EMPIRICAL ESTIMATION OF THE MULTIPLICATIVE EFFECTS OF STEEL INDUSTRI FOR MACEONIAN ECONOMY

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Abstract

Scientific and professional public obviously highlight the fact that the development dynamics of each national economy is largely based on more efficient industrial system (hence strongly highlighted efforts for reindustrialization of the world economy), given the fact that the technical progress largest economic effects materialize in the framework of the industry. In this context, identifying and quantifying the role and importance of each industry to the national economy is of paramount importance in the process of designing national industrial policies. The main aim of this paper is quantitative and scientifically based assessment of basic metal industry and its role and importance for the Macedonian economy by applying the economic impact methodology based on input - output model and the analysis of economic and financial indicators that capture the company's performance and the performance of whole industry. Such economic assessment and analysis involves studying the direct effects (the contribution of the steel industry to GDP, exports, employment, taxes and corporate - social responsibility) and multiplicative effects (indirect through the chain of suppliers and induced by the effect of consumption) that the industry generates in the national economy by the reproduction processes.[1]

Key words: Economic impact analysis, input-output model, direct and multiplicative effects, steel industry.

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1. INTRODUCTION

Scientific and professional public obviously highlight the fact that the development dynamics of each national economy is largely based on more efficient industrial system (hence strongly highlighted efforts for reindustrialization of the world economy), given the fact that the technical progress largest economic effects materialize in the framework of the industry. In this context, identifying and quantifying the role and importance of each industry to the national economy is of paramount importance in the process of designing national industrial policies.

The main aim of this paper is quantitative and scientifically based assessment of basic metal industry[2] and its role and importance for the Macedonian economy by applying the economic impact methodology based on input - output model and the analysis of economic and financial indicators that capture the company's performance and the performance of whole industry. Such economic assessment and analysis involves studying the direct effects (the contribution of the steel industry to GDP, exports, employment, taxes and corporate - social responsibility) and multiplicative effects (indirect through the chain of suppliers and induced by the effect of consumption) that the industry generates in the national economy by the reproduction processes.

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[2] The steel industry in Republic of Macedonia is instrumental in supplying the materials requirements for construction, manufacturing, and the energy industries. For this study, the steel sector or the industry of basic metals is defined to include several industries according to NAICS Classification System: 1) Iron and steel mills (electrical arc furnace); 2) Ferroalloy manufacturing (companies producing ferroalloy inputs to steel making, including ferrochrome, ferronickel and related products); 3) Steel products manufactured form purchased steel (companies producing steel pipe and tube manufacturers and companies rolling and drawing purchased steel to produce finished steel products; 4) Smelting industry; and 5) Non-ferrous metal industry.
Below is the list of the biggest companies in the steel industry or the industry for basic metals that is considered in this empirical study:
1) Makstil AD - Skopje,
2) Jugohrom AD - Jegunovce
3) Trade doo IGM - Kavadarci
4) RZ Institut AD - Skopje,
5) FZC October 11 AD - Kumanovo
6) Zeleznik AD - Demir Hisar,
7) Skopski Leguri AD - Skopje,
8) MZT AD - Skopje,
9) Feni - Kavadarci
10) AD Dojran Steel - Dojran
11) ArcelorMittal AD - Skopje.
12) Fakom ad Skopje
13) Bucim AD - Radovish

2. THEORETICAL EXPLINATION OF INPUT – OUTPUT MODEL

An input-output (I/O) analysis uses an economic model that traces the flow of goods and services, income, and employment among related sectors of the economy. The I/O approach triggers the flow of activities as follows: When final demand for a good changes, the sector producing the good (output) purchases inputs from other industrial sectors, which in turn purchase inputs from other industries. Moreover, all of these industrial sectors purchase additional labor input. The employees use their compensation to purchase goods and services from the economy. Linkages among industries in a region create a ripple effect as a result of change in demand for a product. Strong linkages can lead to healthier economies, as capital flows through the economy rather than out of it.

