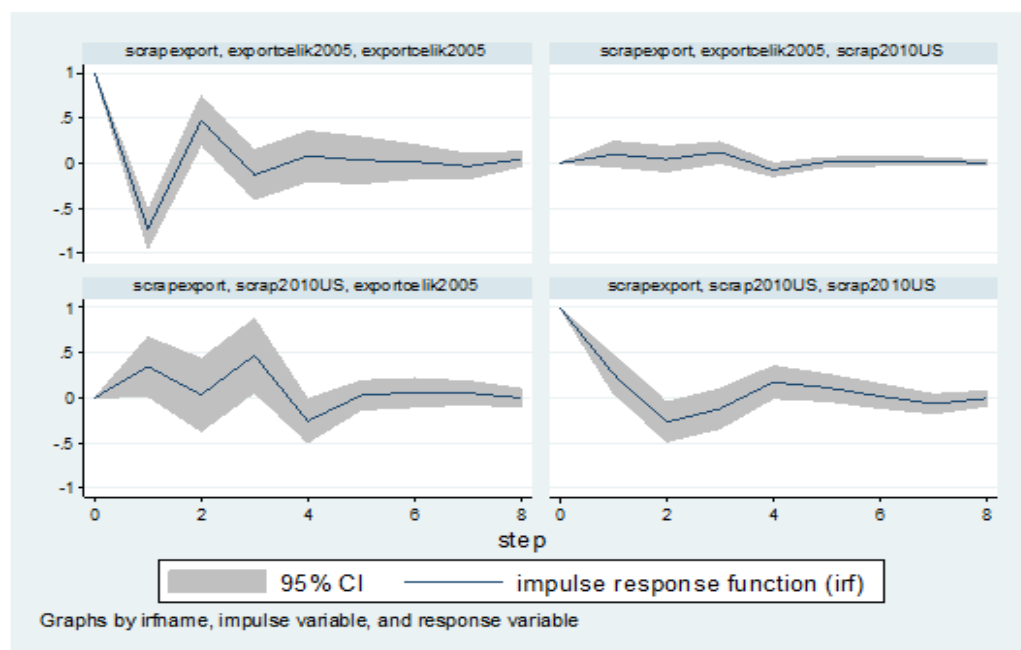


Figure 37. Impulse Response Function between the Rate of Change in the Scrap Price and the Growth Rate of Steel Export of Turkey

IRF graph demonstrates that about 5% of a shock in export will be reflected in the scrap prices. In addition, the effect will last long and it will diminish in 6 periods.

In Section 4.1.1 it is concluded that a positive shock to the growth in basic metal production has no impact on the global scrap price, however, here it is observed that a positive shock to the export has statistically significant impact on the global scrap price. However, size of the impact is too small but positive in general. So, an important industry knowledge comes across: the quality of the scrap in Turkey is worse than the imported scrap. Another important point is that, the quality needed for the exported products are much higher than the domestic outputs. As a result, when the production increases in Turkey, it does not have to mean that the import of the scrap will increase. However, if the export amount of the basic metals increase, it is highly likely that the scrap import will increase because of the increased demand by Turkey. To sum up, a positive shock in the growth rate in the exports of the basic metal from Turkey has positive effect on the rate of change in the scrap price because the demand for the global scrap increases.

4.2.2. Summary of the Effects of Turkey's Basic Metal Production Industry on the Global Basic Metal Prices

As a summary, Turkey has no effect on global basic metal price despite being one of the largest producers since Turkey is a country with a high percentage of semi-integrated plants. On the other hand, Turkey can affect global scrap prices as being a large importer of scrap. However, the affect can be observed when there is a change in export amount, but not when there is a change in production. The result is due to quality expectation of exported materials. Turkey needs to import more scrap when the firms need to export more since the domestic scrap is not as good as the imported scrap.

4.3. THE EFFECTS OF VOLATILITIES OF THE EXCHANGE RATE, OIL PRICE AND THE BASIC METAL PRICE TO TURKISH BASIC METAL PRODUCTION

Basic assumption in this part of the study is that the volatility in the global basic metal prices, oil prices or exchange rate might affect the basic metal production industry, since they might result in an unpredicted future about the production costs of the plants.

The volatility variables for basic metal prices, the oil price and the foreign exchange rate are estimated in Section 3.4 and the volatilities are depicted in Figures 29-31. A VAR model is constructed with volatility variables where that are taken an exogenous variables while the growth in the basic metal production in Turkey and rate of change in the basic metal prices are the endogenous variables.

4.3.1. The Effects of Volatilities of Rate of Returns in Basic Metal, Oil Prices and Exchange Rate on Turkish Basic Metal Production Growth Rates

Three volatility variables are used in the model: One of them is the exchange rate since imports are in terms of US dollars, the second one is the oil price since it is an important input for production, and third one is the basic metal price. To find out a relationship, a VAR model is created using the exogenous volatility variables

calculated in Section 3.4 with the endogenous variables as the rate of change in basic metal prices and the growth rate in basic metal production in Turkey.

Table 17-18 shows the results of the VAR model as rate of change in basic metal price and growth rate of basic metal production is endogenous while volatility in exchange rate is exogenous. Here volatility of exchange rate has a statistically significant coefficient in ‘growth rate of basic metal production’ and it is negative. It means volatility in exchange rate can negatively affect production.

Table 19-20 shows the results of the VAR model as rate of change in basic metal price and growth rate of basic metal production is endogenous while volatility in basic metal price is exogenous. Here volatility of basic metal price has a statistically significant coefficient in ‘growth rate of basic metal production’ and it is negative. It means volatility in basic metal price can negatively affect production.

Table 21 shows the results of the VAR model as rate of change in basic metal price and growth rate of basic metal production is endogenous while volatility in oil price is exogenous. Here coefficient of volatility of oil price in ‘growth rate of basic metal production’ is not significant. It means volatility in oil price has no effect on basic metal production in Turkey.

Table 17. VAR model results for the rate of change in basic metal price and the growth rate of metal production with the volatility in exchange rate

VAR		
Equation: Rate of change in basic metal price		
	Coefficient	p-value
Rate of change in basic metal price lag 1	0.290	0.000
Rate of change in basic metal price lag 2	0.006	0.933
Growth rate of metal production lag 1	0.124	0.051
Growth rate of metal production lag 2	0.081	0.208

Table 17 (Continued)

Volatility in exchange rate	-13.4	0.004
Equation: Growth rate of metal production		
	Coefficient	p-value
Rate of change in basic metal price lag 1	0.008	0.407
Rate of change in basic metal price lag 2	0.299	0.005
Growth rate of metal production lag 1	-0.530	0.000
Growth rate of metal production lag 2	-0.144	0.082
Volatility in exchange rate	-10.8	0.073

Table 18. Granger causality results for the rate of change in basic metal price and the growth rate of metal production with the volatility in exchange rate

Equation	Variable	χ^2	p-value
Rate of change in basic metal price	Growth in basic metal production	3.94	0.139
Growth in basic metal production	Rate of change in basic metal price	11.30	0.004

Table 19. VAR model results for the rate of change in basic metal price and the growth rate of metal production with the volatility in the basic metal price

VAR		
Equation: Rate of change in basic metal price		
	Coefficient	p-value
Rate of change in basic metal price lag 1	0.305	0.000
Rate of change in basic metal price lag 2	-0.007	0.928
Growth rate of metal production lag 1	0.128	0.051
Growth rate of metal production lag 2	0.100	0.125
Volatility in basic metal price	-4.47	0.101
Equation: Growth rate of metal production		
	Coefficient	p-value
Rate of change in basic metal price lag 1	0.098	0.347
Rate of change in basic metal price lag 2	0.295	0.005
Growth rate of metal production lag 1	-0.548	0.000
Growth rate of metal production lag 2	-0.132	0.107
Volatility in basic metal price	-8.39	0.014

Table 20. Granger causality results for the rate of change in basic metal price and the growth rate of metal production with the volatility in price

Equation	Variable	χ^2	p-value
Rate of change in basic metal price	Growth in basic metal production	4.33	0.115
Growth in basic metal production	Rate of change in basic metal price	11.6	0.003

Table 21. VAR model results for the rate of change in basic metal price and the growth rate of metal production with the volatility in oil price

VAR		
Equation: Rate of change in basic metal price		
	Coefficient	p-value
Rate of change in basic metal price lag 1	0.282	0.001
Rate of change in basic metal price lag 2	-0.017	0.839
Growth rate of metal production lag 1	0.133	0.045
Growth rate of metal production lag 2	0.092	0.165
Volatility in oil price	-0.975	0.280
Equation: Growth rate of metal production		
	Coefficient	p-value
Rate of change in basic metal price lag 1	0.096	0.385
Rate of change in basic metal price lag 2	0.282	0.008
Growth rate of metal production lag 1	-0.514	0.000
Growth rate of metal production lag 2	-0.129	0.126
Volatility in oil price	-0.20	0.860

4.3.2. Relationship between the Rate of Return in Basic Metal and Volatility of the Rate of Return in Crude Oil

Oil is also an important input for plants as an energy supply as it is mentioned in the thesis before. That is why hypothesis here is that the oil price fluctuations might have effects on the rate of change in basic metal prices. As a result, the relationship with crude oil prices and the basic metal can be useful to understand the effects on global metal prices. Running an ARCH/GARCH model and applying a VAR methodology

will help to understand the relationship. However, same result is observed as before. Volatility in oil price has no effect on the rate of change in global basic metal price. This leads to a finding that oil price is not one of the main drivers of basic metal prices in the world. Further analysis can be extended with coal, electricity etc. Table below summarizes the result.

Table 22. VAR model results for the rate of change in basic metal price and the rate of change in oil price with the volatility in oil price

VAR		
Equation: Rate of change in oil price		
	Coefficient	p-value
Rate of change in oil price lag 1	0.167	0.056
Rate of change in oil price lag 2	-0.022	0.801
Rate of change in basic metal price lag 1	0.229	0.131
Rate of change in basic metal price lag 2	0.096	0.505
Volatility in oil price	-2.32	0.116
Equation: Rate of change in basic metal price		
	Coefficient	p-value
Rate of change in oil price lag 1	0.192	0.000
Rate of change in oil price lag 2	-0.044	0.400
Rate of change in basic metal price lag 1	0.236	0.008
Rate of change in basic metal price lag 2	-0.217	0.797
Volatility in oil price	-1.000	0.246

4.4. Concluding Remarks on the Hypotheses

Summarizing the results and turning back to hypotheses in introduction, it can be concluded that:

Hypothesis 1: If there is a shock that increase the input prices (basic metals and scrap), the metal producers decrease their purchase volumes of inputs (basic metals and scrap) in the spot markets. This will lead to decreases in the amounts of metal products available in future months in the metal markets.

