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IN SLOVENIA:
AN INPUT-OUTPUT ANALYSIS**

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INTER-SECTORAL PRODUCTION LINKAGES IN SLOVENIA: AN INPUT-OUTPUT ANALYSIS

Uroš Geršak and Daniela Muhaj*

ABSTRACT

Slovenia was hit hard by the 2008 global financial crisis. We employ input-output based data and methodologies to examine the structure of the Slovenian economy pre- and post-crisis. We leverage inter-sectoral linkages to map the country's economic landscape. Multipliers, backward and forward linkages were computed to identify key economic sectors. Our analysis indicated that while most key economic sectors preserved their status despite the crisis, the negative impact on construction was substantial. Finally, based on our preliminary results, we highlighted a meaningful shift from services industries to manufacturing during the crisis, which eventually changed the structure of the Slovenian economy. Further empirical analysis is needed to determine the driving factors behind the observed patterns.

POVZETEK

Slovenijo je leta 2008 zelo prizadela globalna finančna kriza. V članku sva analizirala strukturo slovenskega gospodarstva pred in po krizi. Pri tem sva uporabila input-output podatke in metodologijo input-output analize. Strukturo slovenskega gospodarstva sva prikazala z izrisom vzajemne povezanosti med posameznimi dejavnostmi. Nadalje sva na podlagi multiplikatorjev, povezav nazaj in povezav naprej določila ključne gospodarske dejavnosti. Rezultati analize kažejo, da je večina ključnih dejavnosti ohranila status navkljub krizi, učinek krize pa se je najbolj poznal v gradbeništvu. Prav tako sva zaznala spremembo strukture slovenskega gospodarstva, saj je prišlo do premika od storitvenih dejavnosti k predelovalnim dejavnostim. V prihodnje bi bila potrebna analiza, s katero bi določili poglobitve dejavnike, ki so povzročili ta premik.

JEL Classification Numbers: C67, D57, L16

Keywords: input-output model, inter-sectoral linkages, output multipliers, structural change, Slovenian economy

Ključne besede: input-output model, medsektorske povezave, proizvodni multiplikatorji, strukturna sprememba, slovensko gospodarstvo

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1. Introduction

Slovenia has experienced a full cycle of expansion and contraction over the past decade. The rapid economic growth following European Union (EU) accession in 2004 – powered by excessive borrowing and risk taking by banks and enterprises – was facilitated by easier access to external financing. Models of this nature are inherently unsustainable, and thus excessive borrowing exacerbated the vulnerability of the economy. After a serious blow from the global financial crisis, diffused through external trade and financing channels, Slovenia has slowly been emerging from its own economic calamity, which culminated in a bank bailout in late 2013.

The global crisis of 2008 hit hard on two fronts, the financial sector, and the real economy. Existing literature presents a fairly extensive analysis of financial sector contagion, and the spill over effects in subsequent sectors, but it lacks in the assessment of inter and intra–sectoral linkages within the "real economy". Of particular importance to our inquiry is the understanding of the extent to which the causes and effects of the financial crisis are reflected in the structure and mutual linkages of the real sector. The goal is to analyse sectoral linkages before the crisis and during the crisis to assess mutual dependence across industries, and the degree of structural change in the Slovenian economy.

The analysis presented hereafter leverages the static Leontief and Ghoshian Input-Output (IO) model. An overview of the structure of the Slovenian economy is presented in the following section. We then outline the input-output framework, to follow with the results of multiplier and key sector analysis. The economic landscapes of Slovenia in 2005, 2009 and 2010 are discussed using the multiplier product matrix. The paper concludes by highlighting some major takeaways and describing proposals for future areas of research.

2. Structure of the Slovenian Economy

Approaching the 2008 financial crisis, the Slovenian economy was growing at a steady pace, with an average real growth rate at around 4% over the 1996-2008 period. In the third quarter of 2008, growth levels slowed down, and were shortly followed by a relatively drastic decline of 8% in 2009. While modest recovery took place in 2010 – 2011, the economy fell into a deeper recession in 2012 –

2013. As of 2014, Gross Domestic Product (GDP) has resumed its positive growth rate, and is expected to sustain its rhythm in the short to medium term.

Figure 1

What were the main drivers of economic growth and decline in Slovenia? In an attempt to answer this question, our study uses input-output (IO) data tables to take a closer look at sector specific patterns. To capture the evolution of the Slovenian economy during two distinct periods – before and during the global financial crisis – this paper uses data from domestic product-by-product IO tables¹. The data in these tables includes input and output information on products and services produced by industries, government, and non-profit institutions serving households (NPISH).

To ensure methodological consistency we used 2005 data for before the crisis period, and 2009 and 2010 data for the in crisis time frame. The data was compiled using the ESA 1995 methodology by the Statistical Office of the Republic of Slovenia (SORS)². For 2005 consolidated tables of the Slovenian economy are compiled using NACE Rev.1 industry classification system and CPA 2002 for products. On the other hand, 2009 and 2010 data are classified using NACE Rev. 2 and CPA 2008. Due to different classification systems between 2005 and 2009/2010 we converged classifications NACE Rev. 1 and NACE Rev. 2 to our classification "NACE Rev. 1 adjusted", which have 45 products/industries.³

2.1 General Insights from IO Tables

IO tables provide insight on the status quo of a particular economy on an annual basis through an analysis of inter-industrial transactions in goods and services. The specific values for domestic production, and the input components for goods and services, are captured by the figures in the column sector of IO tables, while rows capture output values. The economic structure of the Slovenian

¹ Domestic input-output tables are used throughout the text to ensure consistency. However, there are three types of input output tables, which differ on their treatment of import data. The first type incorporates import data. These tables are not being used for our input output analysis, because we need domestic production separated from imports to correctly measure multipliers. Thus, statisticians prepare two other input-output tables: domestic (imports are added as an additional line), and import input-output tables.

² The data are available on the [SORS](#) and [EUROSTAT](#) data was used to complement SORS tables

³ More on data issues and aggregation from products to industries is explained in the Appendix A: *Data Sources and Classification*

economy for 2005, 2009 and 2010 is presented in Appendix B (Ministry of Internal Affairs and Communications, 2005): Figure 2, Figure 3 and Figure 4 respectively.

According to the data, **total supply experienced a steady increase from 2005 to 2010 maintaining the same pace through 2009**. This upward trend was caused by a simultaneous increase in both domestic production (26.5%) and imports (27.9%). In 2010, the total supply of goods and services was 94.039 million Euros with domestic production amounting to 71.188 million Euros (75.7% of total supply), while imports were valued at 22.851 million Euros (24.3% of total supply). Total supply in the economy augmented by 26.8% compared to 2005 levels.

The ratio of intermediate inputs⁴ slightly increased from 2005 (55.2%) to 2010 (55.8%) after having experienced a modest decrease in 2009 (54.4%). Upon a closer inspection of the cost structure breakdown for domestic production, intermediate inputs of goods and services used in production such as raw materials and fuels accounted for 30.579 million Euros in 2005, while goods accounting for 63.9% and services for only 35.1%. However, the contribution of services was recorded at 39.3% in 2010. Gross value added, which is another structural element for domestic consumption, increased from 2005 levels (44.8%) to 2009 (45.6%) and was followed by a slight decrease in 2010 (44.2%).

On the demand side, total demand, intermediate demand and exports increased while investment decreased. The total amount of goods and services demanded in 2010 (94.039 million Euro) increased significantly from the 2005 levels (74,139 million Euros). Intermediate demand increased by 0.5% from 2005 (41.2%) to 2010 (41.7%)⁵. The 2010 levels of exports (40.5% of total demand) were comparatively higher to the value recorded for 2005 (38.5%). Additionally, when looking at the calculated change in export volumes from 2005, 2009 to 2010, a staggering 34.63% increase is recorded. The surge in export volumes, one of the main drivers of economic recovery in Slovenia, was mainly the result of improved foreign demand, and a rise in domestic manufacturing production.

⁴ Represents the ratio of domestic production accounted for by intermediate inputs

⁵ Within final demand, consumption increased by 31.43% (relative increase of the consumption value not the ratio to final demand), while investment decreased by 4.01%

2.1.1 Domestic Production

Manufacturing is the most important Slovenian industry. In 2005, domestic manufacturing production represented 35% of all domestic production. In 2009, there was a significant 6.5% drop in manufacturing production, and in 2010 manufacturing recovered to the 30.5% level. In Slovenia, manufacturing is heavily export-oriented, and depends primarily on foreign market demand. Slovenia's main trading partners (Germany, Italy, Austria and Croatia) were already in recession in 2008; therefore manufacturing adjusted by decreasing production levels, which in turn had an adverse effect in investment and exports.

Conversely, the 2009 and 2010 domestic production share of most other industries in Slovenia did not change significantly compared to 2005 levels. There are however two exceptions: (i) construction and transport, and (ii) storage and communication. Production in the construction industry dropped by 2 percentage points in 2010 and the domestic share of transport, storage and communications grew steadily from 2005 onward. Besides the aforementioned industries, other important ones are: (i) real estate, renting and business activities, and (ii) wholesale and retail trade, repair of motor vehicles, personal and household goods. Industries with the highest share of domestic production are highlighted in the following table.

Table 2

Upon disaggregating industry data to divisions (Table 3), it becomes evident which industries have the largest share in total output in Slovenia in this period. At this more granular level, construction (F45), followed by wholesale trade (G51), real estate services (K70), public administration (L75), land transport (I60), and health and social work services (N85) are the largest divisions in the Slovenian economy. Within manufacturing, the most important categories were chemicals, chemical products and manmade fibres (D24), fabricated metal products (D28), motor vehicles, and trailers and semitrailers (D34).

According to our preliminary analysis, the top 5 contributors to growth in 2005 were: (i) construction (F45), (ii) wholesale trade (G51), (iii) real estate (K70), (iv) other business services (K74), and (v) health and social work (N85). However, the main contributors to growth in 2010 were all divisions of manufacturing: a) chemicals, chemical products and manmade fibres (D24), b) basic

metals (D27), c) fabricated metal products (D28), d) office machinery and computers (D3033), and e) motor vehicles, trailers and semitrailers (D34). Manufacturing, being an export-oriented industry, was the main beneficiary of improved foreign demand by trading partners recovering from the crisis aftermath.

2.1.2 Intermediate Consumption and Value Added

Use of domestic intermediate inputs increased, while use of imported products in production decreased by 4 percentage points in 2010 relative to 2005 levels. Manufacturing, which decreased its imported products by 10 percentage points, was the main driver behind the aforementioned changes. Additionally, manufacturing has the highest share (70%) of the imported intermediate inputs.

Composition of the valued added remained stable, with a noteworthy decrease in net operating surplus by 0.9 percentage points due to crisis induced financial distress.

Table 4

2.1.3 Demand

Slovenia's main source of growth pre-crisis was an increase in all categories of demand expenditure, especially government expenditure (average growth rate per year in 2005-2009 period was almost 7%). The growth rate of household expenditure and gross fixed capital formation was just slightly lower, 6% and 5% respectively.

Investment growth (gross fixed capital formation) dropped by 16% in 2010. However, this decrease was offset by a 14% growth in exports. Consumption kept growing in 2010, although it decreased in subsequent years, and exports were the main driver of economic growth post-crisis.

To reiterate, manufacturing has the largest share in exports. In 2005, this share was 83%, but due to crisis it dropped to 76% in 2009 and 2010. Upon supplementing the information from the IO tables with GDP data, we observed an 11% drop in exports in 2009 in real terms (Figure 5). In 2010, exports recovered and this figure recorded a 6% increase.

Figure 5

To sum up, we identified main industries in Slovenia based on information from IO tables. However, to analyse their economic impact, and influence on the other industries supplementary

analysis based on IO tables is required. The following section explains in detail the methodology employed in this paper to conduct subsequent levels of analysis.

3 Methodological framework

3.1 Input-output Analysis

Wassily Leontief (Leontief, 1966) coined and developed the concept of IO tables. The main applications of IO analysis have been discussed in Leontief (1984), Miller and Blair (2009), Fleissner (1993), Holub and Schnabl (1994), United Nations (1996), Kurz, Dietzenbacher and Lager (1998), and ten Raa (2006). IO economics can be regarded as a vast collection of data describing an economic system, or as an analytical technique for explaining the behavior of the economy, and its supply-demand general equilibrium. Work in IO economics can be purely descriptive, dealing only with the preparation of the tables, or it can be purely theoretical, dealing with the formal relationships that can be derived under various underlying assumptions. Alternatively, it could be a mixture, using both empirical data and theoretical relationships in the attempt to explain or predict actual economic developments, which is the approach adopted by this paper.

IO tables – the core of IO analysis – describe the flow of goods and services among all sectors of an economy over a specified period of time (i.e. annually). The structure of each sector's production activity is represented by appropriate structural (technical) coefficients, which describe in quantitative terms the relationships between the inputs it absorbs and the output it produces. IO analysis is a method of systematically quantifying the mutual interrelationships among the various sectors of the economy. Specifically, sectoral interdependence is captured by a set of linear equations, which express the balance between total input and total output of each good and service produced.

IO tables are not only a system of quantifying the production of commodities by means of other commodities, but also a system of value added chains in interdependent markets. Consistent with scope and purpose of this study, the nature of this market interdependence will be assessed at the national level for the Slovenian economy through an analysis of IO technical coefficients.

3.2 Input-Output Coefficients

Input – output analysis starts with the calculations of *input coefficients*, otherwise known as *technical coefficients*, and *output coefficients* known as *allocation coefficients*.

Input coefficients are calculated by dividing each entry of the input – output table by the corresponding column total of domestic output. The input coefficients can be interpreted as the corresponding shares of costs for goods, services and primary inputs in total output. As the input coefficients cover all inputs including the residual variable operating surplus they add up to unity (EUROSTAT, 2008).