An input-output model is a snapshot of an economy in equilibrium, where the gross output of each industry is equal to the gross inputs to the industry. The gross output of an industry includes both inter-industry sales and sales to final demand. The gross input of an industry includes the purchase of goods and services, labor, investment, and profit. The Input - Output model provides a means of examining relationships within an economy both among different sectors and between sectors and final consumers such as households and government. The model allows one to examine the impact on the entire economy of a change in one or several economic activities.

The Input - Output model provides a means to capture and measure these effects. It uses three effects to measure economic impact: direct effect, indirect effect and induced effect.

• *Direct effect* refers to production change associated with a change in demand for the good itself. It is the initial impact to the economy, which is exogenous to the model.

• *Indirect effect* refers to the secondary impact caused by changing input needs of directly affected industries (e.g., additional input purchases to produce additional output).

• *Induced effect* is caused by changes in household spending due to the additional employment generated by direct and indirect effects.

2.1 *The concept of multiplicative effects (indirect and induced economic impacts*

The economic impact of the Steel Industry's activity is not limited to the employment, compensation, and other economic activity directly related the Industry's business operation. Through its supply chain, the Steel Industry creates jobs in related industries, and some of these jobs would not exist without the activity of the Steel Industry. Similarly, the wages paid to employees working at the Steel Industry and in its supply chain have an effect on the broader economy as employees use their compensation to buy goods and services.

The **Direct Spending** of the Steel Industry in the Pennsylvania economy is made up of the total of the direct spending on payroll, goods and services, and construction. The money spent by the Steel Industry in the operation of their businesses is spent again by the recipient employees and local businesses. These businesses in the Steel Industry's supply chain make their own purchases and hire employees, who then spend their salaries and wages throughout the local, regional and state economies – termed **Indirect Spending**. Employees of the Steel Industry and the companies in the Steel Industry's supply chain use their salaries and wages to purchase goods and services from other businesses for personal consumption – termed **Induced Spending**. A chain reaction of indirect and induced spending continues, with subsequent rounds of additional spending gradually diminished through savings, taxes and expenditures made outside the state. This economic ripple effect is measured by IMPLAN and other input-output economic models, using a series of multipliers to provide estimates of the number of times each dollar of input, or direct spending, cycles through the economy in terms of indirect and induced output, or additional spending, personal income and employment. Figure below presents an illustration of direct, indirect and induced impacts of the Steel Industry's activity.