Result 1: A positive shock in the rate of change in basic metal price positively affect the growth rate of metal production in Turkey in two periods. As a result, hypothesis is shown to be accurate.

Hypothesis 2: The metal producers use forward contracts and order their inputs (basic metals and scrap) a couple of months (like two months) before their productions take place. A shock that increases the input prices at the time of ordering might dissipate over time and the input prices might return to their normal levels when the metal products (produced with high input prices) are ready to sell. Accordingly, metal producers might prefer to supply high amounts of metal in the markets, since their products have high present prices associated with high input costs of earlier months, before the expected price drops of their products following present low input prices. Here the motivations of the metal producers are clear: sell the own product now at the present high price while it is high due to high past input costs and buy the inputs now at the present low input prices.

Result 2: Decrease of purchase volume of materials can be valid, however; the production after two months does not decrease.

Hypothesis 3: If the metal prices are high at the metal spot markets, then the purchasers may prefer to postpone their demands until the metal prices drop to lower levels. This might lead to low capacity usages by manufacturing firms using metal products intensively and hence a contraction in manufacturing sector.

Result 3: In the first period of a shock in the rate of change in price level, production decreases and since input price changes directly reflect to domestic price. An increase in price level in Turkey results in a demand decrease. So that hypothesis is accurate.

Hypothesis 4: The metal purchasers know that the metal suppliers purchase their inputs (basic metals and scrap) two months in advance. Hence, if a metal input price increasing shock happens now, this might alert them to increase their demand for final metal products now before the increased metal input costs are reflected in future metal prices on the future spot markets. Then this might lead to increased production in the metal sector.

Result 4: Hypothesis is not valid since there is no increase in demand in one period after a shock in price level.

Hypothesis 5: Due to the fact that Turkey plays an important role in the global steel production, an increase in final metal products' exportation by Turkey might lead to decreases in the price of raw materials.

Result 5: A shock in growth of exports in basic metals affect scrap prices; however, has no effect on basic metal prices. But the size of the effect is too small.

Hypothesis 6: Since scrap is a major input for Turkish metal production, the effect of changes on the import prices of the scrap will be significant on Turkish metal production growth rates.

Result 6: Basically, since the majority of the plants are integrated, the effect comes from the change in basic metal price, not from the scrap price.

Hypothesis 7: The global input price changes in basic metals and scrap directly affect Turkish production sector's future output levels and revenues per volumes (as an approximation to the price of the final metal product) by causing variations in forward input prices (basic metals and scrap).

Result 7: Correct, the prices are reflected directly in one period to domestic prices.

Hypothesis 8: Any price change in the basic metal prices will be reflected into the scrap price. This fact is mainly due to the substitution effects between these two inputs for the plants. When there is an increase in the basic metal prices such as iron ore, the demand for scrap will increase. This is expected to push the price of scrap to higher levels.

Result 8: Correct, a shock in the rate of change in basic metal price directly reflected to the rate of change in scrap price.

Hypothesis 9: Volatilities of exchange rate, oil price or the basic metal price have significant effects on Turkish basic metal production industry.

Result 9: VAR models suggest that volatility of exchange rate and basic metal price have negative effects on basic metal industry in Turkey, however it is not the case for oil price.

Hypothesis 10: Volatility of the oil price has significant effects on the basic metal prices.

Result 10: Both inputs are major inputs for producers, however, volatility of oil price has no direct effect on the rate of return in basic metal price.

CHAPTER 5

CONCLUSIONS

Manufacturing industry is the one of key fundamentals of many country's GDP. Turkey as being a developing country, requires further investments especially in manufacturing industry. Within manufacturing industries, there are couple of sub-industries driving the growth up and having major impacts. Basic metal industry is an important one among them.

Basic metal industry holds an important part in manufacturing industry with an average share of 11% within 2010 to 2015. Not only it holds an important part in manufacturing but also it is an input for many industries such as automotive, machinery, construction etc.

Considering the importance of basic metal production in Turkey, the relationship between global metal prices and basic metal production is examined with different methodologies. Firstly VAR analysis is conducted to understand lagged relationship between variables. Secondly, Granger causality will be tested for causality effects. In addition, impulse response functions will be derived to explain the effects of shock and forecast error variance decompositions are derived.

Besides, the effect of scrap prices is studied with the same manner since Turkey is one of the largest scrap importers. Scrap is another main input for metal production industry, especially for steel industry.

The effect of the rate of change in domestic price of metal industry is examined to understand the price pass through of changes in scrap and basic metal prices.

Moreover, the effects of changes in Turkey's export in metal products on global basic metal or scrap prices is studied to understand the significance of Turkey in global metal input prices or scrap.

Finally, volatility of the oil prices, exchange rate or metal prices are used to understand the effect on Turkish basic metal industry.

Results found in the thesis are:

- The rate of change in global basic metal prices has a significant effect on growth rate of Turkish basic metal industry. While the effect is negative in the first period, it is positive in the second period. The first effect is due to demand side dynamics whereas the second effect is due to supply side dynamics. With an increase in domestic price, end customers decrease their purchase; however, in the second period, the manufacturers try to sell their expensive stock (since they purchased it two-three months ago) so that domestic price level decreases and production increases.

- Scrap price has significant effect on Turkish steel production. Effect is stable in the first period, then negative and then positive.

- There is a Granger causality from basic metal price to scrap price which means scrap prices are highly affected by basic metal prices.

- Growth rate of export of basic metal has significant impact on the scrap price, but no effect on the basic metal price. This is mainly due to the fact that Turkey is one of the largest importers of scrap.

- Volatility of exchange rate, basic metal price has significant negative effect on Turkish basic metal production while volatility of oil price has no significant effect.

- Being another important input for producers, the volatility of oil price has no direct impact on the rate of change in basic metal prices.

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APPENDICES

APPENDIX A. COMPLEMENTARY ANALYSIS

A.1.Cointegration Results

From PP and ADF tests there are three combinations that are used in the thesis that has to be tested for cointegration.

Table A.1.1 Cointegration test results Scrap Price and Domestic Price

Rank	Trace Statistics	5% Critical Value
0	6.86*	15.41
1	1.75	3.76

Table A.1.2 Cointegration test results Basic Metal Price and Domestic Price

Rank	Trace Statistics	5% Critical Value
0	10.18*	15.41
1	1.26	3.76

Table A.1.3 Cointegration test results Basic Metal Price and Scrap Price

Rank	Trace Statistics	5% Critical Value
0	9.38*	15.41
1	1.4	3.76

Table A.1.4 Cointegration test results Basic Metal Price, Scrap Price and Basic Metal Production

Rank	Trace Statistics	5% Critical Value
0	21.18*	29.68
1	9.7	15.41
2	4.2	3.76

As a result of the cointegration tests for the all relationship VECM model cannot be used, instead all models will be structured as VAR models.

A.2.Lag Length Definition

Table A.2.1 Optimal Lag Length

VAR Model	Optimal Length (AIC, HQIC, SBIC)	AIC	HQIC	SBIC	Selected Lag Length
Rate of change in basic metal price and growth rate of metal production	2,2,1	-5.70	-5.62	-5.52	2
Rate of change in scrap price level change and growth in steel production	4,2,1	-4.86	-4.69	-4.51	2
Rate of change in global basic metal price and rate of change in domestic price in Turkish basic metal industry	1,1,1	-7.55	-7.50	-7.42	1
Rate of change in scrap price and rate of change in basic metal price	2,2,1	-6.03	-5.90	-5.74	1
Rate of change in export volume and rate of change in basic metal price level	1,1,1	-2.70	-2.65	-2.58	1
Rate of change in steel export volume and rate of change in scrap price level	4,3,1	-3.57	-3.40	-3.23	3

A.3.VAR Stability Tests

Stability results derived from eigenvalues of the equations are summarized in below tables. As a reminder, all the VAR models without scrap price and exports are in the period of 2005 to 2016 while rest are from 2012 to 2016. All of the tables will suggest that all of the VAR models are stable since all modulus are within the circle of 1.

Table A.3.1 VAR stability results

VAR Model	Mod. 1/2	Mod. 3/4	Mod. 5/6	Mod. 7/8
VAR model results for rate of change in basic metal price and growth rate of metal production	0.41/0.41	0.36/0.29	-	-
Rate of change in scrap price level change and growth in steel production	0.54/0.54	0.52/0.52	-	-
VAR model results for rate of change in global basic metal price and rate of change in domestic price in Turkish basic metal industry	0.42/0.42	-	-	-
VAR model results for rate of change in export volume and rate of change in basic metal price level	0.35/0.18	-	-	-
Rate of change in scrap price and rate of change in basic metal price	0.59/0.59	0.44/0.44	-	-
VAR model results for rate of change in steel export volume and rate of change in scrap price level	0.72/0.72	0.65/0.64	0.64/0.64	-
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of exchange rate	0.47/0.43	0.43/0.29	-	-

Table A.3.1 (Continued)

VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of price level	0.37/0.42	0.42/0.34	-	-
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of oil price	0.44/0.41	0.41/0.3	-	-
VAR model results for rate of change in basic metal price and rate of change in oil price with volatility of price level	0.29/0.29	0.23/0.23	-	-

A.4. VAR autocorrelation tests

On LM autocorrelation test, H_0 : There is no autocorrelation in Lag x . So if p value is greater than 0.05, hypothesis will be failed to be reject. Below table shows that there is no autocorrelation in residuals of any VAR model.

Table A.4.1 Autocorrelation Results

VAR Model	Lag 1	Lag 2	Lag 3
VAR model results for rate of change in basic metal price and growth rate of metal production	0.89	0.5	-
Rate of change in scrap price level change and growth in steel production	0.39	0.07	-
VAR model results for rate of change in global basic metal price and rate of change in domestic price in Turkish basic metal industry	0.11	-	-
VAR model results for rate of change in export volume and rate of change in basic metal price level	0.43	0.25	-

Table A.4.1 (Continued)

Rate of change in scrap price and rate of change in basic metal production	0.32	0.93	-
VAR model results for rate of change in steel export volume and rate of change in scrap price level	0.15	0.59	0.61
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of exchange rate	0.88	0.34	-
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of price level	0.89	0.41	-
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of oil price	0.98	0.57	-
VAR model results for rate of change in basic metal price and rate of change in oil price with volatility of price level	0.77	0.71	-

A.5. Jarque Bera Normality test

On LM autocorrelation test, H_0 : Residuals are normally distributed. So if p value is greater than 0.05, hypothesis will be failed to be reject. Below table shows that on some VAR models, residuals are not normally distributed. However, results will not have significant impact on deriving impulse response functions.