Input coefficients for *domestic intermediaries* are generally defined as:

(1) $a_{ij} = x_{ij}/x_j$ input coefficients for domestic intermediaries

a_{ij} = input coefficient for domestic goods and services ($i = 1, \dots, n; j = 1, \dots, n$)

x_{ij} = flow of domestic commodity i to sector j

x_j = output of sector j

Similarly, *output coefficients* are calculated by dividing each entry of the IO table by the corresponding row total. They can be interpreted as the shares in total output (revenue) or market shares for commodities and primary inputs. For value added they reflect the distribution of primary inputs. The output coefficients of a given sector are:

(2) $b_{ij} = x_{ij}/x_i$ output coefficients

b_{ij} = output coefficient for domestic goods and services ($i = 1, \dots, n; j = 1, \dots, n$)

x_{ij} = flow of commodity i to sector j

x_i = output of sector i

3.3 Static Input – output Model

The static IO model is a linear model based on Leontief production functions and a given vector of final demand. The model's objective is to calculate the unknown activity (output) levels of individual sectors (endogenous variable) for the given final demand (exogenous variable). The balance between total input and outputs can be described by the following definition equations:

$$(3) \quad \mathbf{x}_{11} + \mathbf{x}_{12} + \mathbf{x}_{13} + \mathbf{x}_{1d} = \mathbf{x}_1$$

$$(4) \quad \mathbf{x}_{21} + \mathbf{x}_{22} + \mathbf{x}_{23} + \mathbf{x}_{2d} = \mathbf{x}_2$$

$$(5) \quad \mathbf{x}_{31} + \mathbf{x}_{32} + \mathbf{x}_{33} + \mathbf{x}_{3d} = \mathbf{x}_3$$

where, x_{ij} – intermediaries from sector i to sector j , x_{id} – final demand for commodity i , x_j – output of sector j .

Input coefficients for domestic intermediaries are calculated as follows:

$$(6) \quad \mathbf{a}_{ij} = \mathbf{x}_{ij}/\mathbf{x}_j$$

Furthermore, the requirements for intermediaries can be defined as the set of input coefficients weighted with the corresponding output level:

$$(7) \quad \mathbf{x}_{ij} = \mathbf{a}_{ij}\mathbf{x}_j$$

Following the assumption that the sectors produce with fixed technical coefficients; the definition equations' system can be rewritten by replacing \mathbf{x}_{ij} by $\mathbf{a}_{ij}\mathbf{x}_j$. The purpose of these equations, also known as input – output system, is to make explicit the dependence of inter – industry flows on the total output of each sector.

$$(8) \quad \mathbf{a}_{11} \mathbf{x}_1 + \mathbf{a}_{12} \mathbf{x}_2 + \mathbf{a}_{13} \mathbf{x}_3 + \mathbf{x}_{1d} = \mathbf{x}_1$$

$$(9) \quad \mathbf{a}_{21} \mathbf{x}_1 + \mathbf{a}_{22} \mathbf{x}_2 + \mathbf{a}_{23} \mathbf{x}_3 + \mathbf{x}_{2d} = \mathbf{x}_2$$

$$(10) \quad \mathbf{a}_{31} \mathbf{x}_1 + \mathbf{a}_{32} \mathbf{x}_2 + \mathbf{a}_{33} \mathbf{x}_3 + \mathbf{x}_{3d} = \mathbf{x}_3$$

Input – Output System

This set of equations is transformed into the following Leontief equation system, which has a number of characteristics: 1) final demand (exogenous variable) is isolated on the right side of the equation, 2) net output (output less intra-sectoral consumption) is identified in the diagonal of the matrix, and 3) inputs have a negative sign, while output has a positive sign.

$$(11) \quad (\mathbf{1} - \mathbf{a}_{11}) \mathbf{x}_1 - \mathbf{a}_{12} \mathbf{x}_2 - \mathbf{a}_{13} \mathbf{x}_3 = \mathbf{x}_{1d}$$

$$(12) \quad -\mathbf{a}_{21} \mathbf{x}_1 + (\mathbf{1} - \mathbf{a}_{22}) \mathbf{x}_2 - \mathbf{a}_{23} \mathbf{x}_3 = \mathbf{x}_{2d} \quad \text{Leontief Matrix}$$

$$(13) \quad -\mathbf{a}_{31} \mathbf{x}_1 - \mathbf{a}_{32} \mathbf{x}_2 + (\mathbf{1} - \mathbf{a}_{33}) \mathbf{x}_3 = \mathbf{x}_{3d}$$

In matrix terms the Leontief Matrix is defined as:

$$(14) \quad \mathbf{Ax} + \mathbf{y} = \mathbf{x}$$

$$(15) \quad \mathbf{x} - \mathbf{Ax} = \mathbf{y}$$

$$(16) \quad (\mathbf{I} - \mathbf{A})\mathbf{x} = \mathbf{y}$$

The solution of this linear equation system is:

$$(17) \quad \mathbf{x} = (\mathbf{I}-\mathbf{A})^{-1} \mathbf{y} \quad \text{Leontief Solution}$$

\mathbf{A} = matrix of input coefficients for intermediaries; \mathbf{I} = unit matrix; $(\mathbf{I}-\mathbf{A})$ = Leontief matrix; $(\mathbf{I}-\mathbf{A})^{-1}$ = Leontief inverse; \mathbf{y} = vector of final demand; \mathbf{x} = vector output.

Similarly we can use output coefficients in the Input - Output system to get alternative Input – Output model, which was defined by Ghosh (Miller & Blair, 2009). It relates sectoral gross production to the primary inputs. Derivation of the Ghosh solution is similar to Leontief's; we just use output coefficients (2) instead of input coefficients.

The basic equation of the allocation system is:

$$(18) \quad \mathbf{X}_i = \sum \mathbf{X}_{ij} + \mathbf{V}_i$$

where X_i is the output sector i and $\sum X_{ij}$ is the amount of intermediate inputs.

The solution for the Ghosh model is:

$$(19) \quad \mathbf{x}' = \mathbf{v}'(\mathbf{I}-\mathbf{B})^{-1} \quad \text{Ghosh Solution}$$

\mathbf{B} = matrix of output coefficients; \mathbf{I} = unit matrix; $(\mathbf{I}-\mathbf{B})$ = Ghosh matrix; $(\mathbf{I}-\mathbf{B})^{-1}$ = Ghosh inverse; \mathbf{v}' = total value added expenditures across all sectors; \mathbf{x}' = vector output. Elements g_{ij} measure value of production in sector j per unit of primary input in sector i .

Both models assume that all sectors produce with linear Leontief production functions (constant returns to scale) and that all inputs – intermediaries, capital, capital, labour, and land – are unlimited and are used in fixed proportions proportional to output. It is further assumed that a substitution of inputs is not possible; thus changing factor prices have no influence on the technical input coefficients. Additionally, there are no constraints in the economy; increased demand can be accommodated by increased production. We must be aware of the shortcomings of the model's assumptions to correctly evaluate results (Fjeldsted, 1990).

3.4 Multipliers

To capture the effect an exogenous shock (increased demand) has on the economy (output, income, employment, value added etc.) we can use multipliers calculated from IO tables. Multipliers capture the combined effect an exogenous shock has on economy; its initial, direct, and subsequent

(indirect) effects when the economy adjusts to the shock. These multipliers are known as *simple multipliers*.

Upon adding final demand by households as a column, and compensation of employees as a row in the input coefficient matrix (A), the IO model is closed with respect to households (Hussain, 2011). In this scenario, households are endogenous and multipliers calculated from enlarged input coefficient matrix now include induced effects. Such effects measure household income generation by means of an increase in the compensation of employees and higher consumer expenditures on goods and services due to exogenous shock. The latter ones are known as *total multipliers*.

There are two additional types of multipliers, *Type I* and *Type II*, which take into account the initial effect of the exogenous shock. They are calculated by dividing simple multipliers or total multipliers by the initial effect of the exogenous shock. The first calculation yields Type I multiplier, and in the second case we get Type II multiplier (D'Hernoncourt et al, 2011).

3.4.1 Output multipliers

Output multipliers measure total value of production by all industries of the economy required to obtain a 1€ increase in final demand for a specific industry. In the case of output multipliers, the initial effect is 1€ therefore a simple output multiplier is the same as Type I multiplier, and total output multiplier is the same as Type II multiplier.

Consistent with the explanation of the static IO model, multipliers are derived from Leontief inverse $(\mathbf{I}-\mathbf{A})^{-1}$ (17). Let $\mathbf{L} = (\mathbf{I}-\mathbf{A})^{-1} = l_{ij}$, where \mathbf{I} is a unit matrix and \mathbf{A} is input coefficient matrix. The output multiplier is calculated as the column sum of the Leontief inverse (\mathbf{L}), and then the *simple output multiplier* for sector j is:

$$(20) \quad m(o)_j = \sum_{i=1}^n l_{ij}, \text{ where } n \text{ is the number of sectors.}$$

Similarly, total output multiplier is calculated as the column sum of Leontief inverse (l'_{ij}) with households sector's final demand as a column input and compensation of employees as a row input.

3.4.2 Income multipliers

Income multipliers measure households' income (compensation of employees) received per Euro's worth of sectoral output (Miller & Blair, 2009). The computation of the income multiplier

requires the wage coefficient (vector) from the IO tables, which is calculated by dividing the compensation of employees by total output (h_j). Then the simple income multiplier is given by:

$$(21) \quad m(h)_j = \sum_{i=1}^n h_i l_{ij}$$

Again, if we close the model with respect to household we get total income multiplier if we substitute l_{ij} in (21) with the ones from extended Leontief's inverse (l'_{ij}). To calculate Type I and Type II multipliers we have to define what the initial effect is. In the case of income multiplier, the initial effect is an additional income payment to workers in sector j (Miller & Blair, 2009). Thus, we divide the simple and total multiplier by the wage vector to obtain Type I and Type II multipliers respectively.

3.4.3 Value added multipliers

Value added multipliers measure value added generated in each sector as a result of the new output. Not unlike other multipliers, to calculate an value added multiplier we calculate a value added coefficient (vector) by dividing value added to total output (v_j). Then the simple value added multiplier is given by the following expression:

$$(22) \quad m(v)_j = \sum_{i=1}^n v_i l_{ij}$$

3.4.4 Employment multipliers

Employment multipliers capture the number of jobs generated in each sector as a function of new output. When defining the employment vector (e_j), the employment multiplier is specified in the following way:

$$(23) \quad m(e)_j = \sum_{i=1}^n e_i l_{ij}$$

The employment vector is derived from the employment data (number of persons) by activities (NACE 2)⁶, which we changed to NACE 1 adjusted. To calculate employment vector we divided number of persons employed in relevant industry by total number of employees.

⁶ We used Employment (NACE Rev. 2) data available on SORS ([link](#)) web page.

3.5 Inter – sectoral Linkage Analysis

Input – output analysis establishes a production linkage between different sectors of the economy. Such linkages are referred to as "forward" and "backward" linkages in the literature. "Forward linkages" capture the supply side of the production and are used to indicate that increased output from sector j will result in additional amounts of output available as input for other sectors. On the other hand, "backward linkages" are demand oriented. They indicate that if sector j increases its output than its demand for the output of other sectors will also increase. Hirschman formulated the concept of linkages; he was interested in investment decisions by entrepreneurs in the developing countries, and how to maximize benefits of these investments (Jones, 1976).

Various definitions of linkage indicators have been critically assessed with regard to their identification of key economic sectors in developing countries (Harrigan & James, 1988). Rasmussen, who derived total backward linkage from the column sums of the Leontief inverse, proposed a comprehensive measure; they reflect the direct and indirect effects (Miller & Blair, 2009). Measuring forward linkages is more controversial. Rasmussen measured forward linkages by the row sums of the Leontief inverse. In that instance forward linkage measure simultaneous increase of one unit in the gross output of every sector in the case of direct forward linkages and one unit of final demands of every sector in the case of total forward linkages. However due to criticism, that they are not related to real economic situation (simultaneous increase in output/demand of all sectors), it was proposed that output coefficients and Ghosh inverse should be used instead (Miller & Blair, 2009). We have used both approaches for measuring forward linkages, firstly to see if there are important differences in the two measures, and secondly to have better understanding of the linkages in the economy.

Production linkages are used to define key sectors of the economy these are sectors whose activity exerts a greater than average influence in the overall economy of Slovenia. The search for key sectors is based on the assumption that some activities in an economy have the potential to generate greater growth, and through their backward and forward linkages spur the growth of the rest of the economy. In this paper, key sectors are identified by calculating backward and forward linkages proposed by Rasmussen drawing on entries in the Leontief and Ghosh inverses.

Let $\mathbf{L} = (\mathbf{I}-\mathbf{A})^{-1} = [l_{ij}]$ be the Leontief inverse Matrix and let L_j be the column and L_i the row multipliers of this Leontief inverse. Sector j 's backward linkages (BL_j) are defined as:

$$(24) \quad BL(t) = \frac{L_j}{1/nV}$$

Sector i 's forward linkages (FL_i) are defined:

$$(25) \quad FL(t) = \frac{L_i}{1/nV}$$

For forward linkages based on the Ghosh inverse Matrix (FL_i^*) let $\mathbf{G} = (\mathbf{I}-\mathbf{B})^{-1} = [g_{ij}]$ be the Ghosh inverse Matrix and let G_i be the row multipliers of this Ghosh inverse. Then forward linkages (FL_i^*) are defined as:

$$(26) \quad FL(t)^* = \frac{G_i}{1/nV'}$$

where V is global intensity matrix: $V = \sum_{i=1}^n \sum_{j=1}^n l_{ij}$ and $V' = \sum_{i=1}^n \sum_{j=1}^n g_{ij}$.

The usual interpretation is to propose that, if $BL(t)_j > 1$, a unit change in final demand in sector j will generate an above-average increase in activity in the economy. Following the same logic, for $FL(t)_i > 1$, it is asserted that a unit change in all sectors' final demand would create an above the average increase in sector i and for $FL(t)_i^* > 1$ sector's final demand is replaced by the value added. Therefore, a *key sector* is defined as one having both indices greater than 1. Sector j is considered as a *backward linkages oriented sector*, if $BL(t)_j > 1$ and $FL(t)_i < 1$, and it is defined as a *forward linkages oriented sector* if $BL(t)_j > 1$ and $FL(t)_i > 1$. When both linkages are less than one, the sector is considered as a *weakly linkages oriented sector*.