Picture1. *Direct, indirect and induced effects of basic metals industry*
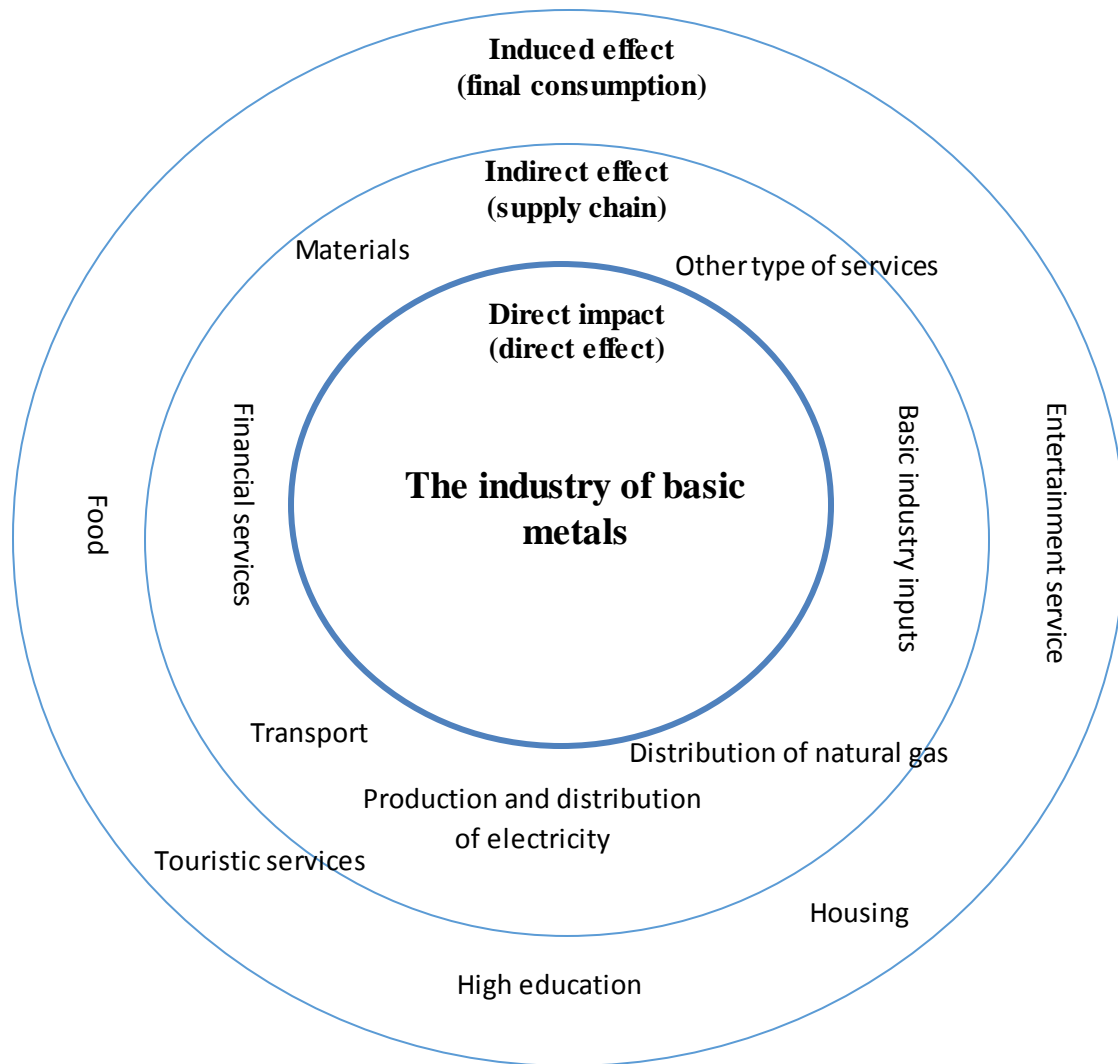
2.2 *Description of economic impact analysis of Steel industry and main assumption of the input – output model*

The model that we estimates in this research determines the impact that steel industry has on the Macedonian economy, including employment, total value added, employee compensation, proprietor income and property income. These are defined as follows:

• **Output Multiplier**: An output multiplier for a sector is defined as the total production in all sectors of the economy that is necessary to satisfy a dollar's worth of final demand for that sector's output (Miller and Blair, 1985). In other words, every dollar change in finaldemand spending (direct output) changes in the total value of output in all sectors.

• **Personal Income Multiplier**: For every dollar change in final-demand spending (direct output), the change in income received by households.

• **Employment Multiplier**: For every million-dollar change in final-demand spending (direct output) in a sector, the change in number of jobs in the economy.

• **Indirect Business Taxes Multiplier**: For every dollar change in final-demand spending (direct output), the change in indirect business taxes. Limitations of the Input-Output Model and the IMPLAN Model Input-output models incorporate several important assumptions (Miller and Blair, 1985; Minnesota IMPLAN Group, 1996) that place limitations on their interpretation:

The Input - Output model assumes a linear production function, which means constant returns to scale and constant production functions for each firm within an industry. For example, the

model assumes that a small sawmill would use the same inputs, in the same proportion, as a large sawmill. Furthermore, the model assumes that the percentage of those inputs that are purchased locally is constant from one firm to the next.

• Output is also assumed to be homogenous. In other words, the assumption is that the two sawmills would produce the same percentage of lumber, wood chips, and other outputs.

• It assumes that there are no constraints on the supply of any commodity.

• It assumes that increases or decreases in employment cause in- or out-migration from the state modeled, so that "full employment" is maintained.