Table A.5.1 Jarque-Bera Results

VAR Model	Variable 1	Variable 2	ALL
VAR model results for rate of change in basic metal price and growth rate of metal production	0.03	0.47	0.09
Rate of change in scrap price level change and growth in steel production	0.58	0.36	0.54

Table A.5.1 (Continued)

VAR model results for rate of change in global basic metal price and rate of change in domestic price in Turkish basic metal industry	0.00	0.73	0.01
VAR model results for rate of change in export volume and rate of change in basic metal price level	0.03	0.00	0.00
Rate of change in scrap price and rate of change in basic metal production	0.52	0.74	0.76
VAR model results for rate of change in steel export volume and rate of change in scrap price level	0.03	0.12	0.03
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of exchange rate	0.45	0.71	0.69
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of price level	0.48	0.53	0.6
VAR model results for rate of change in basic metal price and growth rate of metal production with volatility of oil price	0.2	0.8	0.46
VAR model results for rate of change in basic metal price and rate of change in oil price with volatility of price level	0.26	0.31	0.28

A.6. Details on basic metals

A.6.1.1. Copper Producer Countries

Major copper producer is Chile and there is a large gap between other countries. China and United States follows Chile. In top 7 there are two African countries which are Congo and Zambia. Figure A.6.1 from USGS, shows top 7 with their production volumes.

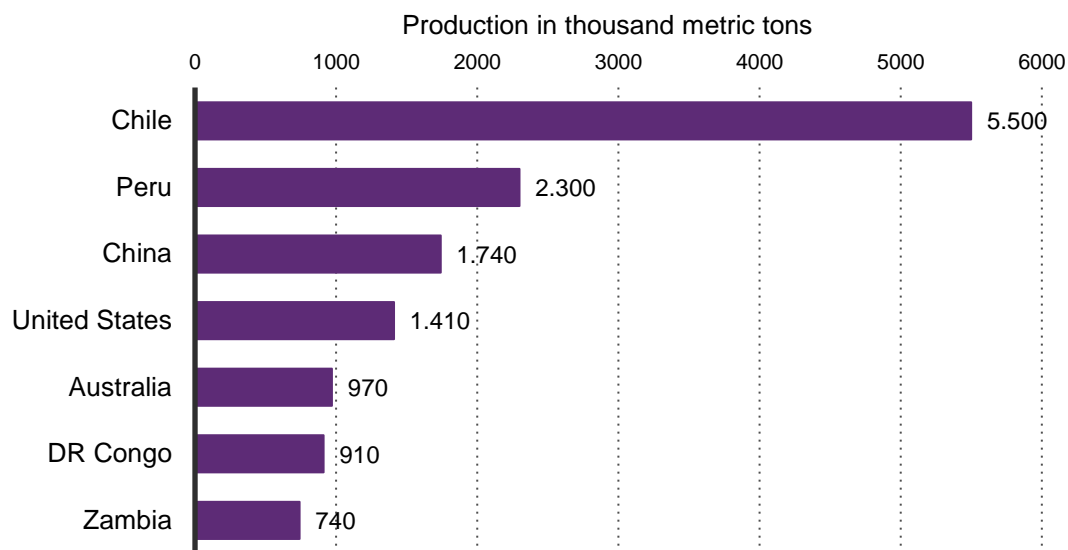


Figure A.6.1. Top 7 Copper Producer Countries (USGS)

A.6.1.2. Top Copper Producer Firms

Largest copper producer is Codelco which is a Chilean state owned company, while it is followed by Phoenix based Freeport-McMoran, then Swiss based Glencore. 4th place is Anglo-Australian BHP and followed by Southern Copper which is a subsidiary of Grupo Mexico. Figure A.6.2 from InfoMine shows top 10 copper producers

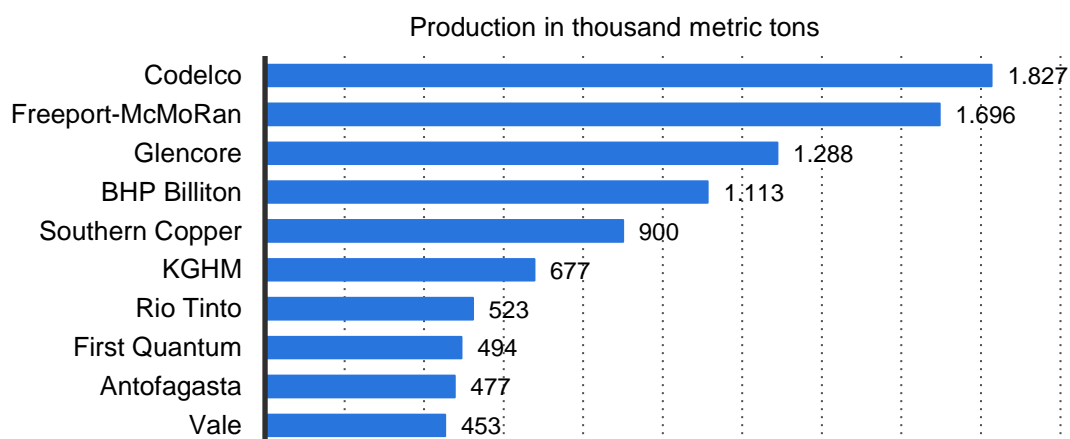


Figure A.6.2. Top 10 Copper Producer Firms (InfoMine)

A.6.2.1. Zinc Producer Countries

In 2016, China is the major producer for Zinc, which has a large gap between second producer country, Peru. Most of the zinc is produced in three continents, Asia, Oceania and America. Figure A.6.3 from USGS shows top 7 countries.

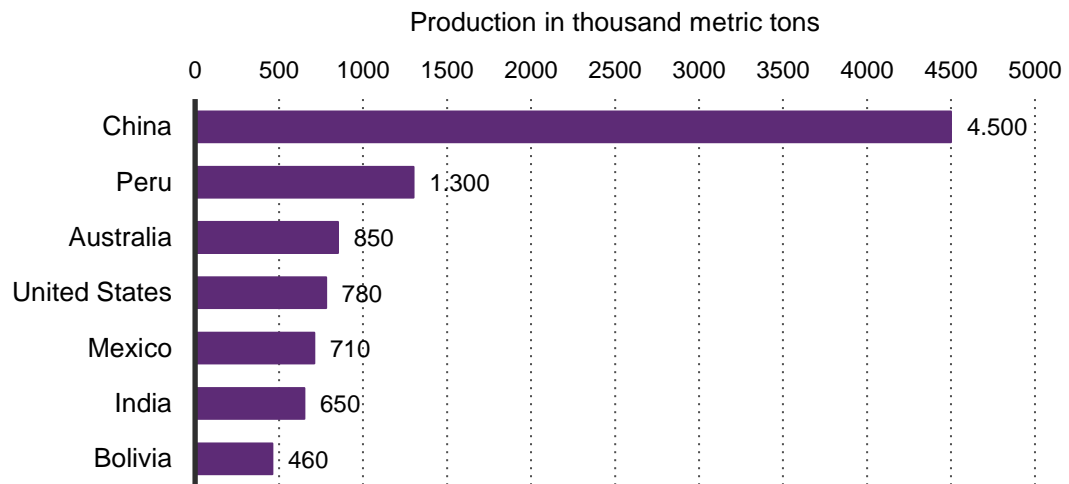


Figure A.6.3. Top 7 Zinc Producer Countries (USGS)

A.6.2.2. Top Zinc Producer Firms

Being not very different than copper producers, most of the top producers are not from the countries that are rich in zinc. Top 2 players are from Korea and Switzerland. Canadian, Brazilian, Indian, Swiss and Swedish firms are in top 10. Figure A.6.4. from International Lead & Zinc Study Group, demonstrates the production from different firms.

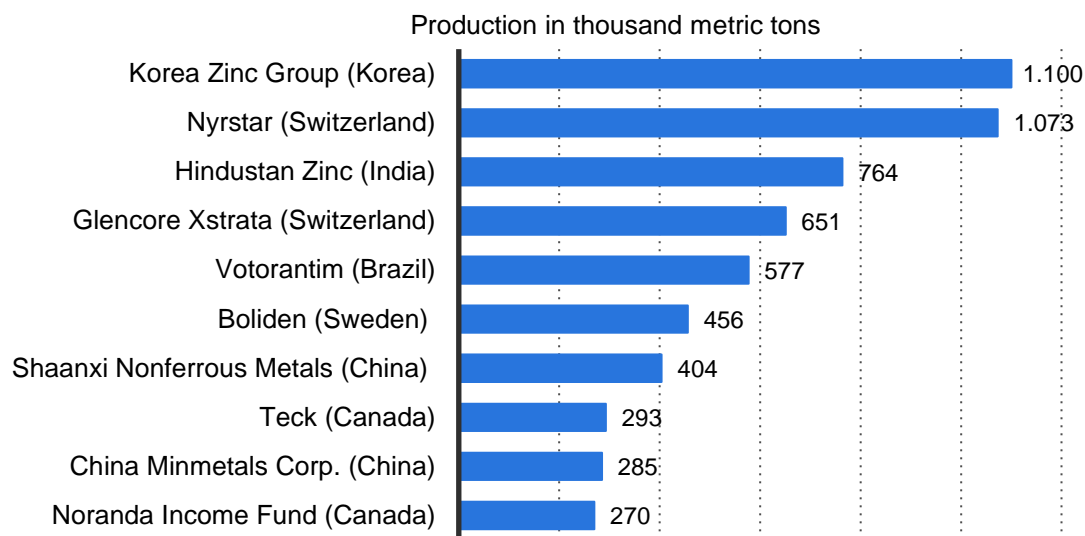


Figure A.6.4. Top 10 Zinc Producer Firms (International Lead & Zinc Study Group)

A.6.3.1. Lead Producer Countries

In 2016, China is the major producer for Lead, which has a large gap between second producer countries, Australia. Most of the lead is again produced in three continents, Asia, Oceania and America. Figure A.6.5 from USGS shows top 7 countries.