3.6 Multiplier Product Matrix Analysis

The input-output multiplier product matrix (MPM)⁷ is a visualization technique derived from the Leontief inverse matrix used to capture economic structural changes. Following Sonis et al. (1997), the MPM matrix is defined as:

⁷ MPM provides a presentation of key sector analysis of backward and forward linkages in the visual form of a macro-economic photograph (*economic landscape*) of the structure of an economy, providing a basis for the comparison of structures of different economies or the same economy over time

$$(27) \quad M = [m_{ij}] = \frac{1}{V} \begin{bmatrix} L_1 \\ L_2 \\ \vdots \\ L_n \end{bmatrix} (L_1 L_2 \cdots L_n)$$

where, $L = [l_{ij}]$ is the Leontief inverse, V is the grand sum of rows and columns of \mathbf{L} or $V = \sum_{i=1}^n \sum_{j=1}^n l_{ij}$, $L_j = \sum_{i=1}^n l_{ij}$ and $L_i = \sum_{j=1}^n l_{ij}$. The column and row multipliers from MPM are the same as those from the Leontief inverse matrix; thus the MPM structure is essentially connected with the properties of sector backward and forward linkages. The rows and columns of the matrix \mathbf{M} can be arranged along the magnitude of the values of these linkages from the largest to the smallest to provide the hierarchy of backward (columns) and forward (rows) linkages.

4. Results and Analysis

4.1 Multiplier Analysis

One way to describe inter-linkages and key sectors in the economy is by using multiplier analysis. Usually more multipliers - output, income, value added and employment multiplier - are calculated to have clear view how investment in some industry would impact the overall economy. From the policy purposes perspective, it is more interesting how the change in the demand will affect income, employment and value added in the economy, while output change is more relevant for the inter-linkages analysis of the economy, and the definition of key sectors.

To examine the different effects in the output multiplier we use the following subcategories for guidance (McLennan, 1995):

- a. *Initial effect*⁸: the initial increase in demand (exogenous shock).
- b. *First round effect*: input coefficients (direct effect) that capture adjustment of the economy to additional output as a result of the initial effect.
- c. *Industrial support effect*: indirect effects that captures all subsequent adjustments in the economy resulting from the initial effect.

⁸ This is similar to approximation of the inverse $(\mathbf{I}-\mathbf{A})^{-1} = \mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + \dots + \mathbf{A}^n$, initial effects are denoted by \mathbf{I} , first round (direct) effects by \mathbf{A} and industrial support (indirect) effects with the remaining terms $\mathbf{A}^2 + \mathbf{A}^3 + \dots + \mathbf{A}^n$

- d. *Production induced effect*: the sum of first round and industrial support effect, and therefore captures all adjustments by industries due to the initial increase in specific sectoral demand.

Results of the multiplier calculations⁹ are presented in the Table 5 for 2005, Table 6 for 2009, and Table 7 for 2010. Throughout the analysis time frame, the highest **output multiplier** was in construction (F45), the highest **income multiplier** in education services (M80), the highest **value added multiplier** in the real estate services (K70), and the highest **employment multiplier** in the products of agriculture, hunting, forestry, logging, fishing, aquaculture (A0105). Table 8 summarizes the ten industries with the highest multipliers. Arrows were used to trace the changes in the observed years. In all years, the highest multipliers (rank 1) consistently preserved their rank, however other multipliers shifted around from 2005 to 2010.

Comparing multipliers between 2005 and 2009/2010, most differences on the "top ten list" occur in the output multiplier, while differences for other multipliers are not significant in magnitude (see Table 8). Specifically, all differences in the output multiplier between 2005 and 2009/2010 occurred in the services industries, with the exception of one manufacturing industry (D1516 - Food products, beverages and tobacco products) falling to the 5th rank. In 2005, I63 - Supporting and auxiliary transport services; travel agency services was in the 3th place, and then fell to 9th place in 2009, J66 - Insurance and pension funding services, except compulsory social security services fell from 5th to 8th, while O91 - Membership organisation services was in the 4th place in 2005 and in 2009 not on the top ten list anymore. On the other hand, industries from manufacturing moved from 2nd to 5th place: D28 - Fabricated metal products, except machinery and equipment was not on the top ten list in 2005 and was ranked 2nd in 2009 and 2010, D22 - Printed matter and recorded media, D1719 - Textiles, wearing apparel and D1516 were ranked third, fourth and fifth respectively. This is compatible with our analysis of domestic production, which analyzes industries on the basis of their share in the total output and contribution to growth.

We were particularly interested in the existence of industries with all multipliers on the "top ten list". Multiplier analysis is conducted for policy purposes. This analysis assumes that if there is

⁹ We used arbitrary rule to analyze industries with share of domestic production in the total output above 0.3%. With that we have 34 sectors of the economy in all three years. The reason was that some of these small sectors had high multipliers

additional money to spend, it should be invested in the industry with the highest multiplier. For instance, to have the highest impact on: (i) output, investment should be concentrated in the construction sector, (ii) income, investment should be in the education services, (iii) value added, in real estate, and (iv) employment, in agriculture. When discussing the allocation of additional funds, the economic impact gradient across industries should be considered. For instance, the expected investment return on industries belonging to the “top ten list” for different multipliers will be marginally higher. Specifically in this case, there are no sectors/industries consistently belonging to the top ten categories across multipliers. However, some industries have a maximum of three out of ten highest multipliers, while the majority of industries only have one. In 2005, there were six industries with three top ten multipliers: 1) Other business services (K74), 2) Retail trade services (G52), 3) Hotel and restaurant services (H55), Insurance and pension funding services, except compulsory social security services (J66), Education services (M80), and Membership organisation services (O91). The number of industries with three top ten multipliers decreased from four (K74, G52, J66, M80) in 2009, and to two (K74 and M80) in 2010.

4.2 Inter – sectoral Linkage Analysis

Results of the key sector analysis are presented in Table 9 in Appendix B. Sectors with shares in total output above 0.3% (in years 2009, 2010) are highlighted in order to ensure consistency with the multiplier analysis. These sectors are positioned above the line in Table 9. For the purposes of this analysis a key sector is one with backward linkages, and forward linkages above 1.

Key sectors have stronger than average influence on other industries, and the effect changing production in these industries would spill over to other sectors. Given the time frame for this study, **key sectors** in the Slovenian economy are the following:

- a) D22 Printed matter and recorded media
- b) D3790 Recovered secondary raw materials, Sewage and refuse disposal services, sanitation and similar services
- c) E40 Electrical energy, gas, steam and hot water
- d) F45 Construction work

- e) G51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles
- f) I64 Post and telecommunication services

Three additional industries became central to economic activity in 2009, and remained such even in 2010. These industries are:

- a) D26 Other non-metallic mineral products
- b) D28 Fabricated metal products, except machinery and equipment
- c) I60 Land transport and transport via pipeline services

Additionally, four key industries in 2005 lost their position during the crisis. This group includes:

- a) A0105 Products of agriculture, hunting, forestry, logging, fishing, aquaculture
- b) D20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials
- c) G50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel
- d) K74 Other business services

There are five **backward linkages** oriented sectors. These sectors consist of activities that are highly interdependent with activities of other sectors of the economy from which they purchase inputs.

Sectors with above the average backward linkages from 2005-2010 include:

- a) D1516 Food products, beverages and tobacco products
- b) I63 Supporting and auxiliary transport services; travel agency services
- c) J66 Insurance and pension funding services, except compulsory social security services

And in years 2009 and 2010:

- d) D20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials
- e) O92 Recreational, cultural and sporting services

Finally, there are four **forward linkages** oriented sectors. The output of forward oriented sectors is used as an input in other industries, and thus they are dependant on the output of other

industries. If the output of other industries changes that also affects industries with above the average forward linkages. Forward linkages sectors, during this study's timeframe, include the following:

- a) J65 Financial intermediation services, except insurance and pension funding services
- b) K72 Computer and related services

And in years 2009 and 2010:

- c) G50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel
- d) K74 Other business services

The remaining industries are **weakly linkages oriented sectors** given that their linkage indicators are smaller than one in the given years. Moreover, the inter-sectoral analysis produced compatible results with the domestic production and multiplier analysis. This outcome was expected because they are all based on output multipliers.

4.3 Multiplier Product Matrix Analysis

Using the Multiplier Product Matrix (MPM) matrix, we construct an economic landscape to provide a summary of Slovenia's economic structure from 2005 to 2010. For comparison purposes, 2005 is considered as the base year, meaning that the 2005 hierarchy of the sectors was maintained for the MPM of the succeeding years in order to examine the changes in landscape over the 5 year period.

For the construction of these landscapes, the location of rows and columns of the MPM was rearranged in order to reveal the descending rank-size hierarchies of multipliers and Hirschman – Rasmussen indices¹⁰. On the basis of the rearranged MPM, the three-dimensional diagrams of descending economic landscapes were drawn for the corresponding years. Since each element of the MPM is the product of a forward linkage and a backward linkage divided by the global intensity of the Leontief inverse matrix, the height of the bars in the graphical representation of MPM is contingent on the level of interdependence of the sectors in the economy. The larger the MPM value, the higher the bar representing it in the landscape, and the greater the inter-sectoral relationship. If the landscape is

¹⁰ Forward linkages are calculated as was proposed by Rasmussen, row sums of Leontief's inverse

flat or the height of the bars is identical, then the magnitude of the relationships is the same¹¹. In the landscapes *rows* represents forward linkages, while *columns* represents backward linkages (Guo & Planting, 2000). The results of the MPM analysis are depicted in Figure 6, Figure 7, and Figure 8. To have comparable results with multiplier and inter-linkages analysis, industries with a total output share above 0.3% were analysed.

In 2005, the highest bar is at the intersection of the Other business services (K74), and Construction (F45). Therefore, K74 had the highest backward and forward linkages in the Slovenian economy at the time. The remaining industries are ordered by the size of their forward and backward linkages, which gives rise to a downward slope for the overall landscape. The second ranked industry in terms of linkage hierarchy is Wholesale Trade (G51) followed by Construction (F45), Financial intermediation services (J65), and Post and telecommunication services (I64). With regards to backward linkages, Construction (F45) is followed by the Food products, beverages and tobacco products (D1516), Supporting and auxiliary transport services (I63) Recreational, Cultural and sporting services (O92), and Insurance and pension funding services (J66).

MPM analysis tests whether or not the economy has experienced **structural change** over time. In the absence of structural change the economic landscape would preserve its shape. Normally when analyzing structural change, the longer time period is under scrutiny, compared to the 5-year period we are using. However, the Slovenian economy was already hit very hard by the 2009 recession (Figure 1); therefore the goal is to assess whether adjustment to the crisis started immediately or it was lagged. Comparing the structure of the economy over the 2005-10 period, there are notable differences in the landscapes between 2005 and 2009/2010, while landscapes in 2009 and in 2010 are similar.

Most noteworthy change is the strengthening of backward linkages from 2005 to 2009 in the manufacturing sector (D28, D1719, D24, D25 and D27). Additionally, the first industry from services sector to increase its height was I60 on the 9th place. Increased magnitude of backward linkages is associated with a greater influence of the associated sectors in the economy. On the other hand, only 5 sectors experienced a drop in the height of the backward linkages, with the biggest drop in the I63 subsector. Additionally, manufacturing sectors (I60, D29, D28, D22) showed significant increases in

¹¹ A low and flat landscape indicates low linkages among the economic sectors

forward linkages. The only exceptions were I60 and F45, which mainly provide intermediate inputs to the economy. H55 experienced the biggest drop in forward linkages, followed by D1516 and D20.

5. Conclusion

During tough economic times, the government is required to make hard decisions. Ultimately, the question remains whether the government can help or not, and if yes, who should they help. Ideally, investments should be allocated in industries with the highest returns, with returns being measured in terms of the overall economic impact of the economy. To this end, it is important to understand how domestic industries are interrelated with one another.

IO analysis, a method that systematically quantifies the mutual interrelationships between various industries, has evolved from mere academic investigation to application in national economic policy assessment. IO models, when applied correctly, can be powerful tools for estimating the economy-wide effects of an initial change (being it an endogenous or exogenous shock) in economic activity. Our research employed a static input-output model to identify these inter-linkages and capture their evolution over time. For instance, multipliers were used to determine which industries would have the highest spillover effects at the economy wide level in case of an industry specific investment.

Given the timeframe of our analysis, six industries prevailed as **key sectors**: D22, D3790, E40, F45, G51, and I64. Over the 2009-10 period, three more industries were added to this initial group: D26, D28, and I60. Thus, there were nine key sectors (industries) in Slovenia in the immediate aftermath of the global financial crisis. In other words, the intensity of inter-linkages among sectors increased from before the crisis period. Within this category of highly interconnected sectors, five were backward oriented linkages (D1516, I63, J66, D20, and O92), while the remaining four were forward oriented sectors (J65, K72, G50, and K74). The MPM analysis yielded similar results, but most importantly highlighted the existence of a significant degree of structural economic change over the 2005-2010 period. Specifically, an increase in both forward and backward linkages was recorded for the manufacturing industries.

While the analysis focused primarily on domestic industries, it is account for export-oriented industries. Despite not being very closely connected to the rest of the economy, these industries are important because they establish economic linkages with the rest of the world's economy. Such external linkages, not unlike the domestic economy scenario, can be thought of as channels of transmissions for economic shocks, being those positive or negative. For instance, industries D24 and D27 are 3rd and 6th in manufacturing shares, but exported 92% and 70% of their respective outputting in 2010. However, they are both classified as weakly linked sectors, except D27 in 2009, because these sectors are final producers exporting most of their production. Nonetheless, their contributions to growth were 1st (D27) and 4th (D24) largest after the crisis indicating that these industries played a crucial role during the recovery phase.