3. EMPIRICAL ESTIMATION OF STEEL INDUSTRY MULTIPLICATIVE EFFECTS ON THE MACEDONIAN ECONOMY

The economic contribution of steel industry to the Macedonian economy, however, goes beyond these sector specific measures because steel companies purchase from many other sectors of the Macedonian economy. Moreover, the steel industry contributes to household incomes, which then induces additional rounds of stimulus to the economy as households spend its income on goods and services. It is obvious that this industry supports lot of businesses and jobs in many sectors in the economy and contributes to many sectors through the consumption channels.

Type I multiplier (the sum of a direct and indirect effects divided by the direct impact and measure the effect of the production of basic metals industry on total output in the national economy through the supply chain of the industry) shows that the production and sales of

companies within the industry for basic metals for 1 denar generate additional production in the economy of 0.41 denars (this type of multiplier measures the economic impact of the industry for basic metals to the national economy only through the stimulation of production of the companies that appear in the industry's supply chain).

Type II Multiplier (the sum of a direct, indirect and induced effects divided by direct effect and measures the economic impact of the industry's production on the national economy) shows that the production of the industry for basic metals 1 denar generate additional economic impact from 1.33 denars (this type of multiplier measures the overall economic impact of the basic metals industry in the national economy as a sum of the indirect effects produced by the supply chain and induced effects which are constructed by consumption effects).

The table below shows a general overview of the estimated economic multipliers that steel industry generates in the national economy derived by the empirical analysis and research made in the study.

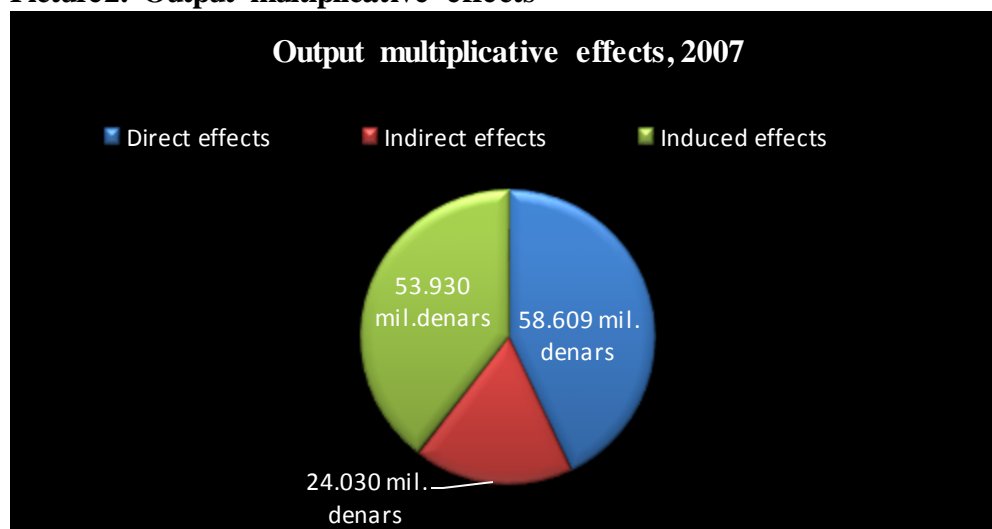**Table1. Economic multipliers for steel related manufacturing sectors in 2007 and 2014**