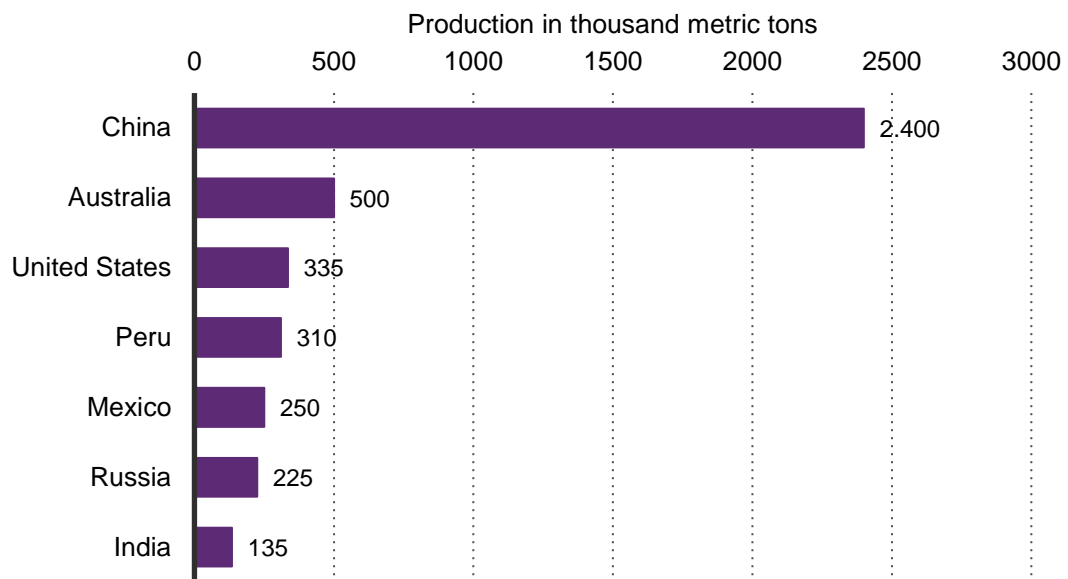


Figure A.6.5. Top 7 Lead Producer Countries (USGS)

A.6.3.2. Top Lead Producer Firms

For lead production, Glencore and Doe Run from US are leading firms for production, followed by India, Teck and BHP. It can be seen that firms who are leading in Zinc are also leading for lead metal production. Figure A.6.6 from International Lead & Zinc Study Group, shows the production from different firms.

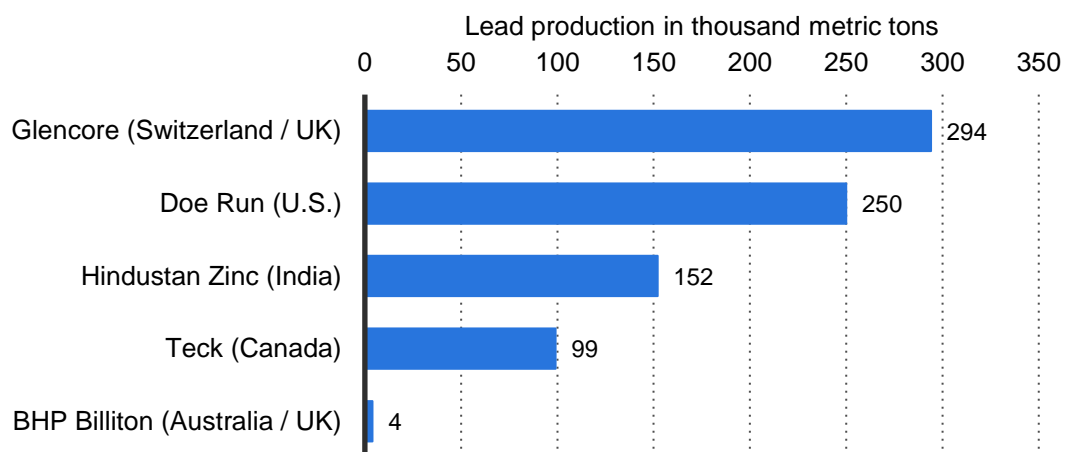


Figure A.6.6. Top 5 Lead Producer Firms (International Lead & Zinc Study Group)

A.6.4.1. Nickel Producer Countries

Philippines are the leading nickel mining country with 23%, it is followed by Canada, Russia, Australia and New Caledonia. Other than Philippines, it can be said that there is no dominance in terms of mining of Nickel. Figure A.6.7, from INSG shows the distribution of Nickel mining countries in 2015.

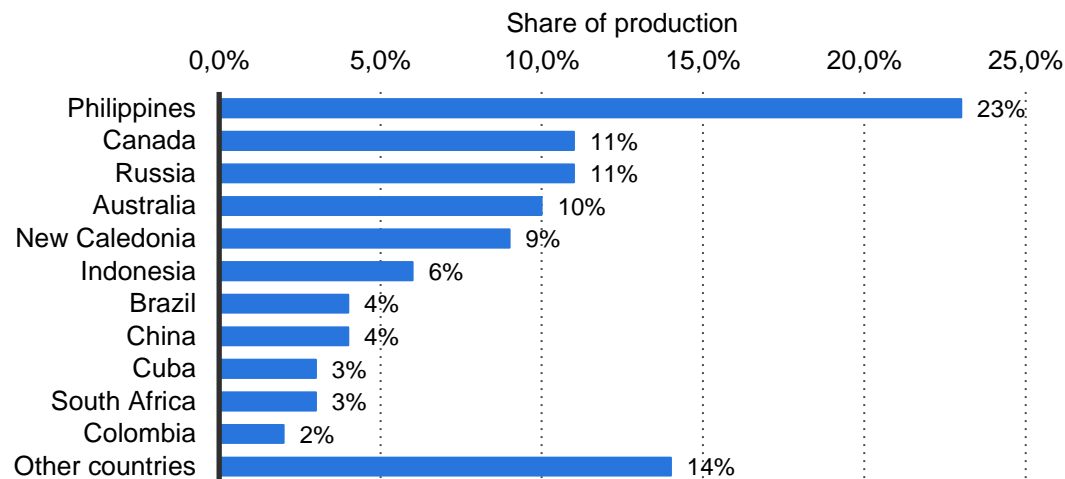


Figure A.6.7. Top Nickel Producer Countries (INSG)

A.6.4.2. Top Nickel Producer Firms

Top producer of nickel are Vale and Norilsk Nickel. Again there is no dominant producers in the world compared to other metals. Glencore is again active in Nickel like other metals. Figure A.6.8 from Norilsk Nickel shows largest producers in 2016.

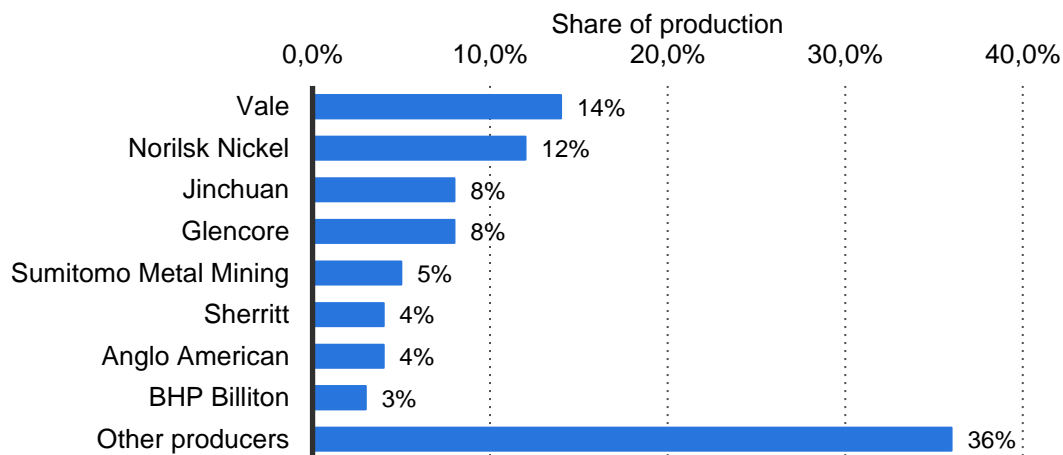


Figure A.6.8. Top Nickel Producer Firms (Norilsk Nickel)

A.6.5.1. Aluminum Producer Countries

Production is mainly done by China. They produce 6.5 times more than North America. However, they are not the leading miner of bauxite. Australia is the richest in terms of bauxite, there are also countries such as Guinea, Brazil, and Jamaica which are not rich in terms of other ores. Figure A.6.9 from IAI, shows the production in 2016 and Figure A.6.10 from USGS shows bauxite mining countries.

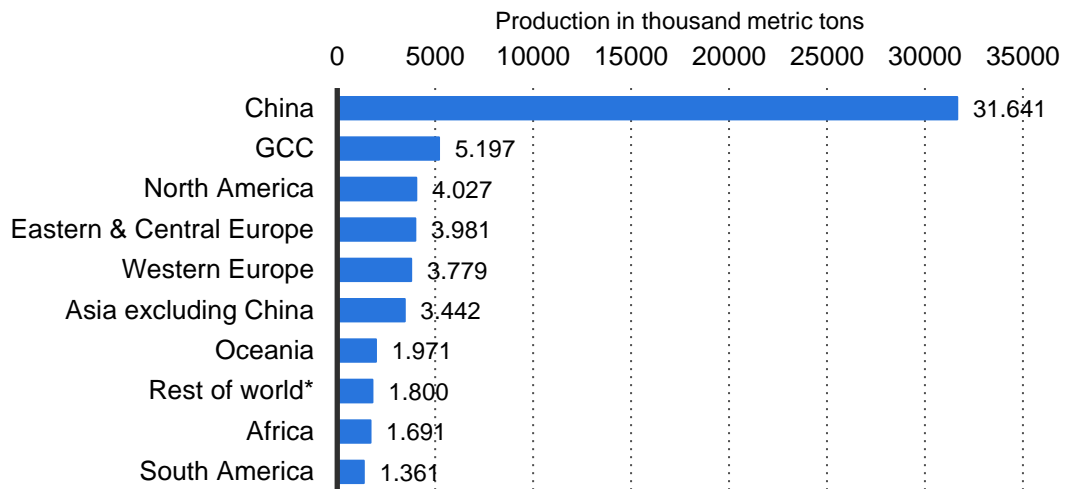


Figure A.6.9. Leading Aluminum Producer Countries (IAI)

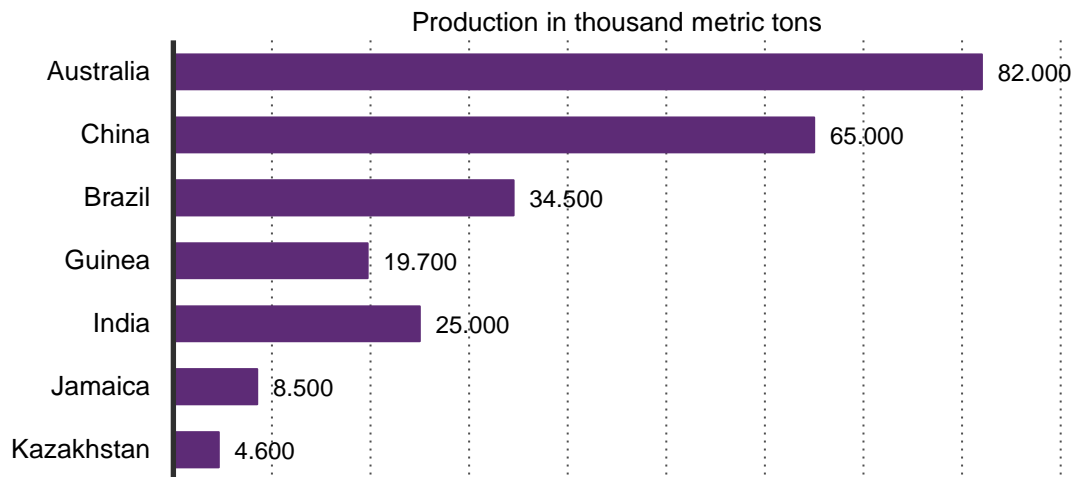


Figure A.6.10. Leading Bauxide Mining Countries (USGS)

A.6.5.2. Top Aluminum Producer Firms

Chinese firms dominate Aluminum production market while UC Rusal from Russia, Rio Tinto Alcan from Canada and Alcoa from US are in top 6. Figure A.6.11 from CRU group shows the statistics in 2016.