In sum, this research has merely paved the path and established a framework for leveraging the understanding of mutual interdependence among economic sectors in devising sound policies. Given the limitations of our data and the assumptions employed to calibrate the static IO model it would be bold to provide concrete policy conclusions, and thus that is far beyond the scope of our research at this point. Nonetheless, our hope is to have provided enough evidence for policymakers to appreciate the importance of evaluating causes and consequences of specific interventions from a systemic perspective at the domestic level and beyond. Next steps include the investigation of these mutually dependent inter-linkages at the microenterprise level, and the transmission mechanism/s between the real and financial economy. This would help complete a model that would provide a holistic understanding of the Slovenian economy in the context of the crisis, while providing insight for implementing adequate policies that will eventually lead to a resilient economic system.

Appendix A: Data sources and Classification

Statistical office of Republic Slovenia (SORS) is preparing input output tables. Due to changes in the classification (from NACE 1.1 to NACE 2) and methodology (from ESA 1995 to ESA 2010) we had to change original data. We decided to use ESA1995 data (ESA2010 data before the crisis does not exist) and on the divisional level we have adjusted NACE 1.1 and NACE 2 to NACE 1.1 adjusted.

Adjustment at division level (Table 1)

As already mentioned we had to prepare new NACE 1.1 adjusted classification to be able to fit in both classifications¹² and have comparable data for all years. Recalculation was not straightforward, because correspondences between classifications are not 1:1. Therefore for some divisions we had to use arbitrary rules and if majority of subsections corresponded to one division, we included all industry into that division. On the other hand if majority of subsections corresponded to two divisions, we included that division into two divisions.

Due to this fact that we cannot bridge NACE 2 and NACE 1.1 data completely (1:1), we should be careful with analysis.

¹² We used correspondence tables available on <http://www.stat.si/StatWeb/en/mainnavigation/methods-and-classifications/classifications>.

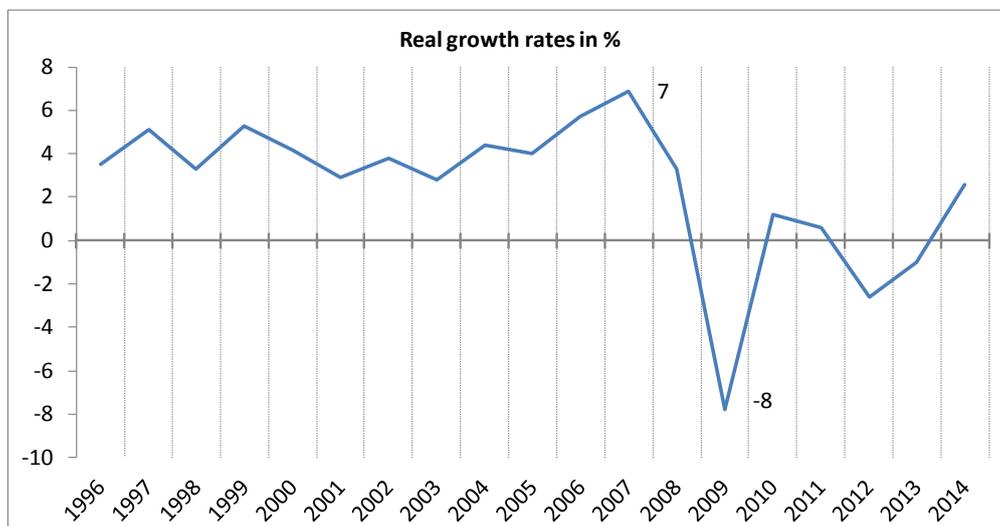
Table 1: Correspondence between NACE 1.1 and NACE Rev. 2

Nace 1.1 adjusted	Nace 1.1	Nace 2
01-05 Products of agriculture, hunting, forestry, logging, fishing, aquaculture	01-05	01-03
10-14 Mining and quarrying	10-14	05-09
15 Food products, beverages and tobacco products	15	10-12
17-19 Textiles; wearing apparel; leather and related products	17-19	13-15
20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials	20	16
21 Pulp, paper and paper products	21	17
22 Printed matter and recorded media	22	18, 50%58
23 Coke, refined petroleum products and nuclear fuel	23	19
24 Chemicals, chemical products and manmade fibres	24	20-21
25 Rubber and plastic products	25	22
26 Other non-metallic mineral products	26	23
27 Basic metals	27	24
28 Fabricated metal products, except machinery and equipment	28	25
29 Machinery and equipment n.e.c.	29	28, 33
30-33 Office machinery and computers; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks	30-33	26, 27
34 Motor vehicles, trailers and semitrailers	34	29
35 Other transport equipment	35	30
36 Furniture; other manufactured goods n.e.c.	36	31-32
37,90 Recovered secondary raw materials, Sewage and refuse disposal services, sanitation and similar services	37,90	37-39
40 Electrical energy, gas, steam and hot water	40	35
41 Collected and purified water, distribution services of water	41	36
45 Construction work	45	41-43
50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel	50	45
51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles	51	46
52 Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	52	47, 50%95
55 Hotel and restaurant services	55	55-56
60 Land transport and transport via pipeline services	60	49
61 Water transport services	61	50
62 Air transport services	62	51
63 Supporting and auxiliary transport services; travel agency services	63	52, 50%79
64 Post and telecommunication services	64	53, 61
65 Financial intermediation services, except insurance and pension funding services	65	64
66 Insurance and pension funding services, except compulsory social security services	66	65
67 Services auxiliary to financial intermediation	67	66
70 Real estate services	70	68
71 Renting services of machinery and equipment without operator and of personal and household goods	71	77
72 Computer and related services	72	50%58, 62-63, 50%95
73 Research and development services	73	72
74 Other business services	74	69-70, 71, 73, 74-75, 78, 80-82
75 Public administration and defence services; compulsory social security services	75	84
80 Education services	80	85
85 Health and social work services	85	86, 87-88
91 Membership organisation services n.e.c.	91	94
92 Recreational, cultural and sporting services	92	59-60, 90-93, 50%79
93 Other services	93	96
95 Private households with employed persons	95	97-98
99 Services provided by extra-territorial organisations and bodies	99	99

Source: SORS.

Appendix B: Tables and figures

Figure 1: Real growth rates of Slovenian GDP – 1996 - 2014



Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
GDP real growth rates in %	3.5	5.1	3.3	5.3	4.2	2.9	3.8	2.8	4.4	4.0	5.7	6.9	3.3	-7.8	1.2	0.6	-2.6	-1.0	2.6