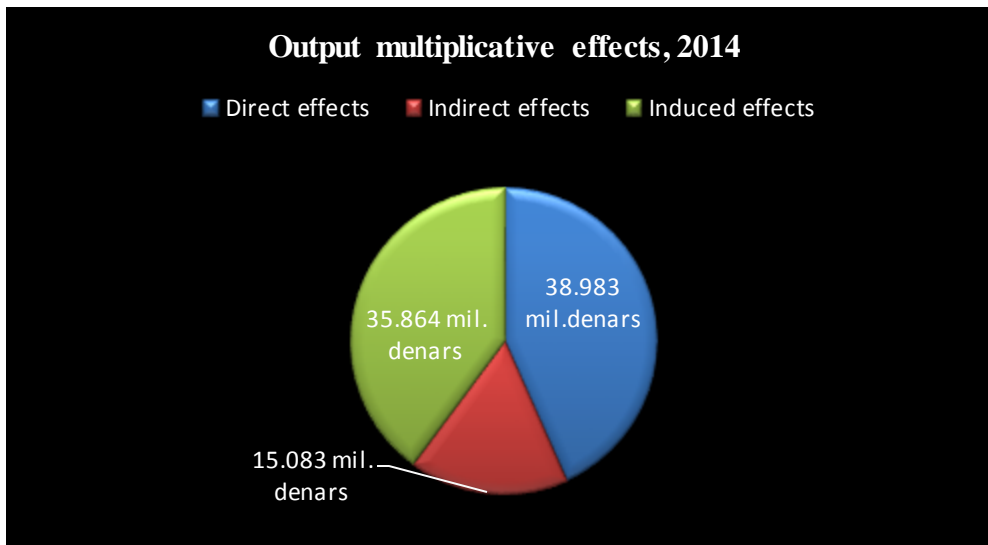| Multiplier	Direct	Indirect	Induced	Total	Type I*	Type II**
Output	1.00	0.41	0.92	2.33	1.41	2.33
Labor income	0.03	0.20	0.30	0.53	7.66	17.66
Employment	1.00	2.27	0.83	4.10	2.27	4.10
Total added value	0.31	0.24	0.75	1.30	1.77	4.19
Employment and taxes per million denars of output						
Employment	8.82					
Total taxes	24,089					
* When the sum of direct and indirect will be divided by direct effects						
**When the sum of direct, indirect and induced effects will be divided by direct effects						
Source: Authors' calculations based on the date from the survey analysis done in this study						

General overview of economic multiplicative effects basic metal industry generates for the Macedonian economy will be decomposed by studying individual multipliers in total value added, taxes, employment, labor income. The estimated results of the empirical analysis and the quantification of multiplicative effects (indirect and induces) show that any increase in the production of steel industry for one denar, contributes a significant increase in the total output in the Macedonian economy for approximately 2.33 denars, 1 denar is a direct impact, the

additional increase in output of 0.41 denars is a result of indirect impact by stimulating the output of the companies in the supply chain of the basic metal industry (this effect actually indicates how many denars will be created in form of production and sales of the companies in the supply chain for each denar rise manufacture of basic metal industry), and the rest of the growth in total output of 0.92 denars are generated through induced impact which is reflected by additional spending in the economy of the workers in the steel industry and employees in supply chain companies.

The greater practical importance of this study is transformation of the estimated coefficients of multiplication in the absolute numbers and values. The total value of production and revenues generated by the companies within the industry for basic metals that are part of this study is 58.609 million denars in 2007 and 38.983 million denars in 2014. But through its multiplicative effects industry for basic metals encourages additional production in the national economy of a total 77.950 million denars in 2007, or the total value of the realized production was 136.559 million denars. One part of this additional production generated by encouraging the production of supply chain companies is approximately 24.030 million denars (indirect channels), while the rest of the 53.920 million denars are generated indirectly through labor income of the employees and corporate profits of the owners of steel companies and through the salaries and profits of the workers and owners of the supply chain companies, and through the government spending generated by collecting taxes form steel companies and companies related to the industry Induced channels). In 2014, the value of realized production with induced production through the chain of suppliers (15.983 million denars) and final consumption (35.864 million) is total of 90.830 million denars.