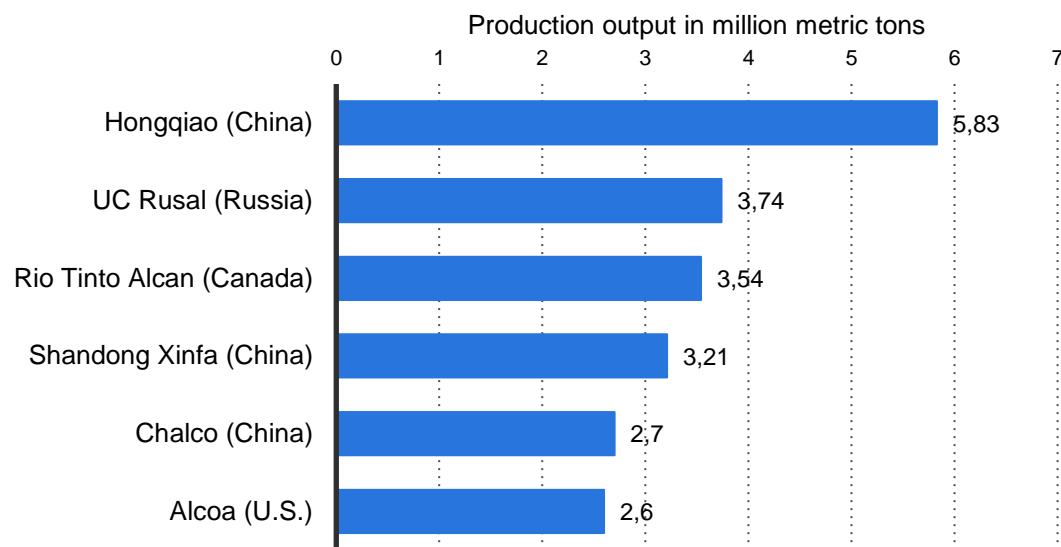


Figure A.6.11. Top 6 Aluminum Producer Firms (CRU Group)

A.6.6.1. Iron and Steel Producer Countries

Largest steel producer in the world is China where its production in crude steel is 7 times higher than Japan which is the second largest country. Figure A.6.12, from world steel association shows the rankings in 2016. Turkey is 8th largest steel producer. However, iron ore is mainly mined in Australia, Brazil and China. Figure A.6.13 from USGS shows the ranking in 2016.

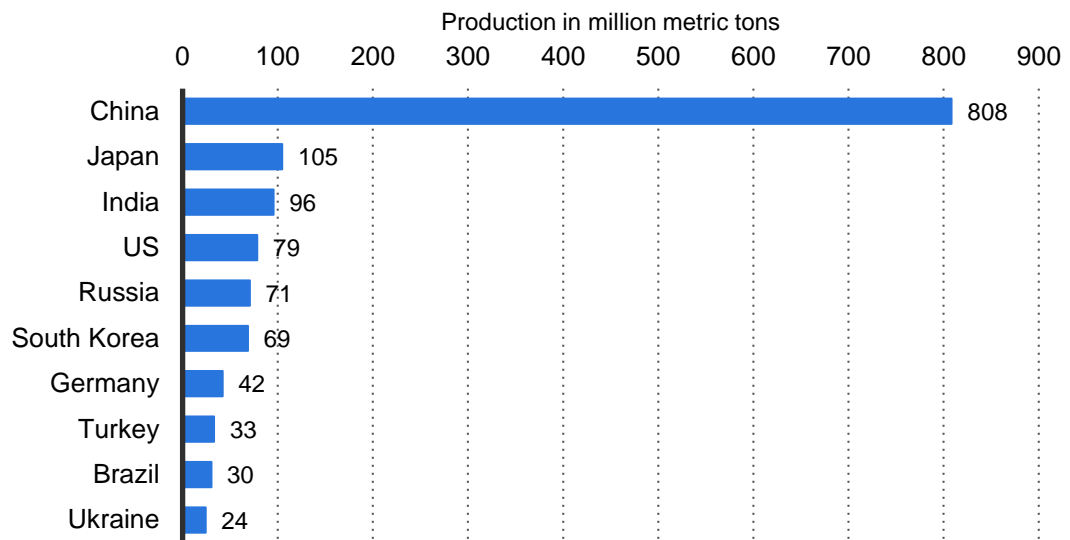


Figure A.6.12. Top 10 Steel Producers (World Steel Association)

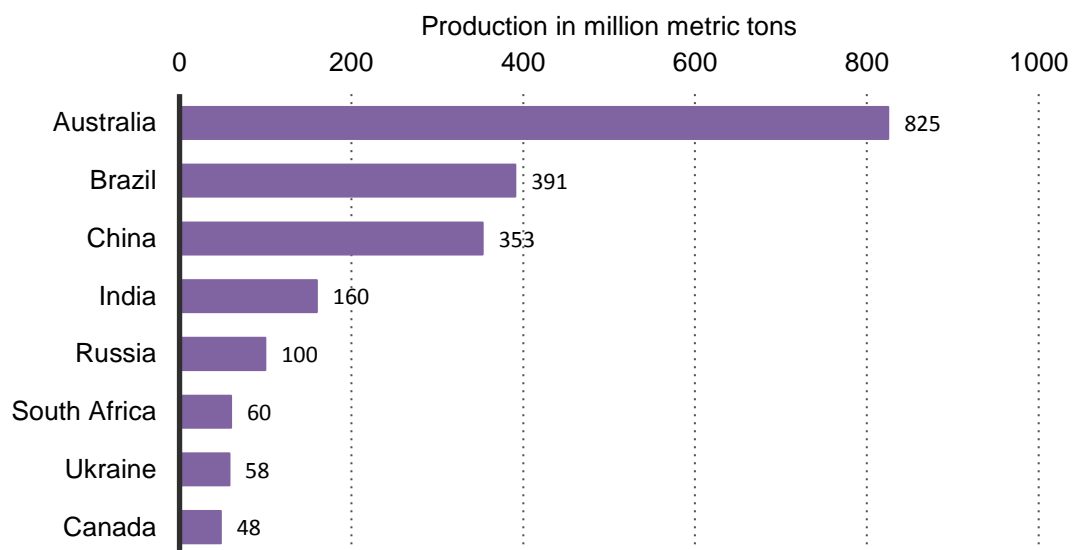


Figure A.6.13. Top 8 Iron Mining Countries (USGS)

1.1.6.2. Top Steel Producer Firms

Largest firms are mainly from China, Japan and India. However, largest firm ArcelorMittal is a Luxembourg based firm which became largest after Arcelor acquired Mittal in 2006. Figure A.6.14 from World Steel Association shows the production volume for firms.

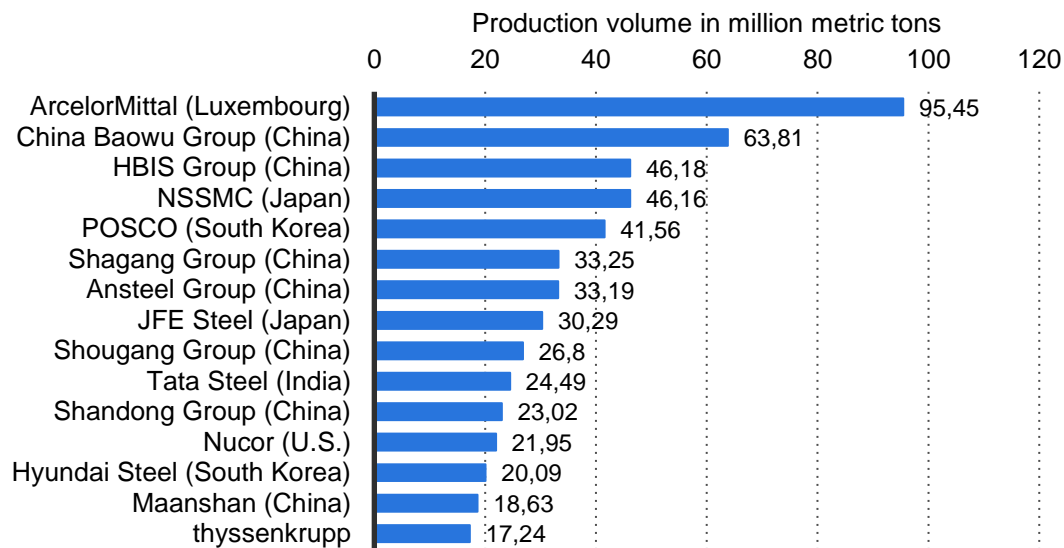


Figure A.6.14. Top Steel Producer Firms (World Steel Association)

APPENDIX B. TURKISH SUMMARY/TÜRKÇE ÖZET

GLOBAL METAL FİYAT DEĞİŞİKLİKLERİNİN TÜRK METAL ENDÜSTRİSİNE VE İHRACATINA OLAN ETKİLERİNİN İNCELENMESİ

1.Giriş

Ülkelerin ekonomik gücünü gösteren önemli faktörlerden bir tanesi üretim sektörünün gelişmişliği ve büyüme hızıdır. Üretim sektörü katma değeri yüksek olan otomotiv ve makina endüstrisinden daha düşük katma değerli kimyasalların üretimine kadar uzanır. Fakat yüksek katma değerli ve ya değil, üretim sektöründeki bir çok endüstri üretiminde emtiaları kullanır.

Bir çok üretimin girdisi olması dolayısı ile emtialardaki fiyat hareketleri ve birbirleri ile olan ilişkileri literatürde çokça incelenmiştir. Önemli bir girdi olması dolayısı ile de emtia fiyatlarının tahmini üretim sektöründe kritik bir yer tutmaktadır.

Emtialar arasında altın, gümüş ve petrol gibi değerli ürünlerin yanısıra nikel, demir, bakır gibi ana metaller, hem ana metal endüstrisi için hem de ana metal endüstrilerindeki çıktıların diğer sektörlerde kullanılmasından dolayı, emtialar arasında etkili bir konuma sahiptir. Aslında, çevremizdeki bir çok yapıda ve üründe ana metalleri görmemiz mümkündür.