Source: SORS

Figure 2: Flow of Goods and Services according to 2005 Input – output tables

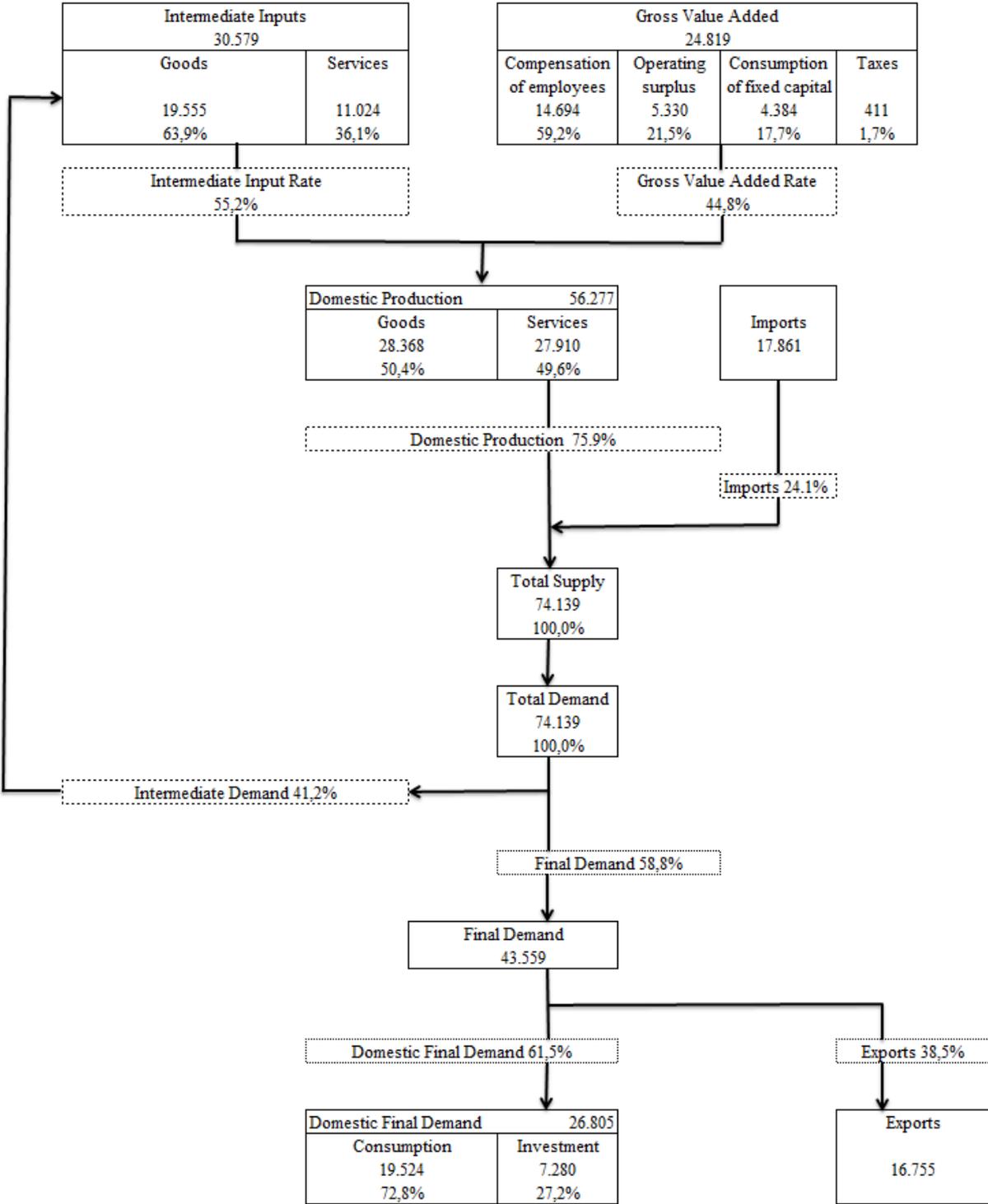


Figure 3: Flow of Goods and Services according to 2009 Input – output tables

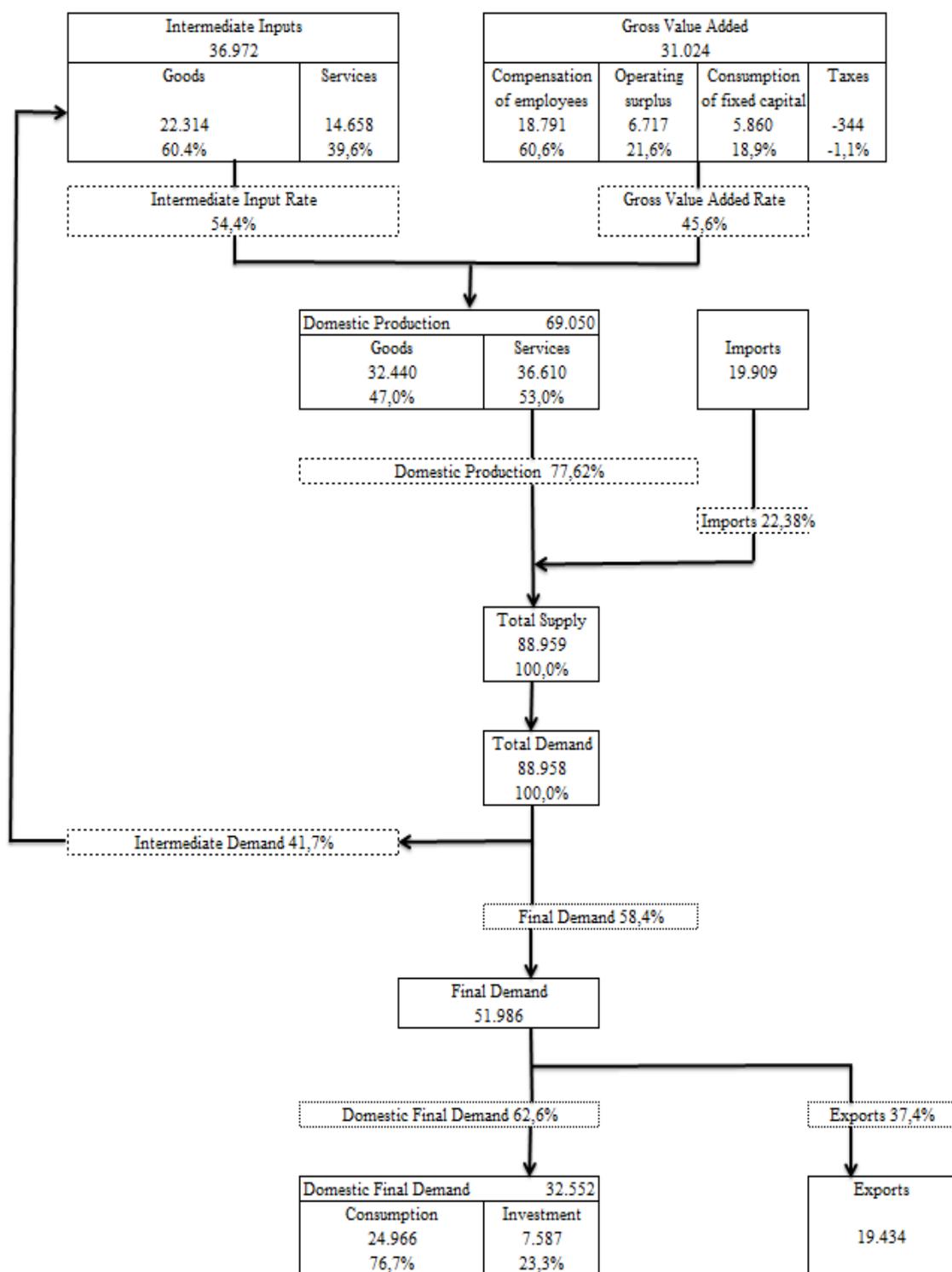


Figure 4: Flow of Goods and Services according to 2010 Input – output tables

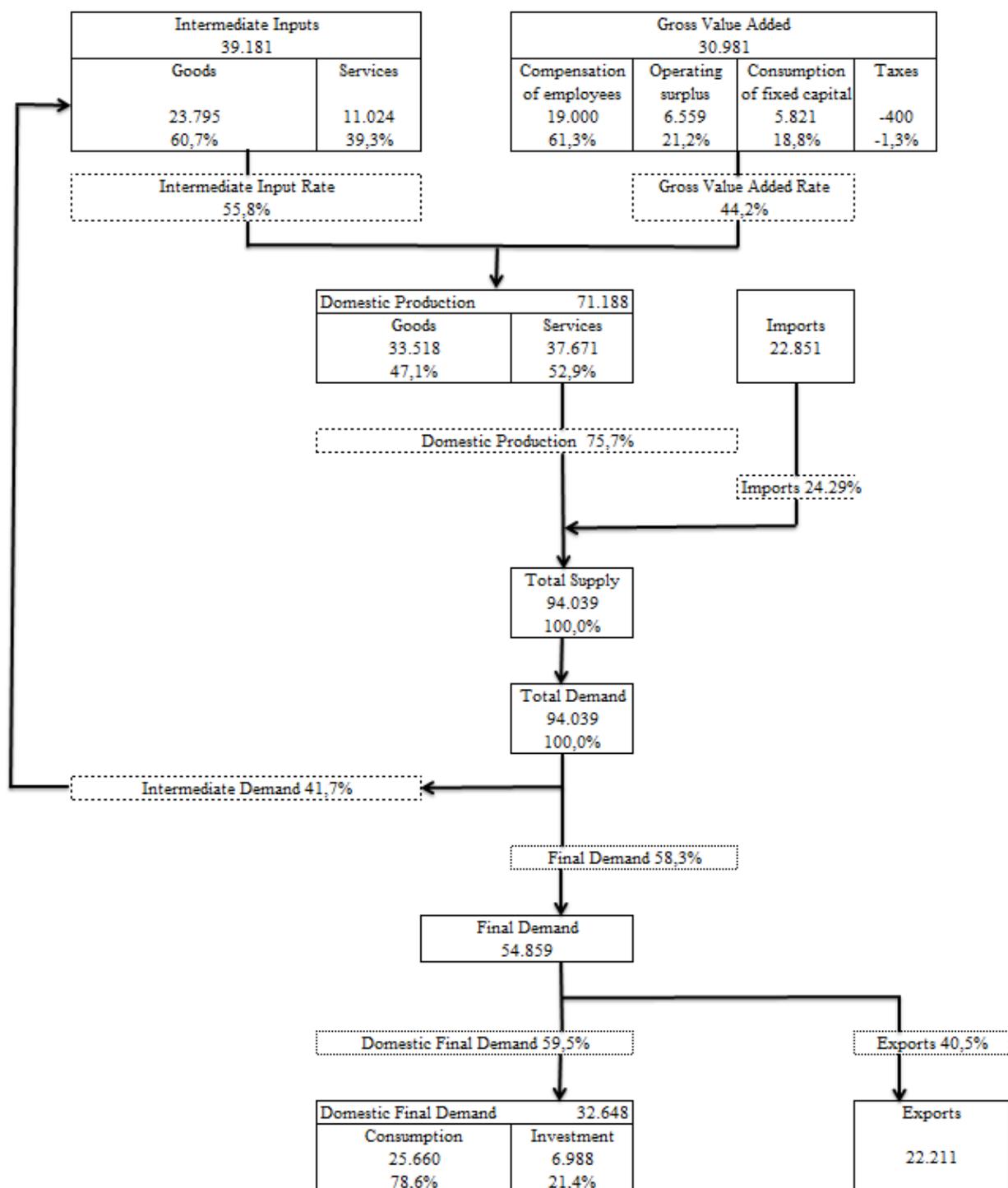


Table 2: Domestic production by sections

	Domestic production (million €)			Share(%)			Growth per year(%)		Contribution to growth (%)	
	2005	2009	2010	2005	2009	2010	2005-2009	2010	2005-2009	2010
Total	56.277	69.050	71.188	100,0	100,0	100,0	4,5	3,1	4,54	3,10
A - Agriculture, hunting and forestry, fishing	1.305	1.476	1.484	2,3	2,1	2,1	2,6	0,6	0,06	0,01
C - Mining and quarrying	268	319	311	0,5	0,5	0,4	3,8	-2,4	0,02	-0,01
D - Manufacturing	19.670	19.674	21.694	35,0	28,5	30,5	0,0	10,3	0,00	2,93
E - Electricity, gas and water supply	1.395	2.350	2.601	2,5	3,4	3,7	13,7	10,7	0,34	0,36
F - Construction	5.730	8.621	7.427	10,2	12,5	10,4	10,1	-13,8	1,03	-1,73
G - Wholesale & retail, repair motor vehicles, personal & household goods	6.039	7.317	7.439	10,7	10,6	10,4	4,2	1,7	0,45	0,18
H - Hotels and restaurants	1.250	1.571	1.577	2,2	2,3	2,2	5,1	0,4	0,11	0,01
I - Transport, storage and communication	4.250	6.693	7.132	7,6	9,7	10,0	11,5	6,6	0,87	0,64
J - Financial intermediation	1.819	2.464	2.672	3,2	3,6	3,8	7,1	8,4	0,23	0,30
K - Real estate, renting and business activities	6.966	9.103	9.194	12,4	13,2	12,9	6,1	1,0	0,76	0,13
L - Public administration and defence, compulsory social security	2.308	2.851	2.973	4,1	4,1	4,2	4,7	4,3	0,19	0,18
M - Education	1.707	2.210	2.257	3,0	3,2	3,2	5,9	2,1	0,18	0,07
N - Health and social work	1.891	2.527	2.569	3,4	3,7	3,6	6,7	1,6	0,23	0,06
O - Other community, social and personal service activities	1.676	1.849	1.832	3,0	2,7	2,6	2,1	-0,9	0,06	-0,02

Source: SORS and own calculations. P and Q sections are not included in the table due to small share.

Table 3: Domestic production by divisions

Nace 1.1	Domestic production (million €)			Share (%)			Growth rate per year (%)		Contribution to growth (%)	
	2005	2009	2010	2005	2009	2010	2005-2009	2010	2005-2009	2010
A Total	56.277	69.050	71.188	100,0	100,0	100,0	4,5	3,1	4,54	3,10
01-05 Products of agriculture, hunting, forestry, logging, fishing, aquaculture	1.305	1.476	1.484	2,3	2,1	2,1	2,6	0,6	0,06	0,01
10-14 Mining and quarrying	268	319	311	0,5	0,5	0,4	3,8	-2,4	0,02	-0,01
15 Food products, beverages and tobacco products	1.800	2.079	2.087	3,2	3,0	2,9	3,1	0,3	0,10	0,01
17-19 Textiles; wearing apparel; leather and related products	1.306	1.038	1.001	2,3	1,5	1,4	-4,1	-3,6	-0,09	-0,05
20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials	603	567	627	1,1	0,8	0,9	-1,2	10,7	-0,01	0,09
21 Pulp, paper and paper products	678	707	749	1,2	1,0	1,1	0,9	5,9	0,01	0,06
22 Printed matter and recorded media	593	587	547	1,1	0,9	0,8	-0,2	-7,0	0,00	-0,06
24 Chemicals, chemical products and manmade fibres	1.940	2.281	2.536	3,4	3,3	3,6	3,5	11,2	0,12	0,37
25 Rubber and plastic products	1.145	1.182	1.349	2,0	1,7	1,9	0,7	14,1	0,01	0,24
26 Other non-metallic mineral products	715	741	746	1,3	1,1	1,0	0,7	0,6	0,01	0,01
27 Basic metals	1.521	1.320	1.876	2,7	1,9	2,6	-2,6	42,1	-0,07	0,80
28 Fabricated metal products, except machinery and equipment	1.745	2.088	2.330	3,1	3,0	3,3	3,9	11,6	0,12	0,35
29 Machinery and equipment n.e.c.	2.329	1.857	1.828	4,1	2,7	2,6	-4,1	-1,6	-0,17	-0,04
30-33 Office machinery and computers; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks	1.836	2.156	2.654	3,3	3,1	3,7	3,5	23,1	0,11	0,72
34 Motor vehicles, trailers and semitrailers	1.883	2.326	2.601	3,3	3,4	3,7	4,7	11,8	0,16	0,40
35 Other transport equipment	177	91	108	0,3	0,1	0,2	-9,8	19,4	-0,03	0,03
36 Furniture; other manufactured goods n.e.c.	1.236	833	839	2,2	1,2	1,2	-6,5	0,7	-0,14	0,01
37,90 Recovered secondary raw materials, Sewage and refuse disposal services, sanitation and similar services	324	449	567	0,6	0,6	0,8	7,7	26,5	0,04	0,17
40 Electrical energy, gas, steam and hot water	1.276	1.724	1.832	2,3	2,5	2,6	7,0	6,2	0,16	0,16
41 Collected and purified water, distribution services of water	119	177	201	0,2	0,3	0,3	9,7	13,8	0,02	0,04
45 Construction work	5.730	8.621	7.427	10,2	12,5	10,4	10,1	-13,8	1,03	-1,73
50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel	1.070	893	892	1,9	1,3	1,3	-3,3	0,0	-0,06	0,00
51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles	2.890	4.100	4.156	5,1	5,9	5,8	8,4	1,3	0,43	0,08
52 Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	2.079	2.361	2.430	3,7	3,4	3,4	2,7	2,9	0,10	0,10
55 Hotel and restaurant services	1.250	1.571	1.577	2,2	2,3	2,2	5,1	0,4	0,11	0,01
60 Land transport and transport via pipeline services	1.887	2.478	2.693	3,4	3,6	3,8	6,3	8,7	0,21	0,31
61 Water transport services	146	205	223	0,3	0,3	0,3	8,1	9,0	0,02	0,03
62 Air transport services	148	183	176	0,3	0,3	0,2	4,8	-4,1	0,01	-0,01
63 Supporting and auxiliary transport services; travel agency services	866	912	1.046	1,5	1,3	1,5	1,1	14,6	0,02	0,19
64 Post and telecommunication services	1.203	1.467	1.472	2,1	2,1	2,1	4,4	0,3	0,09	0,01
65 Financial intermediation services, except insurance and pension funding services	1.123	1.546	1.601	2,0	2,2	2,2	7,5	3,6	0,15	0,08
66 Insurance and pension funding services, except compulsory social security services	539	699	847	1,0	1,0	1,2	6,0	21,0	0,06	0,21
67 Services auxiliary to financial intermediation	157	220	224	0,3	0,3	0,3	7,9	2,1	0,02	0,01
70 Real estate services	2.720	3.729	3.633	4,8	5,4	5,1	7,4	-2,6	0,36	-0,14
71 Renting services of machinery and equipment without operator and of personal and household goods	161	275	265	0,3	0,4	0,4	14,2	-3,8	0,04	-0,02
72 Computer and related services	710	1.171	1.246	1,3	1,7	1,8	13,0	6,4	0,16	0,11
73 Research and development services	255	377	421	0,5	0,5	0,6	9,6	11,9	0,04	0,06
74 Other business services	3.121	4.338	4.488	5,5	6,3	6,3	7,8	3,5	0,43	0,22
75 Public administration and defence services; compulsory social security services	2.308	2.851	2.973	4,1	4,1	4,2	4,7	4,3	0,19	0,18
80 Education services	1.707	2.210	2.257	3,0	3,2	3,2	5,9	2,1	0,18	0,07
85 Health and social work services	1.891	2.527	2.569	3,4	3,7	3,6	6,7	1,6	0,23	0,06
91 Membership organisation services n.e.c.	311	321	312	0,6	0,5	0,4	0,6	-2,7	0,00	-0,01
92 Recreational, cultural and sporting services	911	1.517	1.510	1,6	2,2	2,1	13,3	-0,5	0,22	-0,01
93 Other services	261	450	455	0,5	0,7	0,6	14,4	1,1	0,07	0,01

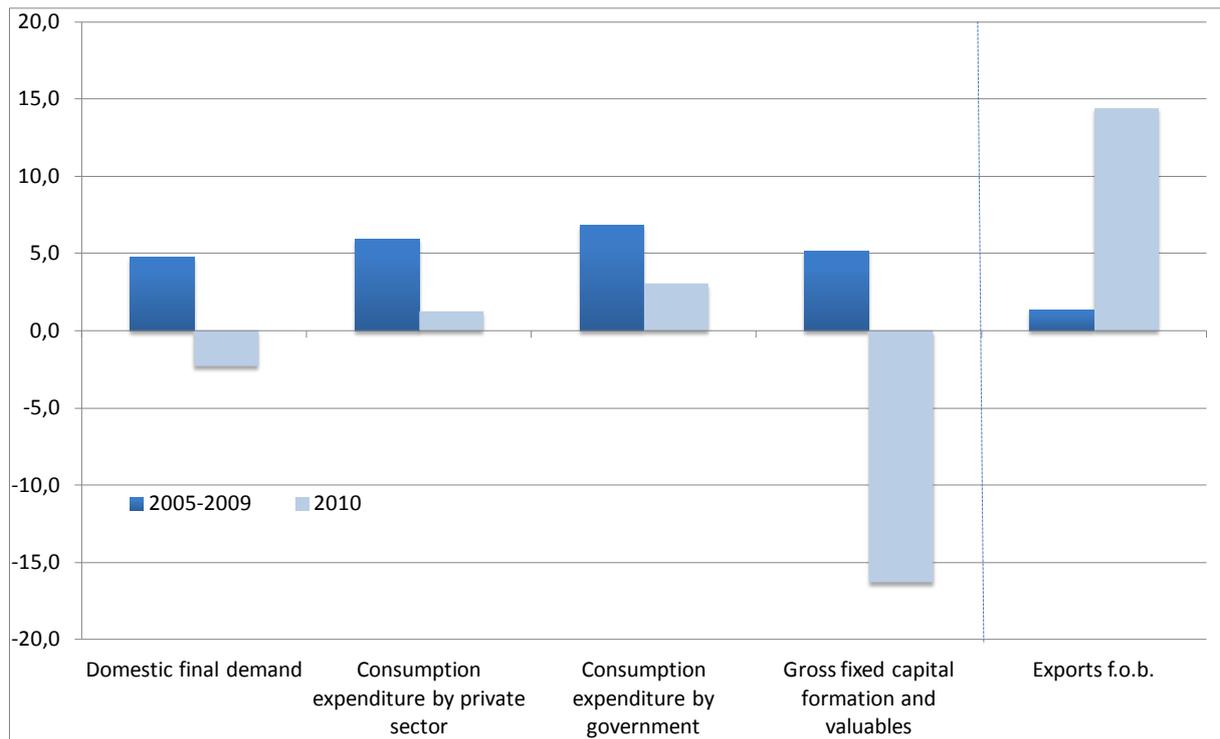
Source: SORS, own calculations. Sections 23, 95 and 99 are not included due to very small figures.