Picture2. Output multiplicative effects

Output multiplicative effects, 2007
Direct effects   Indirect effects   Induced effects
53.930 mil.denars
58.609 mil. denars
24.030 mil. denars

Output multiplicative effects, 2014

■ Direct effects ■ Indirect effects ■ Induced effects

38.983 mil.denars
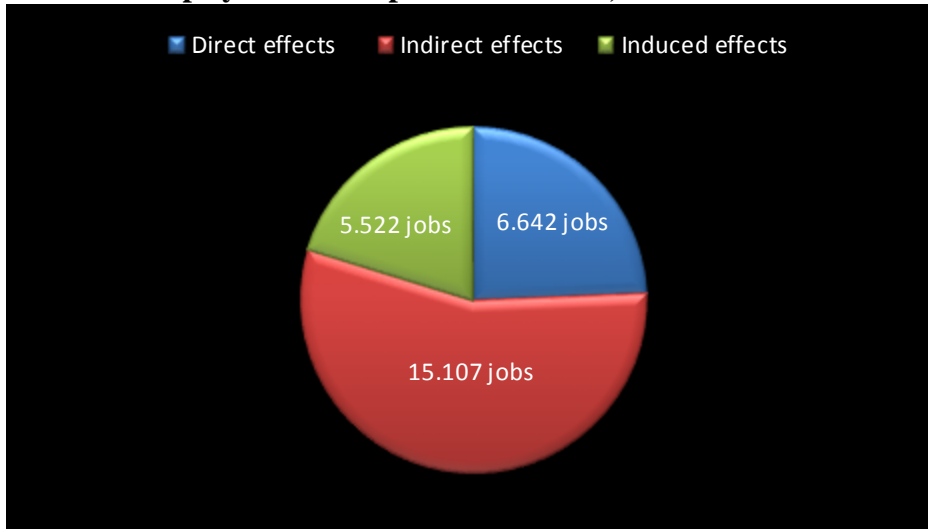
35.864 mil. denars

15.083 mil. denars

The employment multiplier reported below which measures a direct effect in generating jobs through the number of employees in companies that are part of the basic metals industry in million of total output. The employment rate of the basic metals industry as the ratio between the total revenues of the companies and the total number of employees shows that every employee Industrij on average during the year generated 8.82 million. Above we saw that in 2007 the total number of employees in companies that are part of this study is 6642 employees, while in 2014 that number is somewhat lower because of the economic crisis is 6393 jobs. This actually measured a direct impact to the industry viewed through the generation of jobs in the national economy.

The calculated ratio of the relationship between total revenues and number of employees, the total number of employees directly engaged in the companies and the labor income are expected according to the fact that the steel industry is capital intensive which means that its production process is characterized with the large amount of physical capital (machinery and equipment) in terms of manpower.