Metal endüstrisi Çin, Japonya ve Amerika gibi önemli çelik üreticileri için kritik olmayıp, aynı zamanda metal endüstri çıktılarını kullanan otomotiv ağırlıklı Almanya, İngiltere gibi ülkeleri de etkilemektedir. Bilindiği gibi bir otomobilin %70'i çelik, %6'sı ise alüminyumdur. (Kishida)

Bütün bunlara rağmen, ekonomik literatür, ana metal fiyatlarının makroekonomik verilere etkisini incelemekte yetersiz kalmaktadır. Bu sebeple, bu tez bu yönüyle Türkiye ana metal endüstrisi için önem kazanacaktır.

Ana metaller altı ana üründe açıklanabilir: Demir, aliminyum, bakır, çinko, kurşun ve nikel. Bu ürünlerin dünyadaki üretim hacimleri, demir ve çelik için 1.629 milyar ton ham çelik ve 45.8 milyon ton paslanmaz çelik olmak üzere toplamda 1.674 milyar ton, aliminyum 197.1 milyon ton, bakır 20.8 milyon ton, çinko 13.7 milyon ton, kurşun 5.2 milyon ton ve nikel 2.1 milyon tondur. Görüldüğü gibi, ana metallerin üretimlerindeki ana kalem demir ve çeliktir ve toplam üretimin %80'inden fazlasını oluşturmaktadır.

Bu ürünlerin kullanım alanları birbirinden farklılık göstermekle beraber demir ve çelik çoğunlukla makina ve inşaat endüstrisinde, aliminyum taşımacılık ve inşaat endüstrisinde, bakır altyapı ve inşaat endüstrisinde, çinko galvanizleme, kurşun pil üretiminde ve nikel ise paslanma önleyici materyal olarak kullanılmaktadır. Çelik ürünlerini önemli kısmını uzun ve yassı çelikler oluşturmaktadır. Uzun ürünler daha çok inşaat sektöründe kullanılırken, yassı ürünler otomotiv ve makina endüstrisinde ağırlıklı olarak tüketilmektedir.

Ana metal endüstrisi için önemli konulardan bir tanesi de üretim şeklidir. Özellikle çelik üretimi için iki tip üretim şekli vardır. Biricisi demir cevheri kullanılarak yapılan üretim, ikincisi ise hurda kullanılarak yapılan üretimdir. Demir cevheri kullanılarak yapılan üretim tesisleri entegre, hurda ile yapabilen tesisler ise yarı entegre tesisler olarak adlandırılmaktadır. Yani yarı entegre tesisler üretim yapabilmek için demir cevheri değil hurda satın almak zorundadırlar. Bu sebeple sadece ham demir cevheri fiyatları değil hurda fiyatları da endüstriye etkili olacaktır.

Dünya genelinde değerlendirildiğinde, çoğunluk entegre tesislerden oluşmakta iken, Türkiye için tam tersi bir durum söz konusudur. Türkiye'deki çelik üreticilerinin çoğunluğu hurdadan üretim yapmaktadır. Bu bilgi de Türkiye'de etkili olacak fiyatlar için bir ipucu verecektir.

Ana metal ve üretim endüstrisinin önemini Türkiye için değerlendirildiğinde, bazı çarpıcı veriler öne çıkmaktadır. Üretim endüstrisinin Türkiye GSYİH’i içindeki payı ortalama %29 seviyesindedir. Bu oran Finlandiya, Almanya gibi daha endüstrileşmiş ülkelerde %34 seviyesinde daha çok hizmet sektörü gelirine sahip olan Hollanda ve Danimarka’da ise %23 seviyesindedir.

Türkiye’de ana metal endüstrisinin, üretim sektörü içindeki payı ise %11 seviyesindedir. Bu oran Avrupa genelinde en yüksek seviyedir. Norveç ve İsveç’te ana metal endüstrisi sırası ile %11 ve %10’luk paya sahipken, Fransa’da %3 seviyesindedir.

%11’lik oran ile ana metal endüstrisi, gıdanın %15’lik payından sonra ikinci sırada gelmektedir. Fakat ana metal endüstrisi bilindiği gibi aynı zamanda diğer sektörler için de önemli bir girdidir. Yani üretim endüstrisi içerisindeki payı %7 olan otomotiv, ve aynı zamanda GSYİH içindeki payı %7 olan inşaat sektörü için de temel bir sektördür.

Bununla beraber, Türkiye 2016 yılında en büyük 8. üretici konumundadır. Yıllık 33.2 milyon ton ile 42.1 milyon ton üretim yapan Almanya’nın hemen arkasındadır.

Ana metal endüstrisinin önemi sadece yurtiçi üretim ile sınırlı değil. Ana metal endüstrisi aynı zamanda 2017 yılındaki Türkiye ihracatında %13’lik pay ile %17’lik paya sahip olan motorlu araçlardan hemen sonra ve benzer şekilde 2017 yılındaki Türkiye ithalatında %14’lük payı ile ilk sırada gelmektedir.

Ana metal endüstrisinin hem ithalat hem de ihracat için önemli yer taşımasındaki neden çelik üretimi üzerinden açıklanabilir. Daha önce bahsedildiği gibi çelik üretimi için iki önemli kalem uzun ve yassı çeliklerdir. Türkiye uzun çelikte tüketimden fazlasını üretip net ihracatçı konumundayken, yassı ürünlerde tüketimden daha azını üretim net ithalatçı konumundadır.

Çelik için önemli konulardan bir tanesinin girdi tipi olduğu bahsedilmiştir. Hurdanın önemli bir girdi olması dolayısı ile Türkiye’nin hurda ithalatı da önem taşıyacaktır. Türkiye 17.7 milyon tonluk ithalatı ile birlikte, en yakın rakibi Hindistanı yaklaşık

3'e katlayarak, en büyük hurda ithalatçısı konumundadır. Bu veri, hurda ithalatı ve fiyatlarının Türk demir çelik endüstrisi için önemini bir kez daha vurgulamaktadır.

Türkiye'deki çelik üreticileri incelendiğinde, toplam 33 üreticiden sadece 3'ü entegre tesise sahiptir. Yıllık 5.5 milyon tonun üzerindeki üretimi ile birlikte İsdemir birinci sırada, 3.5 ila 4.5 milyon ton arasındaki üretimi ile Erdemir ikinci sırada, 3 ile 4 milyon ton üretimi ile İçdaş 3.sırada yer almaktadır. İsdemir hem yassı hem uzun ürünler üretirken, İçdaş sadece uzun, Erdemir ise sadece yassı üretmektedir.

İsdemir, İskenderun'da konumlanmakla birlikte 2002 yılına kadar devlet destekli bir firma halindedir. 2002 yılında Erdemir'e ve Erdemir'in de Oyak grubu'na satılması ile birlikte Oyak grubunun bir şirketidir. Erdemir, 2006'daki Oyak satın alımına kadar yine devlet destekli bir firmadır. İçdaş ise Çanakkale'de konumlanmakta olup, 1969'daki kuruluşundan beri özel sektöre ait bir firmadır.

Türk çelik endüstrisi için güncel ve uzun süredir sürmekte olan bazı negatif noktalar mevcuttur. Bunlardan önemli bir tanesi, Türkiye'deki üreticilerinin sadece 3'ünün entegre sahip olması söylenebilir. Bunun dışında, Türkiye'nin daha çok uzun çelik üretip daha az yassı çelik üretmesi buna göre net ihracatçı ve net ithalatçı konumunda olması negatif bir yan olarak gösterilebilir. Çünkü yassı çelik uzun çeliğe göre daha katma değerli bir ürün olarak değerlendirilmektedir.

Bunun dışındaki son yıldaki Amerika'nın anti dumping uygulaması, ve aynı zamanda ithal inşaat demiri vergisinin %10'dan %0'a çekilmesi, yerel üreticiler için zorluklara sebep olacaktır.

Bunların yanı sıra yassı çelik ithalatındaki verginin arttırılması da sektöre olumlu yansıyabilir.

2.Literatür Taraması

Emtia fiyatları ve birbirleri ile olan ilişkileri ekonomik literatürde sıkça incelenen konulardan bir tanesidir. Ayrıca emtia fiyatlarının ekonomik aktivitelere olan önemli etkileri vardır (Labys,2006). Buna ek olarak, emtia fiyatlarındaki dalgalanmalar,

yaşam standartları ve makroekonomik veriler üzerinde de etkili olmaktadır (Deaton,1999; Cashin et al.,2002).

Ayrıca bulgular ve çalışmalar gösteriyor ki, metal fiyatlarındaki dalgalanmalar da proje değerlemeleri ve bütçelemelerde önemli rol oynamaktadır (Dooley ve Lenihan,2005).

Emtia fiyatlarındaki değişimlerin önemli etkileri düşünüldüğünde, fiyat dinamiklerinin anlaşılması ve tahmin modellerinin geliştirilmesi kritik olmaktadır. Buna yönelik emtia fiyatlarındaki paralel hareketler Pindyck ve Rotemberg (1990) tarafından incelenmiştir. Ayrıca Rossen (2015) yine paralel hareketleri incelemiş ve fiyat döngüleri ve uzun dönem trendlerini incelemiştir. Buna ek olarak, Winkelried (2016), parçalı lineer trendleri ve döngüler üzerine çalışma yapmıştır.

Emtia fiyatlarının ülkelerin ekonomik değerlerine olan etkileri için ise, Cordon (2012), fiyat şoklarının sonuçlarını incelemiştir. Sonuç olarak Avustralya ekonomisi için fiyat değişimlerinin, reel döviz kuru, dış ticaret artışı, kapital akışı ve rekabetçilikte düşüş olarak bulunmuştur.

Guidi (2010), Birleşik Krallık için petrol şoklarının üretim ve hizmet sektörüne etkilerini incelemiştir. Sonuç olarak üretim sektörünün önemli ölçüde etkilendiğini fakat hizmet sektörünün etkilenmediğini göstermiştir. Benzer olarak, Fukunaga (2010), petrol şoklarının Japonya toplam üretimini etkilediğini gözlemlemiştir. Son olarak Vespignani (2014), SVAR modeli ile emtia şoklarının Avustralya ekonomisine etkilerini incelemiş ve %1'lik ana metal fiyatlarındaki şokun maden endüstrisi karını 4 periyot boyunca negatif etkilediğini bulmuştur. Bunun yanısıra kısa dönemde inşaat sektörüne pozitif fakat uzun dönemde negatif etkilediği görülmüştür.

Bahsedilen çalışmalar ile beraber, hurda ve ana metal fiyatları arasındaki geçişkenliği inceleyen çalışmalar da mevcuttur. Örneğin, Fisher and Owen (1981), alüminyum için ana metal fiyatlarının hurda fiyatlarını etkilediğini göstermiştir. Labys and Kaboudan (1980), yaptıkları çalışmada bakır için yine ana metal fiyatından hurdaya bir geçişkenlik gözlemlemiştir. Fiyat geçişkenliği VAR modeli ile bu tez içerisinde de incelenecektir.