Table 4: Total output, intermediate consumption, valued added and net taxes

	Value (million €)			Share (%)			Growth per year(%)	
	2005	2009	2010	2005	2009	2010	2005-2009	2010
Intermediate inputs	19.300	26.093	26.343	63,1	70,6	67,2	7,0	0,2
Use of imported products	11.278	10.880	12.838	36,9	29,4	32,8	-0,7	3,6
Total intermediate consumption*	30.579	36.972	39.181	100	100	100	4,2	1,2
Compensation of employees	14.694	18.791	19.000	60,2	59,9	60,5	5,6	1,1
Consumption of fixed capital	4.384	5.860	5.821	18,0	18,7	18,5	6,7	-0,7
Operating surplus, net	5.330	6.717	6.559	21,8	21,4	20,9	5,2	-2,3
Value added*	24.408	31.368	31.381	100,0	100,0	100,0	5,7	0,0
Net taxes on products	878	1.053	1.027					
Other net taxes on production	411	-344	-400					
Total output	56.277	69.049	71.189					

Source: SORS and own calculations. *We have deducted net taxes on products and production from total intermediate consumption and total value added respectively.

Figure 5: Average growth rate per year of domestic demand, its categories and exports



Source: SORS and own calculations.

Table 5: Multipliers in 2005

2005	Share in total output		Initial effect	First round effect	Industrial support effect	Production induced effects	Output multiplier	Rank of output multiplier	Income multiplier	Rank of income multiplier	Value added multiplier	Rank of value added multiplier	Employment multiplier	Rank of employ. multiplier
	2	3												
45 Construction work	5,90%	1	1	0,5797	0,4259	1,0056	2,0056	1	0,3968	16	0,6565	20	0,0270	14
51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles	2,22%	2	1	0,4330	0,2354	0,6685	1,6685	8	0,4782	11	0,8102	11	0,0280	12
74 Other business services	1,92%	3	1	0,3468	0,2206	0,5673	1,5673	14	0,5638	6	0,8400	8	0,0376	3
15 Food products, beverages and tobacco products	1,72%	4	1	0,5368	0,3703	0,9072	1,9072	2	0,3981	15	0,6470	21	0,0332	6
29 Machinery and equipment n.e.c.	1,27%	5	1	0,3067	0,1567	0,4634	1,4634	22	0,3275	25	0,4913	28	0,0171	27
52 Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	1,14%	6	1	0,3089	0,1511	0,4601	1,4601	23	0,5307	8	0,8893	4	0,0328	8
60 Land transport and transport via pipeline services	1,10%	7	1	0,3275	0,1840	0,5116	1,5116	17	0,3897	17	0,6293	22	0,0251	17
75 Public administration and defence services; compulsory social security services	1,03%	8	1	0,2514	0,1532	0,4047	1,4047	26	0,6169	2	0,8367	9	0,0284	11
34 Motor vehicles, trailers and semi-trailers	1,00%	9	1	0,2980	0,1304	0,4284	1,4284	24	0,1653	33	0,2843	34	0,0121	32
28 Fabricated metal products, except machinery and equipment	0,99%	10	1	0,3178	0,1666	0,4844	1,4844	19	0,3540	22	0,5574	25	0,0265	16
64 Post and telecommunication services	0,90%	11	1	0,4227	0,2715	0,6942	1,6942	7	0,3846	18	0,8860	5	0,0196	26
01-05 Products of agriculture, hunting, forestry, logging, fishing, aquaculture	0,86%	12	1	0,3699	0,2242	0,5942	1,5942	11	0,2576	29	0,7960	13	0,0912	1
30-33 Office machinery and computers; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks	0,85%	13	1	0,2597	0,1338	0,3936	1,3936	28	0,3376	24	0,4837	29	0,0229	21
40 Electrical energy, gas, steam and hot water	0,84%	14	1	0,3713	0,2026	0,5739	1,5739	12	0,3070	27	0,7517	16	0,0135	30
63 Supporting and auxiliary transport services; travel agency services	0,83%	15	1	0,5417	0,3600	0,9017	1,9017	3	0,3798	20	0,7045	19	0,0238	18
17-19 Textiles; wearing apparel; leather and related products	0,83%	16	1	0,3585	0,2009	0,5594	1,5594	15	0,3524	23	0,4326	30	0,0331	7
55 Hotel and restaurant services	0,82%	17	1	0,3671	0,2296	0,5967	1,5967	10	0,4803	10	0,7807	15	0,0373	4
24 Chemicals, chemical products and man-made fibres	0,73%	18	1	0,2111	0,1181	0,3292	1,3292	30	0,2854	28	0,5387	26	0,0129	31
50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel	0,72%	19	1	0,3768	0,1934	0,5702	1,5702	13	0,4302	14	0,7900	14	0,0225	22
36 Furniture; other manufactured goods n.e.c.	0,70%	20	1	0,3178	0,1759	0,4937	1,4937	18	0,3174	26	0,4941	27	0,0220	23
70 Real estate services	0,70%	21	1	0,1439	0,0944	0,2383	1,2383	33	0,0842	34	0,9309	1	0,0050	34
27 Basic metals	0,69%	22	1	0,2550	0,1462	0,4011	1,4011	27	0,2155	32	0,4051	32	0,0108	33
85 Health and social work services	0,64%	23	1	0,1909	0,0970	0,2879	1,2879	31	0,6024	4	0,8014	12	0,0316	9
92 Recreational, cultural and sporting services	0,56%	24	1	0,3433	0,1890	0,5322	1,5322	16	0,5172	9	0,8562	7	0,0275	13
65 Financial intermediation services, except insurance and pension funding services	0,54%	25	1	0,2708	0,1378	0,4086	1,4086	25	0,4635	13	0,8972	3	0,0199	25
22 Printed matter and recorded media	0,52%	26	1	0,4944	0,2961	0,7905	1,7905	6	0,4735	12	0,7049	18	0,0267	15
66 Insurance and pension funding services, except compulsory social security services	0,47%	27	1	0,4916	0,3004	0,7920	1,7920	5	0,5401	7	0,8354	10	0,0235	19
20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials	0,41%	28	1	0,3858	0,2217	0,6075	1,6075	9	0,3829	19	0,5784	24	0,0371	5
80 Education services	0,41%	29	1	0,1347	0,0795	0,2142	1,2142	34	0,7885	1	0,9050	2	0,0387	2
72 Computer and related services	0,41%	30	1	0,3216	0,1627	0,4843	1,4843	20	0,6132	3	0,8568	6	0,0231	20
26 Other non-metallic mineral products	0,38%	31	1	0,3015	0,1818	0,4834	1,4834	21	0,3610	21	0,5960	23	0,0218	24
25 Rubber and plastic products	0,38%	32	1	0,1867	0,0999	0,2866	1,2866	32	0,2271	31	0,4008	33	0,0169	28
91 Membership organisation services n.e.c.	0,30%	33	1	0,5402	0,3611	0,9013	1,9013	4	0,5822	5	0,7494	17	0,0289	10
21 Pulp, paper and paper products	0,30%	34	1	0,2468	0,1419	0,3887	1,3887	29	0,2487	30	0,4170	31	0,0156	29
37,90 Recovered secondary raw materials, Sewage and refuse disposal services, sanitation and similar services	0,25%	35	1	0,4345	0,2834	0,7179	1,7179		0,4564		0,7165		0,0231	
10-14 Mining and quarrying	0,15%	36	1	0,3227	0,1936	0,5163	1,5163		0,5405		0,7475		0,0235	
35 Other transport equipment	0,14%	37	1	0,4397	0,2830	0,7227	1,7227		0,4983		0,6258		0,0195	
71 Renting services of machinery and equipment without operator and of personal and household goods	0,12%	38	1	0,4222	0,2215	0,6437	1,6437		0,3442		0,8105		0,0131	
67 Services auxiliary to financial intermediation	0,11%	39	1	0,3998	0,2114	0,6111	1,6111		0,5689		0,8476		0,0277	
73 Research and development services	0,11%	40	1	0,2443	0,1227	0,3670	1,3670		0,6374		0,8244		0,0224	
93 Other services	0,11%	41	1	0,2321	0,1116	0,3437	1,3437		0,3702		0,8833		0,0441	
62 Air transport services	0,11%	42	1	0,3999	0,2433	0,6432	1,6432		0,3900		0,5805		0,0158	
61 Water transport services	0,06%	43	1	0,2418	0,0986	0,3404	1,3404		0,1604		0,5614		0,0056	
41 Collected and purified water, distribution services of water	0,05%	44	1	0,2350	0,1431	0,3781	1,3781		0,4870		0,8517		0,0398	
23 Coke, refined petroleum products and nuclear fuel	0,03%	45	1	0,4641	0,2210	0,6851	1,6851		0,4029		0,3289		0,0143	

Source: SORS and own calculations. 34 products with highest share of domestic output in total output are used in the ranking.

Table 6: Multipliers in 2009

2009	Share in total output		Initial effect	First round effect	Industrial support effect	Production induced effects	Output multiplier	Rank of output multiplier	Income multiplier	Rank of income multiplier	Value added multiplier	Rank of value added multiplier	Employment multiplier	Rank of employ. multiplier
	2	3												
45 Construction work	7,28%	1	1	0,5829	0,5270	1,1100	2,1100	1	0,4116	20	0,6980	19	0,0246	14
51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles	2,32%	2	1	0,3910	0,2475	0,6385	1,6385	16	0,5266	7	0,8143	8	0,0211	19
74 Other business services	2,21%	3	1	0,3517	0,2156	0,5673	1,5673	25	0,5975	4	0,8356	7	0,0332	2
28 Fabricated metal products, except machinery and equipment	1,63%	4	1	0,5375	0,5020	1,0395	2,0395	2	0,4115	21	0,6137	25	0,0309	7
15 Food products, beverages and tobacco products	1,49%	5	1	0,4955	0,3302	0,8257	1,8257	5	0,3577	26	0,6405	21	0,0265	9
60 Land transport and transport via pipeline services	1,47%	6	1	0,4095	0,2640	0,6735	1,6735	11	0,4480	17	0,6606	20	0,0238	16
52 Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	1,21%	7	1	0,3553	0,1703	0,5256	1,5256	27	0,4968	10	0,9088	2	0,0316	5
24 Chemicals, chemical products and man-made fibres	1,17%	8	1	0,3554	0,2156	0,5710	1,5710	24	0,3418	28	0,6296	23	0,0131	32
30-33 Office machinery and computers; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks	1,13%	9	1	0,3626	0,2133	0,5759	1,5759	23	0,4035	23	0,5327	30	0,0202	22
40 Electrical energy, gas, steam and hot water	1,09%	10	1	0,4349	0,2732	0,7081	1,7081	10	0,3251	30	0,7310	17	0,0149	29
34 Motor vehicles, trailers and semi-trailers	1,09%	11	1	0,3223	0,1954	0,5177	1,5177	28	0,2241	32	0,3568	34	0,0119	33
75 Public administration and defence services; compulsory social security services	1,00%	12	1	0,2428	0,1717	0,4145	1,4145	31	0,6499	2	0,8562	5	0,0240	15
29 Machinery and equipment n.e.c.	0,99%	13	1	0,3697	0,2310	0,6007	1,6007	19	0,4231	18	0,5949	28	0,0186	25
64 Post and telecommunication services	0,96%	14	1	0,4537	0,3089	0,7627	1,7627	7	0,4138	19	0,8139	9	0,0179	27
92 Recreational, cultural and sporting services	0,90%	15	1	0,4093	0,2539	0,6632	1,6632	13	0,5099	9	0,7565	16	0,0221	18
55 Hotel and restaurant services	0,86%	16	1	0,3771	0,2355	0,6126	1,6126	18	0,4899	12	0,7657	15	0,0315	6
01-05 Products of agriculture, hunting, forestry, logging, fishing, aquaculture	0,83%	17	1	0,3863	0,2664	0,6527	1,6527	14	0,1867	33	0,7813	12	0,0712	1
17-19 Textiles; wearing apparel; leather and related products	0,76%	18	1	0,5049	0,3992	0,9041	1,9041	4	0,4483	16	0,5350	29	0,0320	4
85 Health and social work services	0,72%	19	1	0,1975	0,1108	0,3084	1,3084	32	0,6356	3	0,8012	11	0,0260	10
27 Basic metals	0,70%	20	1	0,3646	0,2297	0,5943	1,5943	21	0,3550	27	0,4520	33	0,0131	31
72 Computer and related services	0,65%	21	1	0,3804	0,2333	0,6137	1,6137	17	0,5809	5	0,8130	10	0,0208	20
63 Supporting and auxiliary transport services; travel agency services	0,60%	22	1	0,4573	0,2914	0,7486	1,7486	9	0,3799	25	0,7718	13	0,0207	21
65 Financial intermediation services, except insurance and pension funding services	0,60%	23	1	0,2676	0,1543	0,4219	1,4219	30	0,4692	14	0,8953	3	0,0155	28
70 Real estate services	0,59%	24	1	0,1098	0,0728	0,1826	1,1826	34	0,0686	34	0,9507	1	0,0038	34
25 Rubber and plastic products	0,54%	25	1	0,3155	0,1985	0,5140	1,5140	29	0,3391	29	0,5276	32	0,0182	26
50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel	0,50%	26	1	0,3833	0,2167	0,6000	1,6000	20	0,4926	11	0,7690	14	0,0256	11
80 Education services	0,48%	27	1	0,1492	0,0906	0,2398	1,2398	33	0,8051	1	0,8839	4	0,0326	3
66 Insurance and pension funding services, except compulsory social security services	0,46%	28	1	0,4531	0,2985	0,7515	1,7515	8	0,5655	6	0,8485	6	0,0196	24
22 Printed matter and recorded media	0,44%	29	1	0,5123	0,3927	0,9050	1,9050	3	0,5219	8	0,7273	18	0,0251	12
36 Furniture; other manufactured goods n.e.c.	0,43%	30	1	0,3565	0,2226	0,5792	1,5792	22	0,4516	15	0,6267	24	0,0251	13
26 Other non-metallic mineral products	0,42%	31	1	0,3931	0,2762	0,6693	1,6693	12	0,4045	22	0,6134	26	0,0201	23
21 Pulp, paper and paper products	0,36%	32	1	0,3481	0,2157	0,5638	1,5638	26	0,3089	31	0,5290	31	0,0135	30
20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials	0,32%	33	1	0,3855	0,2605	0,6461	1,6461	15	0,4005	24	0,6019	27	0,0305	8
37,90 Recovered secondary raw materials, Sewage and refuse disposal services, sanitation and similar services	0,31%	34	1	0,4724	0,3385	0,8109	1,8109	6	0,4825	13	0,6395	22	0,0223	17
91 Membership organisation services n.e.c.	0,24%	35	1	0,5248	0,3329	0,8577	1,8577		0,5821		0,7113		0,0256	
10-14 Mining and quarrying	0,17%	36	1	0,3674	0,2513	0,6187	1,6187		0,5335		0,7454		0,0186	
67 Services auxiliary to financial intermediation	0,15%	37	1	0,4804	0,2842	0,7646	1,7646		0,6519		0,8202		0,0272	
93 Other services	0,14%	38	1	0,2217	0,1216	0,3433	1,3433		0,3302		0,8770		0,0307	
73 Research and development services	0,14%	39	1	0,2615	0,1412	0,4027	1,4027		0,6836		0,8146		0,0197	
71 Renting services of machinery and equipment without operator and of personal and household goods	0,13%	40	1	0,3378	0,2108	0,5486	1,5486		0,3792		0,7928		0,0098	
62 Air transport services	0,13%	41	1	0,4732	0,3205	0,7937	1,7937		0,3864		0,5365		0,0148	
61 Water transport services	0,06%	42	1	0,2085	0,0768	0,2853	1,2853		0,1282		0,5543		0,0044	
35 Other transport equipment	0,06%	43	1	0,4451	0,2748	0,7199	1,7199		0,4785		0,4541		0,0195	
41 Collected and purified water, distribution services of water	0,06%	44	1	0,2278	0,1810	0,4088	1,4088		0,4862		0,9034		0,0285	
23 Coke, refined petroleum products and nuclear fuel	0,00%	45	1	0,4366	0,2596	0,6962	1,6962		0,4635		0,5163		0,0254	