Much more significant is the multiplicative effects of the steel industry in terms of job creation in the national economy, indirectly. Namely, the steel industry through its supply chain creates and supports about 15,107 jobs (indirect multiplier is 2.27) and through induced effects relating to the consumption of employees in the industry and its supply chain this industry indirectly creates and supports about 5,522 employees (induced multiplier is 0.83). The total number of employees that the industry directly or indirectly generates or supports the national economy according to our calculations is 27,271 jobs and 26,211 jobs, in 2007 and 2014, respectively.
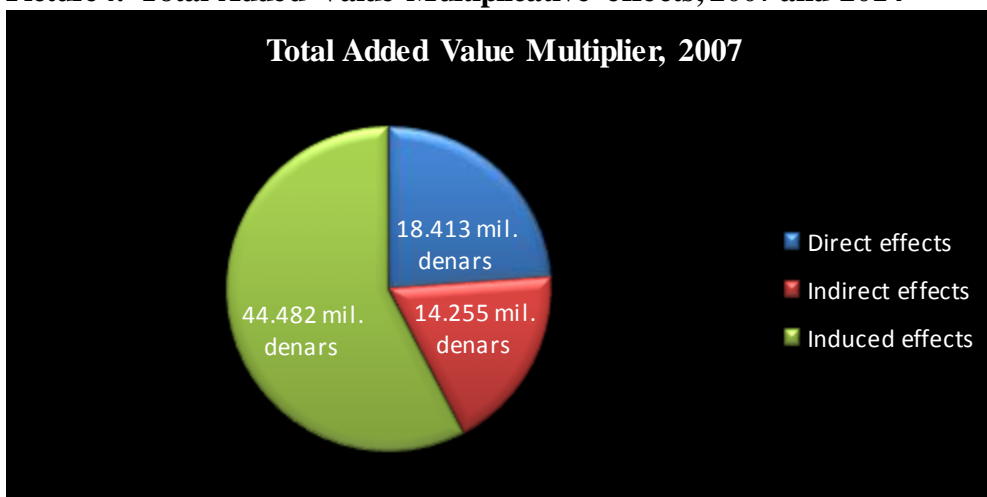
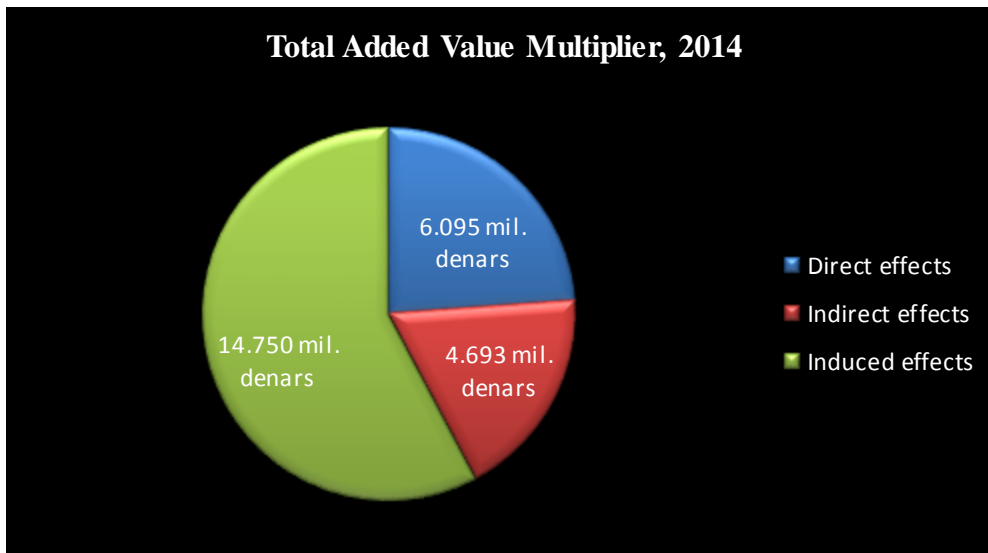**Picture3. Employment multiplicative effects, in 2007**

When it comes to the multipliers in total value added, the results of the analysis show that the steel industry in 2007 through additional indirect and induced effects generated and encouraged the creation of additional value added in the economy of 14,255 million and 44,482 million, respectively, which goes to the conclusion that the total gross value added generated by the steel industry for the national economy, directly or through its multiplicative effects (indirect and induced) is approximately 77,150 million denars.

The analysis of multiplicative effects of the steel industry in generating the total value added for 2014 shows that the industry through its supply chain (4693 million) and by consumption channels (14 750 million) encouraged the creation of additional gross value added of 19,443 million denars, or total economic impact (direct and a indirect) about 25,538 million denars.

Picture4. Total Added Value Multiplicative effects, 2007 and 2014

Total Added Value Multiplier, 2014

6.095 mil. denars

4.693 mil. denars

14.750 mil. denars

■ Direct effects
■ Indirect effects
■ Induced effects

The largest multiplier effect of the total industry's supply chain in terms of total added value is in the sector for collecting scrap metal and iron, industries that appear as providers of spare parts and materials, sector for production, transmission and distribution of natural gas and electricity, wholesale and retail sector and service sector understood in the broadest sense (finance, insurance, business sector and others).

Additionally, our goal in this section besides the analysis of net effects generated directly or indirectly by the steel industry is to quantify the relative size of the steel industry to national economy by calculating relative industry's contribution as a percentage of GDP. The estimated results indicate that the relative share of steel industry to national GDP is 24% and 5.7 %, in 2007 and 2014, respectively. This is a clear argument that the steel industry is the main pillar and one of the most important sector of Macedonian economy.

The direct and indirect tax impacts associated with steel industry is not neglected for the national economy and especially for the central and local government. Actually, tax revenues are paid from contributions to social security, proprietor income, indirect business taxes, household income and corporate profits. According our estimations, the steel sector paid a total of 2.433 and 1.338 million denars in 2007 and 2014, respectively. Additionally, the estimates made relating to the rate of taxes show that companies in this industry for every million revenues pay taxes to the government and the state funds about 24,000 denars.

4. CONCLUSION REMARKS

The economic contribution of steel industry to the Macedonian economy, however, goes beyond these sector specific measures because steel companies purchase from many other sectors of the Macedonian economy. Moreover, the steel industry contributes to household incomes, which then induces additional rounds of stimulus to the economy as households spend its income on goods and services. It is obvious that this industry supports lot of businesses and jobs in many sectors in the economy and contributes to many sectors through the consumption channels. Therefore, to assess the role and importance of the steel industry to the Macedonia economy besides the direct impact it is necessary to estimate the multiplicative effects (indirect and induced) that the industry generated through the supply chain and consumption channels and multipliers.

The estimated results based on the date collected from the survey analysis done in this project by applying the economic impact and input – output methodology showing that the **type I output multiplier** (the sum of a direct and indirect effects divided by the direct impact and measure the effect of the production of basic metals industry on total output in the national economy through the supply chain of the industry) is 1.41 which indicates that for every denar increase in sales of steel industry, total output of the Macedonian economy increases by 1.41 denars, 1 denars is direct sales increase, another 0.41 denars arise from indirect or supply chain impacts. On the other side, the **type II output Multiplier** (the sum of a direct, indirect and induced effects divided by direct effect and measures the economic impact of the industry's production on the national economy) is 2.33 indicating that for every denars increase in steel industry, the total economic impacts is 2.33 denars (1.41 denars from direct and indirect or supply chain effects) and 0.92 denars contributed by induce or consumption effects.

If we transform the estimated multiplicative coefficients presented above in the absolute numbers and values, the additional output of the steel industry generated by the indirect and induced channels in the national economy is a total 77.950 million denars in 2007. One part of this additional production generated by encouraging the production of supply chain companies is approximately 24.030 million denars (indirect channels), while the rest of the 53.920 million denars are generated indirectly through labor income of the employees and corporate profits of the owners of steel companies and through the salaries and profits of the workers and owners of the supply chain companies, and through the government spending generated by collecting taxes form steel companies and companies related to the industry Induced channels). In 2014,

the value of realized production with induced production through the chain of suppliers (15.983 million denars) and final consumption (35.864 million) is total of 51.847 million denars.

When it comes to the multipliers in terms of total value added, the results of the analysis show that the steel industry in 2007 through additional indirect and induced effects generated and encouraged the creation of additional value added in the economy of 14,255 million and 44,482 million, respectively, which goes to the conclusion that the total gross value added generated by the steel industry for the national economy, directly or through its multiplicative effects (indirect and induced) is approximately 77,150 million denars.

The analysis of multiplicative effects of the steel industry in generating the total value added for 2014 shows that the industry through its supply chain (4693 million) and by consumption channels (14 750 million) encouraged the creation of additional gross value added of 19,443 million denars, or total economic impact (direct and a indirect) about 25,538 million denars.

The employment multipliers indicate that the steel industry through its supply chain creates and supports about 15,107 jobs (indirect multiplier is 2.27) and through induced effects relating to the consumption of employees in the industry and its supply chain this industry indirectly creates and supports about 5,522 employees (induced multiplier is 0.83). The total number of employees that the industry directly or indirectly generates or supports the national economy according to our calculations is 27,271 jobs and 26,211 jobs, in 2007 and 2014, respectively.

The largest multiplier effect of the total industry's supply chain in terms of total added value is in the sector for collecting scrap metal and iron, industries that appear as providers of spare parts and materials, sector for production, transmission and distribution of natural gas and electricity, wholesale and retail sector and service sector understood in the broadest sense (finance, insurance, business sector and others).

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