Bütün bu çalışmalar değerlendirildiğinde, ekonomik literatür, metal fiyatlarındaki değişimin üretim üzerine olan etkisini incelemekte yetersiz görülmektedir. Özellikle, bu etkilerin Türkiye için analizleri konusunda ekonomik literatürde herhangi bir çalışma bulunmamaktadır.

%11'lik üretim sektörü içerisindeki payı ile, ana metal endüstrisi ve ana metal fiyatlarının endüstriye etkilerini incelemek Türkiye ana metal sanayi için kritik olacaktır. Aynı zamanda bilindiği gibi, ana metal endüstrisi çıktıları otomotiv ve inşaat endüstrisi için de önemli bir girdi olmaktadır. Bu sebeple, tezin çıktıları ve bulgular Türk ana metal sanayii için daha da önemli bir hal alacaktır.

3. Veri Seti, Değişkenler ve Metodoloji

Bu bölümde, tez içerisinde kullanılacak olan veri setleri ve bu veri setlerinin bir takım özelliklerine değinilecektir. VAR modeli kurulmadan önce veri setlerine durağanlık testleri uygulanmalıdır. Durağanlık testleri ADF ve PP testleri olarak uygulanmıştır. Bunun yanı sıra tezde uygulanacak olan VAR modeli açıklanmıştır.

Tezde yapılacak analizler için 10 ana değişken kullanılmıştır. İlk ikisi, TUIK'ten elde edilen Türkiye ana metal ve çelik sanayi endeksidir. Üçüncü ve dördüncü olarak, IMF'den elde edilen ana metal fiyatları kullanılmıştır. Ek olarak, Platts Türkiye ithalat hurda fiyatları kullanılmıştır. Fiyatların ihracata olan etkisini gözlemek adına, TUIK'ten elde edilen ana metal ve çelik ihracat gelirleri de analizlerde kullanılmıştır. Yurtdışı fiyatlarının yurtiçi fiyatlarını geçişkenliğini incelemek adına, yine TUIK'ten elde edilen yurtiçi çelik ve ana metal fiyat endekslerine de yer

verilmiştir. Ayrıca döviz kuru ve petrol fiyatlarındaki dalgalanmaları incelemek adına, TCMB döviz kuru ve yatırım petrol fiyatları kullanılmıştır.

Hurda ithalat fiyatları hariç olan tüm veriler, 2005 ve 2016 yılları arasında incelenmekte olup, hurda ithalat fiyatları 2010 ve 2016 arasında kullanılmıştır.

Türkiye ana metal endeksinin genel sanayi endeksi ile ilişkisine bakıldığında %97’lik bir korelasyon katsayısı gözlemlenmektedir. İki veri de benzer trendleri izlemektedir.

Türkiye ana metal endeksinin 2009 yılındaki krize kadar arttığını 2009’daki düşüşten sonra tekrar 2016 doğru hızla arttığı gözlemlenmiştir. Benzer şekilde 2009’a kadar artış trendi içerisinde olan global ana metal fiyatlarının 2009’a düşüş yaşadığı sonrasında 2012’ye kadar hızla arttığı ve pik yaptığı, 2016’a kadar da düşüş trendinden olduğu görülmüştür.

Ana metal ve hurda da ithalat seviyelerinden dolayı, Türkiye ana metal sektörü için döviz kuru dalgalanmaları da önemli olmaktadır. Özellikle 2016 sonrasındaki TL’deki değer kaybı fiyatları olumsuz etkilemiştir.

3.1. Metodoloji

Verilerin durağanlığını incelemek üzere ADF ve PP testi uygulanmıştır. ADF modeli aşağıda görülebilir:

Y_t : t anında üretim endeksi

P_t : t anında fiyat seviyesi

$$\begin{aligned} P_t &= \beta P_{t-1} + v_t \\ Y_t &= \beta Y_{t-1} + u_t \end{aligned} \tag{3}$$

$$u_t = \rho u_{t-1} + \varepsilon_t \quad \text{ana metal üretim endeksi için} \tag{4}$$

$$v_t = \rho v_{t-1} + \varepsilon_t \quad \text{fiyat seviyesi için} \tag{5}$$

Yukarıda gösterilmiş olan model, diğer veriler için de kullanılabilir. Kullanılan ADF ve PP modelinin sonuçlarına göre, ana metal ve çelik üretim endeksi, ayrıca ana metal ve çelik ihracat endeksi durağan olarak görülmüştür. Bunun yanı sıra diğer tüm verilerin durağan olmadığı görülmüştür. Analiz yapılacak olan iki verinin aynı durağanlık seviyesinde olması gerektiğinden, veriler büyüme verilerine çevrilmiştir. $(Y_t/Y_{t-1} - 1)$ Bu çevirim ile birlikte, tüm büyüme verilerinin durağan olduğu görülmüştür.

Durağanlık testinin yanısıra, durağan olmayan seriler arasındaki analizlerde cointegration testi yapılmalıdır. Birbiri ile analiz yapılacak olan durağan olmayan seriler test edildiğinde cointegration gözlemlenmemiştir. Böylece tez içerisindeki analizlerde büyüme verileri ile VAR modeli kullanılacaktır.

Son olarak, döviz kuru, global ana metal fiyatı ve ya petrol fiyatındaki dalgalanmaların etkilerini anlamak amacı ile ARCH modeli kullanılmış ve varyanslar tahmin edilmiştir.

ARCH modeli ilk olarak Engle (1982) tarafından ekonomik literature eklenmiştir. Kullanılan ARCH modeli aşağıda görülebilir:

$$\sigma_t^2 = \beta + \sum \alpha_i \varepsilon_{t-i}^2 = \beta + \alpha(L) \varepsilon_{t-1}^2 \quad (6)$$

Modelde tüm i değerleri için β ve α_i değerleri sıfırdan büyük olmalıdır. $\varepsilon_t^2 - \sigma_t^2 = k_t$ eşitliği kullanılarak aşağıdaki gibi ARCH (q) modeli elde edilebilir:

$$\varepsilon_t^2 = \beta + \alpha(L) \varepsilon_{t-1}^2 + k_t \quad (7)$$

ARCH modeli sonuçlarına ana metal fiyatı, döviz kuru ve petrol fiyatlarının ARCH (1) modeli olduğu görülmüştür. ARCH katsayıları aşağıdaki tabloda özetlenmiştir:

Tablo B.1. Değişkenlik Tahmini

Doviz Kuru Modeli – ARCH(1) – 2005-2016 aylık		
Değişken	Katsayı	P-value
Arch geçmiş 1	0.197	0.003
Sabit	0.001	0.000
Ana Metal Fiyat Modeli– ARCH(1) – 2005-2016 aylık		
Değişken	Katsayı	P-value
Arch geçmiş 1	0.314	0.024
Sabit	0.002	0.000
Petrol Fiyat Modeli – ARCH(1) – 2005-2016 aylık		
Değişken	Katsayı	P-value
Arch geçmiş 1	0.352	0.005
Sabit	0.005	0.000

ARCH modelinin yanısıra tez içerisinde sıklıkla VAR modeli kullanılacaktır. VAR modeli aşağıdaki gibi yazılabilir.

$$Y_t = A_0 + A_1 Y_{t-1} + \dots + A_p Y_{t-p} + B_0 X_t + B_1 X_{t-1} + \dots + B_q X_{t-q} + U_t \quad (8)$$

Modelde, $A_0 \in \mathbb{R}^n$ sabit değer vektörü, $Y_t \in \mathbb{R}^n$ içsel değişkenler vektörü, $X_t \in \mathbb{R}^m$ dışsal değişkenler vektörü, A_j 's $n \times n$, $j = 1, \dots, p$ iken içsel değişkenlerin katsayı vektörü, B_i 's $n \times m$ $i = 0, \dots, q$ iken dışsal değişkenlerin katsayı vektörü ve $U_t \in \mathbb{R}^n$ hata terimi vektörü olarak gösterilmiştir.

VAR modeli ile beraber Granger nedenselliği test edilecek, etki tepki fonksiyonları çıkarılacak ve varyans dağıtma modeli kullanılacaktır.

4. Bulgular

Bulgular; ana metal ve hurda fiyatlarının Türkiye metal endüstrisine etkileri, Türkiye metal üretimi ve ya ihracatının ana metal ve ya hurda fiyatlarına etkileri, son olarak da ana metal fiyatı, döviz kuru ve petrol fiyatlarının ana metal endüstrisine etkileri olarak 3 ana başlıkta toplanmıştır.

4.1. Global Metal Fiyatlarının Türkiye Ana Metal Endüstrisine Etkileri

İlk olarak inceleme, global ana metal fiyatlarının Türkiye ana metal endüstrisine olan etkileri üzerine yapılmıştır. Buna yönelik global ana metal fiyat değişimi ve Türk ana metal endüstrisindeki değişim içsel değişken olarak VAR modelinde kullanılmıştır.

Sonuç olarak, global ana metal fiyat değişimlerinin Türk ana metal endüstrisine anlamlı bir etkisi olduğu görülmüştür. Etki tepki fonksiyonlarına göre, ana metal fiyatlarındaki pozitif bir şok, ana metal endüstrisini ilk ayda negatif ve sonrasında da pozitif etkilemektedir.

Benzer bir VAR modeli yurtiçi ana metal fiyat endeksi ve global ana metal fiyat endeksi üzerinden kullanıldığında, global ana metal fiyat endeksindeki pozitif bir şokun hemen bir sonraki ayda yurtiçi fiyatlara yansıdığını sonrasında da bu etkinin giderek düştüğü gözlemlenmiştir.

Yukarıdaki çıktılar, ana metal üreticileri ve tüketicilerinin beklentileri üzerinden açıklanabilir. Ana metal üreticileri kendi hammaddelerini 2 aylık bir süre öncesinde sipariş ediyorlar. Bu sebeple, ilk global ana metal fiyatlarındaki şok yurtiçi fiyatlara yansıyor ve ana metal üretimini düşürüyor. Fakat ikinci ayda üreticilerin elinde şok döneminde satın almış oldukları pahalı hammadde mevcut. Bu sebeple pahalı hammaddeden bir an önce kurtulup daha düşük maliyetli hammadde satın alma eğilimi içerisinde oldukları söylenebilir. Yani ikinci ay içerisinde pahalı hammaddeyi

ellerinden çıkarabilmek için üretimi arttırıyor ve bununla beraber yurtiçi fiyatların da düştüğü gözlemleniyor.