Source: SORS and own calculations. 34 products with highest share of domestic output in total output are used in the ranking.

Table 7: Multipliers in 2010

2010	Share in total output		Initial effect	First round effect	Industrial support effect	Production induced effects	Output multiplier	Rank of output multiplier	Income multiplier	Rank of income multiplier	Value added multiplier	Rank of value added multiplier	Employment multiplier	Rank of employ. multiplier
	2	3												
45 Construction work	6,21%	1	1	0,5951	0,5623	1,1574	2,1574	1	0,4395	15	0,6825	19	0,0255	10
51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles	2,34%	2	1	0,4001	0,2624	0,6626	1,6626	13	0,5476	6	0,7943	10	0,0206	18
74 Other business services	2,23%	3	1	0,3543	0,2156	0,5699	1,5699	20	0,5898	4	0,8283	7	0,0330	2
28 Fabricated metal products, except machinery and equipment	1,88%	4	1	0,5734	0,5811	1,1545	2,1545	2	0,4188	17	0,6110	22	0,0283	6
60 Land transport and transport via pipeline services	1,58%	5	1	0,4166	0,2677	0,6843	1,6843	11	0,4299	16	0,6338	20	0,0218	17
15 Food products, beverages and tobacco products	1,45%	6	1	0,4933	0,3212	0,8145	1,8145	5	0,3557	23	0,6101	23	0,0253	11
24 Chemicals, chemical products and man-made fibres	1,28%	7	1	0,3587	0,2201	0,5788	1,5788	19	0,3220	29	0,5920	24	0,0122	31
30-33 Office machinery and computers; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks	1,22%	8	1	0,3278	0,1866	0,5144	1,5144	27	0,3489	24	0,4967	28	0,0162	27
52 Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	1,19%	9	1	0,3491	0,1666	0,5156	1,5156	26	0,4841	11	0,9037	2	0,0303	5
40 Electrical energy, gas, steam and hot water	1,09%	10	1	0,4222	0,2631	0,6853	1,6853	10	0,3235	28	0,7082	18	0,0142	29
34 Motor vehicles, trailers and semi-trailers	1,05%	11	1	0,2886	0,1657	0,4543	1,4543	29	0,1926	32	0,3259	34	0,0102	32
75 Public administration and defence services; compulsory social security services	1,04%	12	1	0,2501	0,1795	0,4296	1,4296	31	0,6377	3	0,8485	6	0,0235	14
64 Post and telecommunication services	0,91%	13	1	0,4421	0,2921	0,7342	1,7342	7	0,4037	19	0,8067	9	0,0172	23
92 Recreational, cultural and sporting services	0,84%	14	1	0,3940	0,2399	0,6340	1,6340	15	0,5001	8	0,7475	16	0,0219	16
55 Hotel and restaurant services	0,83%	15	1	0,3763	0,2345	0,6108	1,6108	16	0,4913	9	0,7494	15	0,0307	4
29 Machinery and equipment n.e.c.	0,83%	16	1	0,3241	0,1922	0,5163	1,5163	25	0,4029	20	0,5552	27	0,0169	24
27 Basic metals	0,79%	17	1	0,2981	0,1807	0,4789	1,4789	28	0,2526	31	0,3632	33	0,0095	33
01-05 Products of agriculture, hunting, forestry, logging, fishing, aquaculture	0,75%	18	1	0,3574	0,2400	0,5974	1,5974	18	0,1650	33	0,7753	12	0,0679	1
17-19 Textiles; wearing apparel; leather and related products	0,70%	19	1	0,4971	0,3946	0,8917	1,8917	4	0,4004	21	0,4761	30	0,0267	8
85 Health and social work services	0,69%	20	1	0,1922	0,1075	0,2997	1,2997	32	0,6381	2	0,7896	11	0,0259	9
63 Supporting and auxiliary transport services; travel agency services	0,67%	21	1	0,4540	0,2919	0,7459	1,7459	6	0,3328	25	0,7701	13	0,0183	22
72 Computer and related services	0,66%	22	1	0,3758	0,2264	0,6022	1,6022	17	0,5698	5	0,8155	8	0,0200	19
65 Financial intermediation services, except insurance and pension funding services	0,63%	23	1	0,2788	0,1647	0,4435	1,4435	30	0,4548	13	0,8967	3	0,0153	28
25 Rubber and plastic products	0,60%	24	1	0,3186	0,2004	0,5190	1,5190	24	0,3236	27	0,4852	29	0,0165	26
70 Real estate services	0,58%	25	1	0,1135	0,0759	0,1894	1,1894	34	0,0725	34	0,9498	1	0,0039	34
66 Insurance and pension funding services, except compulsory social security services	0,52%	26	1	0,4353	0,2676	0,7029	1,7029	9	0,4782	12	0,8549	5	0,0167	25
50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel	0,46%	27	1	0,3667	0,2013	0,5679	1,5679	21	0,4888	10	0,7672	14	0,0246	12
80 Education services	0,46%	28	1	0,1439	0,0872	0,2311	1,2311	33	0,8059	1	0,8814	4	0,0327	3
36 Furniture; other manufactured goods n.e.c.	0,40%	29	1	0,3428	0,2156	0,5584	1,5584	22	0,4526	14	0,6151	21	0,0228	15
26 Other non-metallic mineral products	0,40%	30	1	0,3827	0,2719	0,6545	1,6545	14	0,4080	18	0,5905	25	0,0189	20
22 Printed matter and recorded media	0,39%	31	1	0,5113	0,3900	0,9012	1,9012	3	0,5319	7	0,7287	17	0,0242	13
20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials	0,35%	32	1	0,4023	0,2756	0,6779	1,6779	12	0,3905	22	0,5732	26	0,0276	7
21 Pulp, paper and paper products	0,35%	33	1	0,3330	0,2081	0,5412	1,5412	23	0,2894	30	0,4302	32	0,0124	30
37,90 Recovered secondary raw materials, Sewage and refuse disposal services, sanitation and similar services	0,35%	34	1	0,4361	0,2953	0,7314	1,7314	8	0,3325	26	0,4729	31	0,0184	21
91 Membership organisation services n.e.c.	0,23%	35	1	0,5133	0,3209	0,8342	1,8342		0,5869		0,7081		0,0258	
73 Research and development services	0,16%	36	1	0,2708	0,1424	0,4132	1,4132		0,6764		0,7992		0,0187	
10-14 Mining and quarrying	0,16%	37	1	0,3620	0,2467	0,6087	1,6087		0,5037		0,7138		0,0174	
93 Other services	0,15%	38	1	0,2316	0,1264	0,3579	1,3579		0,3459		0,8621		0,0302	
67 Services auxiliary to financial intermediation	0,13%	39	1	0,4169	0,2345	0,6514	1,6514		0,5797		0,8241		0,0251	
62 Air transport services	0,13%	40	1	0,5282	0,3497	0,8778	1,8778		0,3612		0,4721		0,0143	
71 Renting services of machinery and equipment without operator and of personal and household goods	0,10%	41	1	0,2685	0,1628	0,4314	1,4314		0,4101		0,8315		0,0085	
41 Collected and purified water, distribution services of water	0,10%	42	1	0,3502	0,2858	0,6361	1,6361		0,5619		0,8355		0,0281	
61 Water transport services	0,07%	43	1	0,2376	0,0939	0,3315	1,3315		0,1305		0,4999		0,0044	
35 Other transport equipment	0,07%	44	1	0,4532	0,2763	0,7295	1,7295		0,3576		0,4496		0,0128	
23 Coke, refined petroleum products and nuclear fuel	0,00%	45	1	0,3223	0,1828	0,5051	1,5051		0,4084		0,6062		0,0776	

Source: SORS and own calculations. 34 products with highest share of domestic output in total output are used in the ranking.

Table 8: First ten multipliers in 2005, 2009 and 2010

Rank	Output multiplier			Income multiplier			Value added multiplier			Employment multiplier		
	2005	2009	2010	2005	2009	2010	2005	2009	2010	2005	2009	2010
1	F45	F45	F45	M80	M80	M80	K70	K70	K70	A0105	A0105	A0105
2	D1516	D28	D28	L75	L75	N85	M80	G52	G52	M80	K74	K74
3	I63	D22	D22	K72	N85	L75	J65	J65	J65	K74	M80	M80
4	O91	D1719	D1719	N85	K74	K74	G52	M80	M80	H55	D1719	H55
5	J66	D1516	D1516	O91	K72	K72	I64	L75	J66	D20	G52	G52
6	D22	D3790	I63	K74	J66	G51	K72	J66	L75	D1516	H55	D28
7	I64	I64	I64	J66	G51	D22	O92	K74	K74	D1719	D28	D20
8	G51	J66	D3790	G52	D22	O92	K74	G51	K72	G52	D20	D1719
9	D20	I63	J66	O92	O92	H55	L75	I64	I64	N85	D1516	N85
10	H55	E40	E40	H55	G52	G50	J66	K72	G51	O91	N85	F45

Source: SORS and own calculations. 34 products with highest share of domestic output in total output are used in the ranking. Codes of products are in the appendix A.

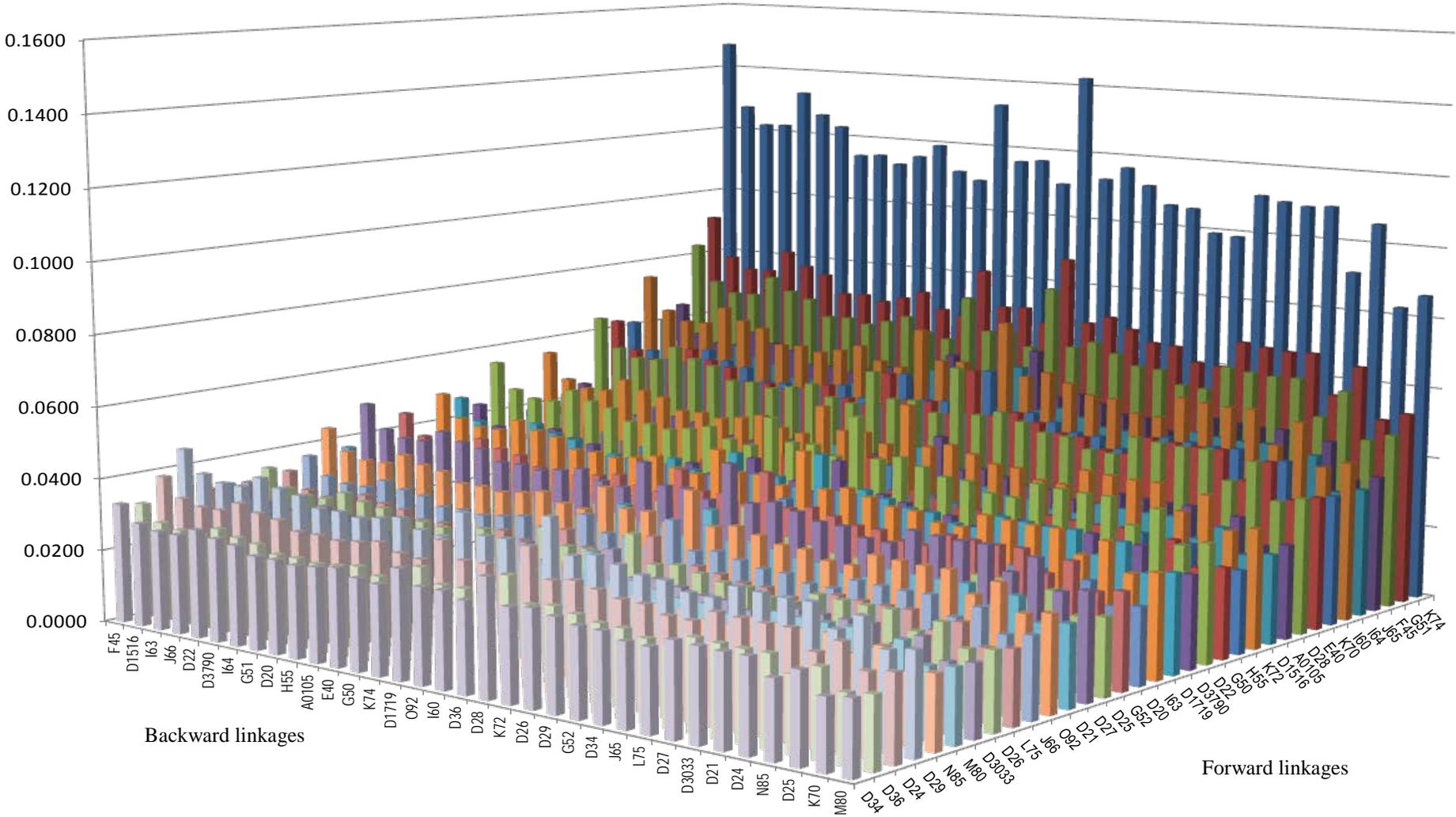
Table 9: Backward and forward linkages (Leontief and Ghosh) in 2005, 2009 and 2010

Nace 1.1*	2005				2009				2010			
	BL(t)	FL(t)	FL(t)*	Type	BL(t)	FL(t)	FL(t)*	Type	BL(t)	FL(t)	FL(t)*	Type
01-05 Products of agriculture, hunting, forestry, logging, fishing, aquaculture	1,0338	1,0881	1,0458	K	1,0195	0,9430	0,9176	B	0,9925	0,9400	0,9195	L
15 Food products, beverages and tobacco products	1,2367	1,0662	0,9510	B	1,1262	0,8923	0,7962	B	1,1274	0,9063	0,8130	B
17-19 Textiles; wearing apparel; leather and related products	1,0112	0,9785	0,9126	B	1,1745	0,9886	0,9828	B	1,1753	1,0067	1,0214	K
20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials	1,0425	0,9036	1,0972	K	1,0154	0,7614	0,8995	B	1,0425	0,7820	0,9137	B
21 Pulp, paper and paper products	0,9005	0,8604	0,8978	L	0,9646	0,7979	0,8531	L	0,9575	0,7567	0,8014	L
22 Printed matter and recorded media	1,1611	0,9997	1,1508	K	1,1751	1,1801	1,6693	K	1,1813	1,1883	1,7833	K
24 Chemicals, chemical products and man-made fibres	0,8620	0,7049	0,6581	L	0,9691	0,8211	0,7320	L	0,9809	0,8203	0,7287	L
25 Rubber and plastic products	0,8343	0,8858	0,9355	L	0,9339	0,7619	0,8199	L	0,9438	0,7654	0,8173	L
26 Other non-metallic mineral products	0,9619	0,7943	1,1950	F	1,0297	0,7582	1,2452	K	1,0280	0,7783	1,2125	K
27 Basic metals	0,9086	0,8823	0,8617	L	0,9835	1,0510	1,1321	F	0,9188	0,9224	0,8780	L
28 Fabricated metal products, except machinery and equipment	0,9626	1,1820	1,1508	F	1,2581	1,3657	1,3432	K	1,3386	1,4383	1,3795	K
29 Machinery and equipment n.e.c.	0,9490	0,7103	0,6571	L	0,9874	0,9633	0,8375	L	0,9421	0,9311	0,8335	L
30-33 Office machinery and computers; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical, precision and optical instruments, watches and clocks	0,9037	0,7921	0,7625	L	0,9721	0,6934	0,6685	L	0,9409	0,6895	0,6624	L
34 Motor vehicles, trailers and semi-trailers	0,9263	0,6630	0,6362	L	0,9362	0,7041	0,6233	L	0,9036	0,7196	0,6367	L
36 Furniture; other manufactured goods n.e.c.	0,9686	0,6869	0,6598	L	0,9741	0,6820	0,6921	L	0,9682	0,6898	0,7061	L
37,90 Recovered secondary raw materials, Sewage and refuse disposal services, sanitation and similar services	1,1140	0,9862	1,4686	K	1,1170	0,9251	1,2318	K	1,0758	0,8499	1,0106	K
40 Electrical energy, gas, steam and hot water	1,0206	1,2777	1,1777	K	1,0536	1,3314	1,1291	K	1,0471	1,2668	1,0834	K
45 Construction work	1,3006	1,6350	1,0059	K	1,3015	1,7728	1,0200	K	1,3404	1,9166	1,1115	K
50 Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel	1,0182	1,0377	1,0135	K	0,9870	0,8990	1,0021	F	0,9742	0,8884	1,0138	F
51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles	1,0820	1,8542	1,1853	K	1,0107	1,9518	1,0837	K	1,0330	1,8949	1,0879	K
52 Retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods	0,9468	0,8956	0,7905	L	0,9411	0,9506	0,7949	L	0,9417	0,9463	0,8029	L
55 Hotel and restaurant services	1,0354	1,0403	0,9458	B	0,9947	0,8273	0,7650	L	1,0008	0,7962	0,7501	B
60 Land transport and transport via pipeline services	0,9802	1,3291	1,0964	F	1,0323	1,5994	1,1389	K	1,0465	1,5829	1,1191	K
63 Supporting and auxiliary transport services; travel agency services	1,2332	0,9188	0,9389	B	1,0786	1,0336	0,9860	B	1,0848	1,0642	0,9770	B
64 Post and telecommunication services	1,0986	1,3328	1,2209	K	1,0873	1,2904	1,1939	K	1,0775	1,2675	1,1952	K
65 Financial intermediation services, except insurance and pension funding services	0,9134	1,3748	1,3047	F	0,8771	1,3771	1,2571	F	0,8969	1,3689	1,2851	F
66 Insurance and pension funding services, except compulsory social security services	1,1621	0,8364	0,9284	B	1,0804	0,7879	0,8735	B	1,0580	0,8139	0,8787	B
70 Real estate services	0,8030	1,3206	0,8954	L	0,7295	1,3059	0,8598	L	0,7390	1,3071	0,8868	L
72 Computer and related services	0,9625	1,0441	1,2021	F	0,9954	1,1899	1,1894	F	0,9954	1,2139	1,2138	F
74 Other business services	1,0164	3,1908	1,5400	K	0,9668	3,1409	1,4928	F	0,9754	3,1489	1,5133	F
75 Public administration and defence services; compulsory social security services	0,9109	0,8092	0,6802	L	0,8725	0,7166	0,6431	L	0,8883	0,7363	0,6601	L
80 Education services	0,7874	0,7868	0,6992	L	0,7648	0,7088	0,6465	L	0,7649	0,7191	0,6591	L
85 Health and social work services	0,8352	0,7447	0,6847	L	0,8071	0,7046	0,6337	L	0,8075	0,7096	0,6428	L
92 Recreational, cultural and sporting services	0,9936	0,8449	0,8397	L	1,0259	0,9389	0,9083	B	1,0152	0,9294	0,9190	B
10-14 Mining and quarrying	0,9833	0,8506	1,6365		0,9985	0,8181	1,6256		0,9995	0,8063	1,6162	
23 Coke, refined petroleum products and nuclear fuel	1,0927	0,6517	0,7188		1,0463	0,6191	0,9804		0,9351	0,6216	0,9374	
35 Other transport equipment	1,1171	0,8661	0,9764		1,0609	0,7339	1,1811		1,0745	0,7718	1,2121	
41 Collected and purified water, distribution services of water	0,8936	0,6975	0,9639		0,8690	0,6696	0,9220		1,0165	0,6775	0,9075	
61 Water transport services	0,8692	0,8020	0,8513		0,7928	0,7355	0,7527		0,8273	0,7601	0,7838	
62 Air transport services	1,0656	0,6997	0,9149		1,1064	0,6363	0,7057		1,1667	0,6453	0,7567	
67 Services auxiliary to financial intermediation	1,0448	0,8823	1,4760		1,0885	0,9049	1,4196		1,0260	0,8872	1,4425	
71 Renting services of machinery and equipment without operator and of personal and household goods	1,0659	0,8383	1,5082		0,9552	0,8242	1,4283		0,8893	0,8283	1,4770	
73 Research and development services	0,8865	0,7341	0,9964		0,8652	0,7485	1,0164		0,8780	0,7514	1,0110	
91 Membership organisation services n.e.c.	1,2330	0,8203	0,9429		1,1459	0,7973	1,0910		1,1396	0,7946	1,1075	
93 Other services	0,8713	0,6995	0,8250		0,8286	0,6965	0,8149		0,8437	0,7003	0,8307	

Source: SORS and own calculations. FL(t) – forward linkages from Leontief inverse matrix, FL(t)* forward linkages from Ghosh inverse matrix.

Type: K – key sector, F – forward linkages oriented sectors, B – backward linkages oriented sectors, L – weakly linkages oriented sectors.

Figure 7: Slovenia's Economic Landscape: 2009



Source: SORS and own calculations. Included are only industries with share in total output above 0.3%.

References

- D'Hernoncourt, J. C. (2011). *Input-Output Multipliers – Specification sheet and supporting material*. Retrieved from Spicosa Project Report, Université Libre de Bruxelles – CEESE, Brussels: http://www.coastal-saf.eu/output-step/pdf/Specification%20sheet%20I_O_final.pdf
- EUROSTAT. (2008). *Manual of Supply, Use and Input-Output Tables*. Retrieved from EUROSTAT: <http://ec.europa.eu/eurostat/documents/3859598/5902113/KS-RA-07-013-EN.PDF/b0b3d71e-3930-4442-94be-70b36cea9b39?version=1.0>
- Fjeldsted, B. L. (1990). *Regional input-output multipliers: calculation, meaning, use and misuse*. Retrieved from Utah Economic and Business Review: <http://www.business.utah.edu/sites/bebr/Documents/uebr/UEBR1990/October%201990.pdf>
- Fleissner, P., 1993. *Input-Output-Analyse: Eine Einführung in Theorie und Anwendungen*. Springer.
- Guo, J., & Planting, M. A. (2000). *Using Input-Output Analysis to Measure U.S. Economic Structural Change Over a 24 Year Period*. Retrieved from International Input-Output Association: https://www.iioa.org/conferences/13th/files/Guo&Planting_US_Economic_Structural_Change.pdf
- Harrigan, F. J., & James, M. (1988). The Measurement of Interindustry Linkages. *Ricerche economiche*, 42, 325-343.
- Holub, H.W. and Schnabl, H., 1994. *Input-Output-Analyse*. Walter de Gruyter GmbH & Co KG.
- Hussain, A. B. (January 2011). Output, Income and Employment Multipliers in Malaysian Economy: Input-Output Approach. *International Business Research*, str. 208-223.
- Jones, L. P. (1976). The Measurement of Hirschmanian Linkages. *Quarterly Journal of Economics*, 90, 323-333.
- Kurz, H.D., Dietzenbacher, E. and Lager, C. (eds) (1998) *Input-Output Analysis*, volume III (Cheltenham, Edward Elgar).
- Lenzen, M. 2001, "A generalized input-output multiplier calculus for Australia", *Economic Systems Research*, vol. 13, no. 1, pp. 65-92.
- Leontief, W. 1987, "Input-output analysis", *The New Palgrave. A dictionary of economics*, vol. 2, pp. 860-864.
- McLennan, W. (1995). *Information Paper: Australian National Accounts: Introduction to Input-Output Multipliers*. Retrieved from Australian Bureau of Statistics:

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5246.01989-90?OpenDocument>

Miller, R.E. & Blair, P.D. 2009, *Input-output analysis: foundations and extensions*, Cambridge University Press.

Ministry of Internal Affairs and Communications. (2005). Input-Output Tables for Japan. Retrieved from Ministry of Internal Affairs and Communications: http://www.soumu.go.jp/english/dgpp_ss/data/io/io05.htm

Nazara, S., Guo, D., Hewings, G.J. & Dridi, C. 2003, *Pyio: Input-output analysis with python*. Retrieved from: <http://www.real.illinois.edu/d-paper/03/03-T-23.pdf>

Sonis, M., & Hewings, G. J. D.. (1999). *Economic Landscapes: Multiplier Product Matrix Analysis For Multiregional Input-Output Systems*. Hitotsubashi Journal of Economics, 40(1), 59–74. Retrieved from <http://www.jstor.org/stable/43296013>

Sonis M, Hewings GJD, Guo J (1997). *Comparative analysis of China's metropolitan economies: an input-output perspective*. In: Chatterji M, Kaizhong Y (eds.) *Regional Science in Developing Countries*. Basingstoke, Macmillan Press:147-162

ten Raa, T., 2006. *The economics of input-output analysis*. Cambridge University Press.

United Nations (1996), *Valuation of household production and the satellite accounts, report prepared by the International Research and Training Institute for the Advancement of Women*, New York.