Global ana metal fiyatı yerine hurda fiyatı ve ana metal endüstrisi yerine çelik endüstrisi kullanıldığında, hurda fiyatındaki pozitif bir şok ilk ay etkisiz, ikinci ay negatif ve sonraki ay pozitif bir etkiye sebep oluyor. Bu bulgu, global ana metal fiyatları ile hurda fiyatları arasında bir Granger nedenselliğini işaret ediyor. Yani, ilk etki global ana metal fiyatları üzerinden gerçekleşiyor ve hurda fiyatları da ana metal fiyatlarını takip ediyor. Bu hipotez ile VAR modeli oluşturulduğunda, ana metal fiyatlarında hurda fiyatlarına bir Granger nedenselliği gözlemleniyor.

Özetle, global ana metal fiyatları ve ana metal endüstrisini farklı periyotlarda farklı şekilde etkiliyor. İlk periyottaki negatif etki yurtiçi fiyatlardaki artıştan kaynaklı iken, ikinci periyottaki pozitif etki üreticilerin ellerindeki pahalı hammaddeyi çıkarıp ucuz hammadde alabilmek adına üretimi arttırmasından kaynaklanıyor. Bununla beraber Türkiye en büyük hurda ithalatçısı olmasına rağmen Türkiye çelik endüstrisine olan ilk etki ana metal fiyatları tarafından gerçekleşiyor. Hurda fiyatları ana metal fiyatlarını takip ediyor.

4.2. Türkiye Ana Metal Endüstrisinin Global Fiyat Seviyelerine Etkileri

İnceleme, iki adımda yapılmıştır. Birincisi ana metal ihracatının ana metal fiyatlarına etkisi, ikincisi ise çelik ihracatının hurda fiyatlarına etkisi olarak. Bu incelemelere yönelik değişkenler içsel tanımlanarak, VAR modelleri oluşturulmuştur.

VAR modeli sonucunda Türkiye ana metal endüstrisi ihracatının, global ana metal fiyatlarına anlamlı bir etkisi görülmemiştir. Bunun yanı sıra, Türkiye çelik endüstrisinin hurda fiyatlarına anlamlı bir etkisi gözlemlenmiştir. Bu etki büyüklük olarak küçük olmasına rağmen, 8 aylık dönem içerisinde pozitif olarak görülmüştür. Yani Türkiye'deki çelik ihracatı arttığında hurda fiyatlarında da artış görülmektedir. Fakat bir önceki bölümde görüldüğü üzere Türkiye ana metal üretiminin hurda fiyatlarında bir etkisi yoktur. Bu iki farklı sonucun sebebi ihracat ve iç pazar kalite beklentileri ile açıklanabilir. Yurtdışı pazarlardaki kalite beklentisi yüksek

olduğundan Türkiye yurtdışı talebi karşılayabilmek adına daha kaliteli olan HMS hurda'yı ithal etmek durumundadır, bunun yanısıra yurtiçi pazarlarda A3 hurda hala kullanılabilir seviyededir. Özetle, yurtdışına ihracın artması ile birlikte Türkiye'nin ithal hurda (HMS) alma miktarı artmakta bu da fiyatlara pozitif yansımaktadır.

4.3. Global Ana Metal Fiyatları, Petrol Fiyatı ve Doviz Kuru Dalgalanmalarının Türkiye Ana Metal Endüstrisine Etkileri

Türk ana metal endüstrisi ihracat için önemli bir yer tutmakla beraber, ithalat için de önemli bir yer tutmaktadır. Özellikle yassı çelik ve hurda ithalatında Türkiye net ithalatçı konumundadır. O sebeple, makroekonomik verilerdeki dalgalanmalar ana metal endüstrisi üzerinde önemli etkiler yaratabilir.

İlk olarak, ana metal fiyatlarındaki dalgalanmaların etkisi VAR modelinde dışsal, ana metal fiyat değişimi ve ana metal endeks değişimi içsel olarak kullanıldığında, fiyat dalgalanmalarının ana metal sektöründe anlamlı etkisi olduğu gözlemlenmiştir. Ayrıca bu etkinin negatif olduğu görülmüştür. Yani dalgalanmalar ana metal endüstrisine beklendiği gibi olumsuz etki yapmaktadır.

Benzer bir VAR modeli, doviz kurundaki dalgalanmaların etkisi VAR modelinde dışsal, ana metal fiyat değişimi ve ana metal endeks değişimi içsel olarak kullanıldığında, doviz kurundaki dalgalanmaların ana metal endüstrisi üzerinde anlamlı etkisi olduğu ve etkinin negatif olduğu gözlemlenmiştir.

Son olarak, benzer VAR modelini, petrol fiyatlarındaki dalgalanmaları dışsal olarak kullanılarak gerçekleştirildiğinde, petrol fiyatlarındaki dalgalanmaların ana metal endüstrisi üzerinde anlamlı bir etkisi olmadığı gözlemlenmiştir.

Bunun yanısıra, diğer bir VAR modeli, petrol fiyatlarında dalgalanmaların etkisi VAR modelinde dışsal, ana metal fiyat değişimi ve petrol fiyat değişimi içsel olarak kullanıldığında, petrol fiyat değişiminin ve ya petrol fiyatlarındaki dalgalanmaların ana metal fiyatlarını anlamlı etkilemediği görülmüştür. Bu analiz global ana metal fiyatlarını, petrol fiyatlarının ve ya dalgalanmalarının ne derecede etkilediğini gözlemek amacı ile oluşturulmuştur.

5. Sonuç

Üretim sektörü bir çok gelişmiş ve gelişmekte olan ekonomiler için önemli bir faktör olmuştur. Türkiye'nin özellikle gelişmekte olduğu bir ekonomi olduğu düşünüldüğünde, üretim sektörüne yapılacak yatırımlar ve ya gelişimler, ekonomik gelişme için kritik olacaktır.

Ana metal endüstrisi üretim sektörü içindeki %11'lik pay ile ikinci sırada yer almaktadır. Sadece üretim sektörü içerisindeki payı değil, ana metal endüstrisinin diğer sektörler için de önemli bir girdisi olması da ana metal endüstrisinin önemini arttırmaktadır. Örneğin, otomotiv ve inşaat sektörü özellikle ana metal endüstrisinin çıktıları ile ürünlerini üretebilmektedir.

Ana metal endüstrisinin Türkiye'deki önemi düşünüldüğünde, global ana metal fiyatları ve ya hurda fiyatlarının ana metal endüstrisi ile ilişkisinin tespiti önem taşıyacaktır. Bu sebeple, tez içerisinde, ilk olarak VAR modeli kullanılmış, Granger nedenselliği değerlendirilmiş, buna yönelik etki tepki fonksiyonları ve varyans dağıtma modelleri oluşturulmuştur.

Ekonomik literatür için kapsamında ve alanında ilk olarak yazılan bir tez olması dolayısı ile tezin çıktıları daha yüksek bir anlam taşıyacaktır.

Tez içerisinde ana metal endüstrisinin alt kollarından olan çelik endüstrisinin de hurda fiyatları ile olan ilişkileri incelenmiştir. Ek olarak, ana metal fiyatlarının yurtiçi ana metal fiyatlarına olan etkisi de global fiyat değişimlerinin yurtiçine geçişkenliğini gözlemlemek adına değerlendirilmiştir.

Bu analizler ile beraber, Türkiye'nin önemli bir ihracatçı olmasından kaynaklı, Türkiye ana metal endüstrisi ve çelik ihracatının, global ana metal fiyatları ve hurda fiyatlarına olan etkileri de incelenmiştir.

Son olarak, ana metal fiyatları, döviz kuru ve petrol fiyatlarındaki dalgalanmaların, ana metal endüstrisine etkileri de değerlendirilmiştir.

Sonuç olarak bulgular aşağıdaki gibi sıralanabilir:

-Global ana metal fiyatlarındaki pozitif deęişim, ana metal endüstrisini ilk periyotta negatif sonrasında pozitif etkilemektedir.

-Global ana metal fiyatlarındaki pozitif deęişim, yurtiçi ana metal fiyatlarını pozitif etkilemektedir. Etki ilk periyottan itibaren başlamaktadır. Yani global fiyatların yurtiçi fiyatlara yansması en geç 1 aydır.

-Global ana metal fiyatlarındaki pozitif deęişim yurtiçi fiyatlara yansarak talep yönlü bir azalma ile ana metal endüstrisini negatif etkilemektedir. Bununla beraber üreticiler hammadde satın alımlarını 2 ay öncesinden yapmaktadırlar. O sebeple, global ana metal fiyatlarındaki şok döneminde satın alınan pahalı hammaddeler, şokun sonrasındaki ikinci periyotta elden çıkarılıp, daha ucuz hammadde alınması amacı ile hızla satılmaya çalışılmaktadır. Bu sebeple, yurtiçi fiyatlarında düşüş ve ana metal üretiminde artış gerçekleşmektedir.

-Global ana metal fiyatları ile benzer bir şekilde, hurda fiyatları da çelik üretimini anlamlı etkilemektedir. Bu etki ilk dönem görülmezken, ikinci dönem negatif ve üçüncü dönem pozitifdir.

-Global ana fiyatları hurda fiyatlarını direkt etkilemektedir. Global ana metal fiyatlarındaki bir artış, hurda fiyatlarına da pozitif yansımaktadır. Bu sebeple, hurda fiyatları aslında global ana metal fiyatlarındaki etkinin ardından ikincil bir etki olarak gerçekleştięi söylenebilir.

-Türkiye ana metal ihracatındaki artış, global ana metal fiyatlarını anlamlı etkilemezken, Türkiye çelik ihracatındaki artış hurda fiyatlarını anlamlı etkilemektedir. Çelik ihracatındaki artış Türkiye tarafından artan talep ile beraber hurda fiyatlarını pozitif etkiledięi gözlemlenmiştir.

-Doviz kuru ve global ana metal fiyatlarındaki dalgalanmalar, Türkiye ana metal üretimini negatif etkilemektedir. Bunun yanısıra petrol fiyatlarındaki dalgalanmaların bir etkisi olmadığı gözlemlenmiştir.

-Son olarak, petrol fiyatlarındaki deęişim ve dalgalanmalar, global ana metal fiyatlarına herhangi anlamlı bir etkide bulunmamaktadır.

APPENDIX C

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü	<input type="checkbox"/>
Sosyal Bilimler Enstitüsü	<input checked="" type="checkbox"/>
Uygulamalı Matematik Enstitüsü	<input type="checkbox"/>
Enformatik Enstitüsü	<input type="checkbox"/>
Deniz Bilimleri Enstitüsü	<input type="checkbox"/>

YAZARIN

Soyadı : Balıkçioğlu
Adı : Cem
Bölümü : İktisat

TEZİN ADI : Examination of the Effects of Change in Global Metal Prices on Turkish Basic Metal Production and Exportation

TEZİN TÜRÜ : Yüksek Lisans ☒ Doktora ☐

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☒
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
3. Tezimden bir (1) yıl süreyle fotokopi alınamaz. ☐

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: