DEVELOPMENT OF INDIRECT IMPACT ASSESSMENT METHODOLOGY AND MULTIPLIERS

Final Report

CONTENTS

SUMMARY

This report highlights the derivation of sector-specific output (revenue), employment, and investment multipliers based on the Input-Output framework for the Georgian economy, which portrays the potential spillover effects of an increase in final demand for the products of a given sector on the whole economy. The resulting multipliers capture the total impact on the economy consisting of *initial, direct, indirect, and induced effects* on the economic variables of interest, respectively, as a result of an exogenous shock to one of the components of final demand (e.g. household or government consumption, export).

At the heart of the analysis is the Input-Output Table (IOT), containing information on inter-sectoral dependences, as well as existing relationships between sectors, final users (e.g. households, government, etc.), and economic production factors. Measured over a specific period (typically one year), an IOT presents inter-sectoral transactions that are generally recorded in monetary terms. Therefore, sectors are connected by the amount they require each other's production as an input.

The present methodology follows a well-established pattern for the construction of a national Input-Output Table, subsequently used to derive the selected multipliers. The core framework consists of three forms of table, each acting as the basis for the IO analysis: the Supply Table, the Use Table, and the Input-Output Table. Since an independent IOT is not yet available, applying an IO analysis to the Georgian economy requires the Supply and Use Tables (SUT), published by National Statistics Office of Georgia (Geostat), to be transformed into a Sector-by-Sector Input-Output Table. The IOT will be constructed using the latest available SUTs (2018), with a 21x21 sectoral disaggregation level, following the methodological instructions in the UN *Handbook on Supply, Use and Input Output Tables* (2018). The multipliers for the IOT will thereafter be derived from the reference year of 2018.

This report presents the derivation of both Type I and Type II multipliers to analyze the initial, direct, indirect, and induced effects in terms of revenue, employment, and investment generation for each sector of the Georgian economy. Type I multipliers incorporate initial, direct, and indirect effects, whereas the sum of the initial, direct, indirect, and induced effects is captured by the Type II multipliers (see Chart 1 below).

The derived output multipliers reflect the cumulative revenues of the Georgian economy, as generated per one additional GEL worth of final demand for a given sector's product. Comparing Type I output multipliers, measured at the sectoral level, it can be inferred that the manufacturing sector (with an output multiplier of 1.60) generates the highest revenues (1.60 GEL per 1 GEL spent); followed by accommodation and food services; and arts, entertainment and recreation with multiplier values of 1.49 for both sectors. By capturing the induced effects of an initial increase in expenditure for each sector, the Type II multipliers reveal that agriculture; professional, scientific, and technical activities; and education currently have the greatest impacts throughout the economy in terms of revenue, with respective multiplier values of 3.20; 3.03; and 3.01. However, it should be noted that Type II multipliers may significantly overestimate the real effects of initial expenditure due to the rigid consumption behavior of households assumed in the

model.[1] Type II multipliers are thus generally considered to be the upper bounds of economic impact. According to Oosterhaven, Peik, and Stedler (1986), a real estimate lies half-way between Type I and Type II multipliers.

CHART 1. INITIAL, DIRECT, INDIRECT, AND INDUCED EFFECTS		
Type II Multipliers (initial, direct, indirect, and induced effects)		
Type I Multipliers (initial, direct, and indirect effects)		**Induced Effects**
Direct Effects	Indirect Effects	
Direct effects arise from changes in demand for intermediate inputs, intended for output production to meet increased final demand.	All subsequent rounds of additional increases in output, that satisfy the second and following rounds of input requirements, are referred to as **indirect effects.**	**Induced effects** are generated in response to changes in the income and spending of households and are associated with changes in the level of economic activity in a given sector and its supporting sectors.
Initial Effects		
Initial effects note the changes in output level of a particular sector as the initial reaction of producers to meet increased final demand for sectoral output.		

Employment multipliers assess the impact of changes in final demand for a sector's output on full-time equivalent (FTE) job creation (both hired work and self-employment) throughout the economy. A comparison of the FTE multipliers indicates that the labor-intensive (and the least labor-productive) agriculture, forestry, and fishing and education sectors are the most highly ranked for employment generation capacity. The Type II employment multipliers for these sectors suggest that for every million additional GEL in final demand for agricultural products and educational services, around 137 and 112 full-time equivalent jobs would be created, respectively. Disaggregating employment multipliers further by gender and age, it is possible to observe that, for instance, education creates approximately 80 FTE jobs for women and 32 for men; while the least opportunistic sectors for women are construction and transportation. Age-disaggregated employment multipliers highlight the notable FTE job creation differences between young (aged between 15-30) and adult employees (30+). For instance, of the total 137 FTE jobs created, per 1 million GEL increase in final demand for agricultural output, only 18 positions are for the young, and 119 for adult employees.

Considering investment multipliers, both Type 1 and Type II multipliers demonstrate that additional spending generates the greatest total investments in the following top ranked sectors: electricity, gas, steam, and air conditioning supply; water supply, sewerage, and waste management; and information and communication. For example, the Type II multipliers imply a 1

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[1] It is assumed that the total household income is spent on consumption.

million GEL additional demand in the electricity, gas, steam, and air conditioning sector generates 644,000 GEL of capital investment to the economy as a whole.

When factoring in the simplified assumptions and limitations of the Input-Output model, the sector-specific multipliers derived from this study should be used with caution in policymaking. However, multipliers might be considered as relatively effective measures for gauging potentially broader impacts on the Georgian economy and considering what can be generated as a result of an increase in final demand for each sector.

1. INTRODUCTION

1.1. BACKGROUND ANALYSIS OF THE MODEL AND AN OVERVIEW OF INDIRECT IMPACT ASSESSMENT METHODOLOGIES

The Input-Output (IO) framework, developed by Professor Wassily Leontief in the 1930s, is a quantitative model that considers the examination of inter-sectoral dependences in an economy. It defines how much output is required for a particular sector from each of the other sectors and itself, in order to produce the worth of 1 unit of currency of its own output. An IO analysis is a standard tool for measuring the spillover effects of changes in final demand on a sector's output.

In the original 1936 study, Leontief provides a detailed description of the IO methodology, which he later applied to the structure of the US economy. The main applications of IO analysis have been discussed by Leontief (1986), Schnabl (1994), Thijs ten Raa (2006), Eurostat (2008), Miller and Blair (2009), Murray and Lenzen (2013), and by the United Nations (2018).

At the very core of the IO framework is the Leontief Input-Output Table, which is constructed using data observed for a specific region (country, state, etc.). The fundamental details in an IOT are the inter-sectoral transactions within an economy over a given period (typically a year). More specifically, an IOT displays the flow of output from each "n" economic sector to each "n" sector, including itself, which requires inputs for production processes. These product flows between economic sectors are thus inter-sectoral transactions, represented in monetary values. The rows of an Input-Output Table are therefore constructed to illustrate the distribution of sectoral outputs throughout the economy, whereas the columns note the composition of inputs used by a given sector to produce its output. The relationship between the inputs absorbed and the outputs produced by a given sector is represented by the technical coefficients in the IO framework (discussed in section 3.2.).

The IO framework is a standard tool for measuring the impacts of exogenous shocks to final demand on output and other notable variables. The Input-Output multipliers, resulting from a IO analysis, serve to measure the total impact of changes in demand to any sector. The total economic impact of shocks consists of the *initial, direct, indirect, and induced* effects to the economy. *Initial effects* show changes in the level of output in a particular sector, as an initial consequence of an increase in the final demand for that sector's domestic output; a reaction of producers to the shock of increased demand. Namely, it is the value of output needed to satisfy the worth of 1 additional unit of currency of the final demand (Miller & Blair, 2009). *Direct effects* arise as a result of changes in the demand for inputs, since the production process of outputs for final demand increases the need for intermediate inputs. "Production of these additional intermediate inputs requires subsequent increased rounds of production since output has to be produced to satisfy the second round of input requirements. All these rounds of additional increases in output are referred to as the *indirect effects* of an exogenous increase in final demand on total output production" (Cassar, 2015). Finally, *induced effects* are generated in response to changes in the income and spending of households on goods and services; associated with changes to the level of economic activity in a given sector and its supporting industries.

An important advantage of using the IO framework is the opportunity to observe indirect and induced effects on the economy with the help of Input-Output multipliers. An Input-Output Table represents a starting point for estimating the multipliers of notable economic variables for the analysis of the indirect economic impacts of an intervention. In order to measure the impact of an exogenous shock to the final demand on different economic variables, particularly output (cumulative revenue), employment, and investment, this methodology will estimate **Type I and Type II** multipliers. Type I multipliers reflect only the combined effect of the initial, direct, and indirect effects of an exogenous shock to final demand, while, Type II multipliers also capture the induced effects, offering a more comprehensive analysis of the impact on output, employment, and investment generation.[2] Induced effects, which include effect of household income and spending, can be calculated by endogenizing households in the model. For example, Cassar (2015) estimated sector-specific Type I and Type II multipliers, derived from a highly disaggregated Input-Output Table, to undertake a comparative analysis of the direct, indirect, and induced impacts in terms of the generation of income, output, value added, and employment for all sectors of the Maltese Economy in 2008. In addition, several further studies have applied an Input-Output analysis to assess the impact of tourism on national economies.[3] Certain similar research has also been performed locally, for example, in a recent study Mosakhlishvili and Mikeladze (2019) measure the impact of changes to the communication sector for the Georgian economy, using a Leontief Input-Output model that calculates multipliers for the sector.

A more advanced, albeit data demanding, approach for estimating economic impacts relies on economic simulation models, including econometric and general equilibrium models.[4] An economy-wide Computable General Equilibrium (CGE) model was developed for Georgia in a recent study by Yerushalmi, Labadze, and Galdava (2015).[5] The authors examine the optimal investment strategy for the maximization of specific social-economic targets, including GDP and welfare growth, income equality, employment creation, and export promotion amongst others. As their study allows the incorporation of historic and expected future economic, social, and even environmental changes in the analysis, these models constitute an improvement over simpler IO models, the disadvantage, however, is that they require a longer and more resource intensive realization process, greater quantitative complexity, higher data requirements, and larger costs.

1.2. BASIC ASSUMPTIONS OF THE MODEL

The Input-Output framework is based on the following assumptions:

1. Fixed input structure

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[2] The initial effect of the shock to final demand of a certain sector's output is included in both types of multiplier.
[3] Briguglio (1992); Blake et al. (2003b); Surugiu (2009).
[4] Cardenete, M.A., Guerra, A., & Sancho, F. (2012). *Applied General Equilibrium: An Introduction.* Springer.
[5] Yerushalmi, E., Labadze, L., & Galdava, I. (2015) *Optimal investment: 'You can't always get what you want'.* Working Paper. Coventry: Institute of Employment Research; University of Warwick. ISET-PI Research Reports.

The technical coefficients of an Input-Output Table (input from sector i for sector j divided by the total output of sector j) measure the fixed relationships between a sector's inputs and outputs. The Input-Output framework assumes that sectors use inputs in fixed proportions, therefore there is no input substitution during changes in output. In reality though, even in the short-term, there is the possibility of substitution. The IO framework suggests: *exogenous shocks will affect the output of a particular sector, but not the mix of inputs that the sector uses to produce its output.*

The assumption of a fixed input structure implies that all sectors employ Leontief production functions, which are characterized by constant returns to scale (if production in sector j doubles, input required from sector i will also double). This assumption prevents the model from reflecting the short-term effects of technological advancement; it ignores economies of scale (Miller & Blair, 2009) and the evolution of economic sectors, including both the formation and closure of companies (often with different technological profiles and inputs).

2. Fixed prices

The IO framework assumes that *any change due to exogeneous shock to the final demand will affect the physical output rather than prices* – there is no mechanism of price adjustment and prices are fixed (Breisinger et al., 2010).

3. Unlimited factor resources

There are no constraints to raw materials or employment in the IO framework, thus unlimited products can be created. Namely, *any increase in demand can be met by appropriate supply*. The shortcomings of this assumption can be clearly illustrated by these examples: if demand increases for gold exports, mining production will not necessarily increase, since the resources simply might not exist; moreover, supply may be constrained when, due to the scarcity of resources, increasing production in one sector is counterbalanced with decreasing production in other sectors (e.g., land reallocation from one export crop to another) (Breisinger et al., 2010).

Mosakhlishvili and Mikeladze (2019) also underline the problems behind the unlimited factor resource assumption. They note that in periods of augmented or reduced economic activity, when there is an excess or shortage of a product, this assumption becomes debased. If the economy faces large-scale problems, the plausibility of this assumption is also in question. When supply constraints are ignored in an Input-Output analysis, the resulting multipliers could be overestimated. For instance, Haggblade et al. (1991) discerned that agricultural growth multipliers are overestimated by a factor between two and ten.

2. SECTORAL DISAGGREGATION AND DATA UTILIZATION

2.1. LEVELS OF SECTORAL DISAGGREGATION

The multipliers will be derived using a 20x20 sectoral disaggregation level from an Input-Output Table for the Georgian economy in 2018, and will cover the following sectors:

1. Agriculture, forestry, and fishing
2. Mining and quarrying
3. Manufacturing
4. Electricity, gas, steam, and air conditioning supply
5. Water supply, sewerage, waste management, and remediation activities
6. Construction
7. Wholesale and retail trade; repair of motor vehicles and motorcycles
8. Transportation and storage
9. Accommodation and food service activities
10. Information and communication
11. Financial and insurance activities
12. Real estate activities
13. Professional, scientific, and technical activities
14. Administrative and support service activities
15. Public administration and defense; compulsory social security
16. Education
17. Human health and social work activities
18. Arts, entertainment, and recreation
19. Other service activities
20. Activities of households as employers; undifferentiated goods and services producing activities of household for own use

The sectoral disaggregation adheres to the statistical classification of economic activities, within NACE Rev. 2, used in the SUTs for 2018. Due to data limitations, only the employment multipliers can be calculated for sector 20 – activities of households as employers; undifferentiated goods and services producing activities of household for own use. The final sector (21) – activities of extra-territorial organizations and bodies – has been excluded from the multiplier analysis, since there are no respective data entries in the SUTs and there are data limitations for other significant variables (e.g., employment).

2.2. DATA UTILIZATION AND RELEVANT SOURCES

The multipliers have been developed based on a Sector-by-Sector IOT for the reference year of 2018 which was constructed by transforming the most recent Geostat Supply and Use Tables

(with 21x21 sectoral dimension).[6] Table 1 summarizes the sources and all data required for the IO analysis, and for constructing multipliers for the Georgian economy; including the data analyzed from the Labor Force Survey (2018).

TABLE 1. DATA TYPE AND SOURCES	
Data Type	Source
21x21 Supply-Use Tables (2018) for Georgia	Geostat
38x38 Supply-Use Tables (2018) for Georgia	Geostat
The value of production inputs used, and outputs produced by each sector	21x21 IOT (2018) constructed for the Georgian economy based on SUT (2018) under this study
Distribution of full-time equivalent (FTE) hired employees by economic activity (NACE rev.2) for 2018	Geostat data receivable upon request (Enterprise survey and non-business sector survey data.)
Distribution of full-time equivalent (FTE) self-employed by economic activity (NACE rev.2)	Labor Force Survey (2018)
Age-disaggregated FTEs (15-30; 30+) by economic activity (NACE rev.2) for 2018	Labor Force Survey (2018)
Sex-disaggregated hired FTEs by economic activity (NACE rev.2) for 2018	Geostat data receivable upon request (Enterprise survey and non-business sector survey)
Sex-disaggregated self-employed FTEs by economic activity (NACE rev.2) for 2018	Labor Force Survey (2018)
Average monthly salaries of hired employees by economic activity (NACE rev.2) for 2018	Geostat data receivable upon request (Enterprise survey and non-business sector survey data.)
Final consumption expenditure by households and non-profit organizations serving households (NPISH)	IOT (2018) constructed for the Georgian economy under this study
Investments/Gross Fixed Capital Formation by economic activity (mln. GEL)	National Accounts of Georgia 2018 – Annual Geostat Publication

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[6] As a robustness check, we calculated the multipliers based on the same 21x21 dimensional IOT, derived from the 38x38 dimensional SUTs, and the results are presented in Appendix A1.

3. METHODOLOGICAL APPROACH AND THE TYPES OF MULTIPLIER

3.1.   TRANSFORMING THE SUPPLY-USE TABLES INTO AN INPUT-OUTPUT TABLE

3.1.1. DATA

The official Input-Output Table is not currently available for Georgia, thus the starting point for deriving the output, employment, and investment multipliers is constructing it. Consequently, Geostat Supply and Use Tables (SUTs) have been utilized for the IOT. Data at purchaser prices are available from 2006. However, the latest available SUT (2018) is calculated based on the System of National Accounts (SNA) 2008 methodology, while previous SUTs are constructed using SNA 1993 methodology. The differences between the methodologies relates largely to improvements in the estimation of financial intermediation services indirectly measured (FISIM), capitalizing on research and development, processing costs, and the calculation of imputed rent on owner occupied dwellings. Besides which, improvements to the data source include assessing the scope of the non-observed economy in various sectors and improving the quality of statistics. Due to such methodological differences, it is impossible to compare 2018 with the previous SUTs. Therefore, the current analysis is conducted solely on 2018 data.

The SUTs are available at two disaggregation levels: for 21x21 and 38x38 sectors, based on the statistical classification of economic activities in NACE Rev. 2. Because the SUTs are represented in the form of square matrices it further simplifies the analysis. The 21x21 disaggregation level is used for the IO analysis, as the 38x38 SUTs are constructed around narrower sectors, which require the application of stronger assumptions for the disaggregation of gross value added, imports, trade and transport margins, and taxes and subsidies on products.[7] In addition, employment data is only available at the 21x21 disaggregation level. The derivation of the IOT also requires the transformation of the initially available SUTs, as discussed below in sections 3.1.2. and 3.1.3.

3.1.2. TRANSFORMATION OF SUPPLY TABLES[8]

A Supply Table represents the structure of goods and services supplied to the economy by product and sector. It distinguishes between the output of domestic sectors and imports by product. A Supply Table is initially compiled using basic prices, and includes two main parts: domestic output and the import of goods and services. A Supply Table at purchase prices is

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[7] An IO analysis based on the 38x38 SUT was also conducted. Every step of the transformation from the SUT to the IOT, as described in subchapters 3.1.2., 3.1.3., and 3.1.4., was applied to the 38x38 SUT. Thereafter, the 38x38 IOT was transformed into a 21x21 IOT by simple aggregation of its elements according to the statistical classification of economic activities, NACE Rev 2 (see Appendix A1.) Finally, based on the 21x21 IOT obtained, multipliers were calculated using the same methodology as described in subchapters 3.2. and 3.3. (see Appendix A4.)

[8] Every step described in this and the following chapters, 3.1., 3.2. and 3.3., can be found in the corresponding excel file, alongside all formulas and details of the calculation.

developed by adding valuation adjustments, as represented by a valuation matrix containing trade margins, transport margins, taxes on products, and subsidies on products. A schematic representation of a Supply Table at purchase prices is given in Table 2: where VT = the supply matrix (product by sector); x = the column vector of product output; R = the valuation adjustment matrix; r = the column vector of valuation adjustment; rT = the row vector of valuation adjustment; m = the column vector of total imports; gT = the row vector of sector output; q = the column vector of product supply; and x', m', r', and q' are, respectively, the values of total product output, import, valuation adjustment, and supply.

TABLE 2. SUPPLY TABLE AT PURCHASE PRICES, SCHEMATIC REPRESENTATION					
	Sectors	Output	Valuation adjustments	Imports	Supply
Products	VT	x	R	m	q+r
Total	gT	x'	rT	m'	q'+ r'

Source: UN Handbook (2018)

Table 3 shows the Georgian Supply Table at purchase prices, provided by Geostat, at a 21 sector/product disaggregation level. As illustrated, the total supply of agricultural goods amounts to 6,149 million GEL, out of which 4,717 million is the domestic output of agricultural goods, while 786 million in agricultural products are imported. The difference between the total supply and the sum of domestic production and imports comes from a valuation adjustment: 647 million GEL is the sum of trade and transport margins (638 mln.) alongside taxes on products (175 mln.), minus subsidies on products (166 mln.). The supply of all other sectors is disaggregated by the same components (domestic supply + valuation adjustment + import = total supply). The final total supply of all goods and services at purchase prices thus equates to104,010 million GEL.

To derive IOTs it is necessary to refine the Supply Table at basic prices (STb). The STb can be obtained by excluding the valuation matrix (R) from the calculations (Table 4). Alternatively, the supply of goods and services at the basic price could be calculated by adding domestic output (x) to imports (m). Table 5 below represents the Supply Table at basic prices for Georgia.

TABLE 4. SUPPLY TABLE AT BASIC PRICES, SCHEMATIC REPRESENTATION				
	Sectors	Output	Imports	Supply
Products	VT	X	m	q
Output	gT	x'	m'	q'

Source: UN Handbook (2018)

TABLE 3. SUPPLY TABLE AT PURCHASE PRICES, 2018 (MLN. GEL)

Products	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Output, total	Trade and transport margins	Taxes on products	Subsidies on products	Import, total	Supply
(1) Products of Agriculture, forestry and fishing	4,711	-	5	-	-	0	1	-	-	-	-	-	-	0	-	-	-	-	-	-	-	4,717	638	175	166	786	6,149
(2) Mining and quarrying products	1	815	14	-	-	4	3	0	0	-	-	0	-	0	-	-	-	-	-	-	-	838	249	104	-	1,192	2,384
(3) Manufactured products	79	11	12,394	0	-	44	10	10	5	0	-	11	0	6	-	1	-	0	1	-	-	12,573	9,045	4,990	-	19,732	46,340
(4) Electricity, gas, steam and air conditioning	-	2	1	1,595	13	4	49	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1,664	494	75	10	181	2,404
(5) Water supply; sewerage, waste management and remediation services	-	-	0	-	462	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	462	115	10	1	33	618
(6) Constructions and construction works	8	30	110	33	2	8,399	7	6	43	7	-	22	1	0	-	-	-	-	1	-	-	8,667	-	391	-	25	9,084
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	68	16	415	0	-	45	7,928	102	4	23	-	9	138	11	-	0	36	0	9	-	-	8,805	(7,911)	16	-	495	1,404
(8) Transportation and storage services	7	3	11	0	-	19	7	4,595	0	0	-	2	2	2	-	-	0	-	-	-	-	4,648	(2,361)	49	26	2,785	5,094
(9) Accommodation and food services	0	-	47	0	-	33	1	0	3,547	7	-	12	0	3	-	1	2	4	1	-	-	3,659	-	31	-	414	4,104
(10) Information and communication services	-	-	-	-	-	-	2	1	-	1,732	-	0	0	40	-	-	-	0	-	-	-	1,775	25	41	-	333	2,174
(11) Financial and insurance services	-	-	-	-	-	0	0	1	-	-	3,141	0	0	4	-	-	-	0	-	-	-	3,147	(293)	39	-	392	3,285
(12) Real estate services	3	28	25	1	2	36	16	56	94	6	-	5,344	1	1	-	2	26	12	1	-	-	5,655	-	51	-	-	5,706
(13) Professional, scientific and technical services	2	0	1	3	-	1	6	4	-	7	-	1	1,388	-	-	0	1	2	-	-	-	1,415	0	26	6	182	1,616
(14) Administrative and support service services	5	1	17	1	-	7	11	26	11	6	-	5	0	828	-	0	1	0	0	-	-	919	-	21	-	314	1,253
(15) Public administration and defence; compulsory social security services	-	-	-	-	-	-	-	0	-	13	-	-	-	-	4,217	-	-	-	-	-	-	4,230	-	1	-	190	4,421
(16) Education services	-	-	0	-	-	-	3	-	-	-	-	-	0	-	-	2,084	1	1	-	-	-	2,089	-	-	-	107	2,196
(17) Human health and social work services	-	-	0	-	-	1	-	-	-	-	-	5	-	-	-	0	2,865	-	-	-	-	2,866	-	-	-	34	2,900
(18) Arts, entertainment and recreation srvices	-	-	-	-	-	-	1	2	4	2	-	5	-	-	-	-	-	2,099	-	-	-	2,112	0	12	-	68	2,191
(19) Other services	-	-	0	-	-	-	2	-	0	-	-	1	-	0	-	-	0	-	614	-	-	618	-	2	-	31	651
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	37	-	37	-	-	-	-	37
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**4,885**	**904**	**13,038**	**1,633**	**479**	**8,593**	**8,046**	**4,807**	**3,721**	**1,790**	**3,141**	**5,413**	**1,532**	**896**	**4,217**	**2,089**	**2,932**	**2,118**	**626**	**37**	**-**	**70,896**	**(0)**	**6,031**	**210**	**27,293**	**104,010**

Source: Geostat, Authors' calculations

TABLE 5. SUPPLY TABLE AT BASIC PRICES, 2018 (MLN. GEL)

Products	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Output, total	Import, total	Supply
(1) Products of Agriculture, forestry and fishing	4,711	-	5	-	-	0	1	-	-	-	-	-	-	0	-	-	-	-	-	-	-	4,717	786	5,502
(2) Mining and quarrying products	1	815	14	-	-	4	3	0	0	-	-	0	-	0	-	-	-	-	-	-	-	838	1,192	2,031
(3) Manufactured products	79	11	12,394	0	-	44	10	10	5	0	-	11	0	6	-	1	-	0	1	-	-	12,573	19,732	32,305
(4) Electricity, gas, steam and air conditioning	-	2	1	1,595	13	4	49	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1,664	181	1,845
(5) Water supply; sewerage, waste management and remediation services	-	-	0	-	462	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	462	33	495
(6) Constructions and construction works	8	30	110	33	2	8,399	7	6	43	7	-	22	1	0	-	-	-	-	1	-	-	8,667	25	8,692
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	68	16	415	0	-	45	7,928	102	4	23	-	9	138	11	-	0	36	0	9	-	-	8,805	495	9,300
(8) Transportation and storage services	7	3	11	0	-	19	7	4,595	0	0	-	2	2	2	-	-	0	-	-	-	-	4,648	2,785	7,433
(9) Accommodation and food services	0	-	47	0	-	33	1	0	3,547	7	-	12	0	3	-	1	2	4	1	-	-	3,659	414	4,073
(10) Information and communication services	-	-	-	-	-	-	2	1	-	1,732	-	0	0	40	-	-	-	0	-	-	-	1,775	333	2,108
(11) Financial and insurance services	-	-	-	-	-	0	0	1	-	-	3,141	0	0	4	-	-	-	0	-	-	-	3,147	392	3,539
(12) Real estate services	3	28	25	1	2	36	16	56	94	6	-	5,344	1	1	-	2	26	12	1	-	-	5,655	-	5,655
(13) Professional, scientific and technical services	2	0	1	3	-	1	6	4	-	7	-	1	1,388	-	-	0	1	2	-	-	-	1,415	182	1,597
(14) Administrative and support service services	5	1	17	1	-	7	11	26	11	6	-	5	0	828	-	0	1	0	0	-	-	919	314	1,232
(15) Public administration and defence; compulsory social security services	-	-	-	-	-	-	-	0	-	13	-	-	-	-	4,217	-	-	-	-	-	-	4,230	190	4,420
(16) Education services	-	-	0	-	-	-	3	-	-	-	-	-	0	-	-	2,084	1	1	-	-	-	2,089	107	2,196
(17) Human health and social work services	-	-	0	-	-	1	-	-	-	-	-	5	-	-	-	0	2,865	-	-	-	-	2,866	34	2,900
(18) Arts, entertainment and recreation srvices	-	-	-	-	-	-	1	2	4	2	-	5	-	-	-	-	-	2,099	-	-	-	2,112	68	2,179
(19) Other services	-	-	0	-	-	-	2	-	0	-	-	1	-	0	-	-	0	-	614	-	-	618	31	649
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	37	-	37	-	37
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**4,885**	**904**	**13,038**	**1,633**	**479**	**8,593**	**8,046**	**4,807**	**3,721**	**1,790**	**3,141**	**5,413**	**1,532**	**896**	**4,217**	**2,089**	**2,932**	**2,118**	**626**	**37**	**-**	**70,896**	**27,293**	**98,190**

Source: Geostat, Authors' calculations

3.1.3. TRANSFORMATION OF THE USE TABLE

The Use Table represents the structure of the usage of goods and services, by product, for intermediate consumption by sector and by the components of final use (final consumption expenditure, gross capital formation, and export). Besides which, the Use Table shows, in general, the following components of gross value added (GVA) by sector: compensation of employees, other taxes minus subsidies on production, consumption of fixed capital, net operating surplus, and net mixed income. The columns in the Use Table represent the cost structure of each sector and the product structure of each type of final use, while the rows signify the distribution of each product and primary input (labor and capital) by use (United Nations, 2018).

As a Use Table is compiled based on data collected from business and household surveys (the product purchasers), it is common, initially, to construct the Use Table at purchasers' prices. Table 6 shows the general structure of the Use Table, from which the IOT is compiled, where: U = the use matrix for intermediates (product by sector); d = the index for domestic origin; m = the index for imported origin; Y = the final use matrix (product by category of final use); x = the column vector of product output; m = the column vector of total imports; wT = the row vector of gross value added (w = the column vector of gross value added); w' = the total value of GVA; gT = the row vector of sector output; and y = the row vector of final use.

TABLE 6. DOMESTIC AND IMPORTED USE TABLE, SCHEMATIC REPRESENTATION			
	Sectors	Final use	Use
Domestic products	Ud	Yd	x
Imported products	Um	Ym	m
GVA	wT		w'
Total	gT	Y	

Furthermore, Table 7 illustrates the structure of the Use Table developed by Geostat, while Table 8 highlights the 21x21 Use Table for Georgia itself. The upper section of Table 7 represents the distribution of goods and services for intermediate consumption (by sector) and final use (final consumption expenditure by households and the government, export, and gross capital formation). However, as domestic and imported use are not separated in the table, product use corresponds to the supply by product section of the Supply Table – the column vector matrices of product supply/use ($q = x + m$) are identical in both tables. The same should be true for the row vector of sector output (gT). Though, the total output by sector in the Use Table is considerably less than the total output by sector represented in the Supply Table (Table 3). The difference is the GVA, absent in the Use Table. Therefore, the row vector of sector output (gT) in the Use Table provided by Geostat is presented as $gT – wT$, which is the sum of the sector intermediate inputs (by sector).

TABLE 7. USE TABLE AT PURCHASE PRICES (WITHOUT GVA), SCHEMATIC REPRESENTATION			
	Sectors	Final use	Use
Total products (domestic + imported)	U	Y	Q
Output	gT – wT	Y	q'

Source: Authors' calculations

TABLE 8. USE TABLE AT PURCHASE PRICES (WITHOUT GVA), 2018 (MLN. GEL)

Products	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households	Final consumption expenditure by government	Export, total	Gross capital formation	Total Use
(1) Products of Agriculture, forestry and fishing	910	3	1,982	0	0	10	32	3	173	0	0	3	3	2	-	5	5	38	0	-	-	1,842	-	587	551	6,149
(2) Mining and quarrying products	6	57	420	0	0	97	6	20	0	-	0	7	0	1	-	0	0	0	1	-	-	-	-	1,729	39	2,384
(3) Manufactured products	704	261	5,158	192	110	3,367	684	1,076	897	114	73	145	136	67	595	71	673	184	86	-	-	15,906	-	11,286	4,555	46,340
(4) Electricity, gas, steam and air conditioning	25	51	456	162	33	35	129	64	181	52	44	70	9	7	108	43	85	54	17	-	-	687	-	75	15	2,404
(5) Water supply; sewerage, waste management and remediation services	10	0	13	1	5	5	11	4	30	1	6	13	1	2	0	6	13	7	5	-	-	250	64	172	(1)	618
(6) Constructions and construction works	4	6	127	26	11	1,201	37	18	83	31	13	58	20	3	-	16	37	24	2	-	-	760	6	32	6,568	9,084
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	7	13	77	6	4	61	160	122	5	2	5	2	4	10	42	2	16	16	2	-	-	151	-	264	434	1,404
(8) Transportation and storage services	63	21	226	26	5	101	447	602	32	14	41	10	18	70	71	16	20	56	15	-	-	338	-	2,903	(1)	5,094
(9) Accommodation and food services	4	1	19	3	1	14	39	77	35	11	42	2	11	68	121	73	47	59	25	-	-	602	-	2,842	7	4,104
(10) Information and communication services	0	1	13	45	1	55	99	20	11	267	102	7	13	8	58	15	7	13	6	-	-	795	6	390	243	2,174
(11) Financial and insurance services	121	23	273	45	11	215	204	143	94	46	18	441	37	24	20	16	69	50	12	-	-	1,134	49	240	-	3,285
(12) Real estate services	8	3	172	6	2	125	592	95	245	67	227	127	41	75	109	25	64	214	75	-	-	3,432	1	-	1	5,706
(13) Professional, scientific and technical services	5	2	125	101	2	63	93	40	30	38	148	57	184	7	64	13	21	51	18	-	-	314	83	44	115	1,616
(14) Administrative and support service services	1	2	31	21	2	29	76	57	89	37	34	34	25	39	73	20	59	55	6	-	-	511	-	50	4	1,253
(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	6	1	0	0	3	-	0	4	5	0	0	0	0	-	-	592	3,559	249	-	4,421
(16) Education services	0	-	1	1	1	1	1	1	1	8	0	2	0	4	8	28	0	1	-	-	-	1,233	865	37	0	2,196
(17) Human health and social work services	-	4	2	1	0	2	0	2	6	0	0	0	2	0	7	8	151	1	-	-	-	1,546	1,151	5	10	2,900
(18) Arts, entertainment and recreation srvices	-	-	0	0	-	0	0	0	0	16	2	4	0	1	41	9	0	106	1	-	-	286	106	1,616	3	2,191
(19) Other services	0	0	2	17	0	0	23	1	11	13	25	1	19	0	-	2	3	5	7	-	-	495	1	25	(0)	651
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	-	-	-	37
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,869	447	9,097	653	187	5,380	2,640	2,345	1,921	713	791	983	527	385	1,318	349	1,299	935	280	-	-	30,911	5,891	22,549	12,543	104,010

Source: Geostat, Authors' calculations

At this stage, it is necessary to:

- Firstly, transform the purchase prices Use Table into a basic prices table;
- Secondly, distinguish between domestic and imported intermediate consumption and final use.

The transformation of the Use Table from purchase to basic prices requires data for each component of the valuation adjustment matrix, disaggregated by product, sector, and the components of final use. However, in the Supply Table only a by-product disaggregation is available. Thus, it becomes necessary to apply a so-called proportionality assumption (United Nations, 2018), according to which each component of the valuation adjustment for each product from the Supply Table is distributed across the sectors and components of final use, proportional to the shares of intermediate consumption of each product (by respective sector) and the shares of final consumption of each product (by component) of final use in the total use of each product.

For example, trade and transport margins for agricultural goods in the Supply Table (Table 3) equate to 638 million GEL, while the share of agricultural products used by the Agricultural sector in total use of agricultural products is 14.8% (910 / 6,149 (Table 8)). Therefore, the trade and transport margins for agricultural goods used by agriculture sector is 94 (14.8% * 638) million GEL.[9] The same method can be applied to taxes and subsidies, which equal 26 (14.8% * 175) and 25 (14.8% * 166) million GEL, respectively. As a result, the intermediate consumption of the agricultural sector, at basic prices, equates to 814 (910 - 94 - 26 + 25) million GEL.[10] This exercise can thereafter be repeated for each product and sector.

The next transformational step is the calculation of the GVA component by sector. As previously mentioned, the total outputs for the sectors do not match the SUTs provided by Geostat, the difference being the GVA. Thus, the GVA can be constructed by deducting sectoral intermediate inputs (g^T in the Use Table) from sectoral outputs ($g^T - w^T$ in the Supply Table). In addition, it is necessary, per sector, to consider taxes minus subsidies, measured above in the GVA calculation.[11]

The final step is the estimation of import usage, across final use sectors and categories, to distinguish domestic (U_d, Y_d) and imported use (U_m, Y_m), as shown in Table 6. The same

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[9] The same calculations are applied to other products (by sector and component of final use), except products with negative trade and transport margins. The 2018 Supply Table contains three goods with negative trade and transport margins: in wholesale and retail trade; the repair of motor vehicles and motorcycles, transportation; and in storage services, financial, and insurance services. To calculate the proportion these products used, by each sector and component of final use, in total use, we divide the sum of trade and transport margins of all other products by sector and component of final use by the sum of total trade and transport margins of all other products.

[10] Due to rounding, numbers presented throughout this report may not add up precisely.

[11] The sum of trade margins is equal to zero, thus it has no effect on calculation of the GVA.

proportional assumption is applied to the import data from the Supply Table. This assumption can be expressed by the following formulas:

$$u_{mij} = m_i \frac{u_{ij}}{q_i} \text{ and } u_{dij} = u_{ij} - u_{mij}$$

$$y_{mik} = m_i \frac{y_{ik}}{q_i} \text{ and } y_{dik} = y_{ik} - y_{mik} \text{ , where}$$

u_{mij} = value of imported products i used as intermediates in sector j

u_{dij} = value of domestic products i used as intermediates in sector j

y_{mik} = value of imported products i used as final use by final use component k

y_{dik} = value of domestic products i used as final use by final use component k

q_i = total use of product i, and

$$q_i = u_i + y_i = (u_{di} + u_{mi}) + (y_{di} + y_{mi}) \text{ or } q_i = x_i + m_i = (u_{di} + y_{di}) + (u_{mi} + y_{mi})$$

Thus, for instance, as the share of intermediate consumption of agricultural goods by agricultural sector in total use of agricultural products is 14.8% ($\frac{u_{ij}}{q_i} = \frac{814}{5,502}$), and the total import of agricultural goods is 786 million GEL (Table 3), the intermediate consumption of imported agricultural goods by agricultural sector is 116 million GEL (u_{mij} = 786 * 14.8%), while domestic use amounts to 698 million GEL (u_{dij} = 814 − 116). Table 9 below shows the Use Table at basic prices and Table 10 reveals the empirical domestic and imported Use Table at basic prices, within the scheme provided in Table 6.

TABLE 9. USE TABLE AT BASIC PRICES, 2018 (MLN. GEL)

Products	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households	Final consumption expenditure by government	Export, total	Gross capital formation	Total Use
(1) Products of Agriculture, forestry and fishing	814	3	1,774	0	0	9	28	3	155	0	0	3	3	2	-	4	5	34	0	-	-	1,648	-	525	493	5,502
(2) Mining and quarrying products	5	48	358	0	0	83	5	17	0	-	0	6	0	0	-	0	0	0	1	-	-	-	-	1,473	33	2,031
(3) Manufactured products	491	182	3,596	134	77	2,347	477	750	625	80	51	101	95	47	415	50	469	128	60	-	-	11,089	-	7,868	3,175	32,305
(4) Electricity, gas, steam and air conditioning	19	39	350	124	25	27	99	49	139	40	34	54	7	5	83	33	65	42	13	-	-	528	-	57	12	1,845
(5) Water supply; sewerage, waste management and remediation services	8	0	11	1	4	4	9	3	24	1	5	10	1	1	0	5	10	5	4	-	-	200	51	138	(1)	495
(6) Constructions and construction works	3	5	122	24	10	1,149	36	17	80	29	13	56	19	3	-	15	36	23	2	-	-	728	6	31	6,285	8,692
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	187	63	1,089	60	26	567	283	290	182	29	24	36	26	21	146	21	130	55	18	-	-	2,765	9	2,130	1,145	9,300
(8) Transportation and storage services	116	36	527	42	11	252	483	650	85	22	46	21	25	73	101	22	54	68	20	-	-	1,117	3	3,448	213	7,433
(9) Accommodation and food services	4	1	19	3	1	14	39	76	35	11	41	2	11	67	121	72	46	59	24	-	-	598	-	2,821	7	4,073
(10) Information and communication services	0	1	12	44	1	53	96	19	10	259	99	6	12	8	56	14	7	13	6	-	-	771	6	378	235	2,108
(11) Financial and insurance services	126	24	308	47	12	231	206	148	99	46	19	437	37	24	24	17	72	51	13	-	-	1,218	49	306	27	3,539
(12) Real estate services	8	3	170	6	2	123	587	94	243	66	225	126	41	74	108	25	63	212	74	-	-	3,401	1	-	1	5,655
(13) Professional, scientific and technical services	5	2	123	100	2	62	92	39	29	38	146	56	182	7	63	12	21	50	18	-	-	310	82	43	113	1,597
(14) Administrative and support service services	1	2	31	21	2	28	74	56	87	36	34	34	24	38	71	20	58	54	6	-	-	502	-	49	4	1,232
(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	6	1	0	0	3	-	0	4	5	0	0	0	0	-	-	592	3,558	249	-	4,420
(16) Education services	0	-	-	-	-	1	1	1	1	5	8	0	2	0	4	8	28	0	1	-	-	1,233	865	37	0	2,196
(17) Human health and social work services	-	4	2	1	0	2	0	2	6	0	0	0	2	0	7	8	151	1	-	-	-	1,546	1,151	5	10	2,900
(18) Arts, entertainment and recreation srvices	-	-	0	0	-	0	0	0	0	16	2	4	0	1	40	9	0	106	1	-	-	284	105	1,607	3	2,179
(19) Other services	0	0	2	17	0	0	23	1	11	13	25	1	19	0	-	2	3	5	7	-	-	494	1	25	(0)	649
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	-	-	-	37
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,789	415	8,494	623	173	4,953	2,544	2,217	1,810	690	774	954	507	375	1,244	337	1,219	907	268	-	-	29,059	5,886	21,194	11,756	98,190
Taxes less subsidies	80	33	603	29	14	427	95	128	111	23	17	28	20	10	73	11	80	28	11	-	-	1,852	4	1,355	787	5,821
Gross Value Added	3,016	457	3,940	980	293	3,213	5,406	2,462	1,800	1,077	2,350	4,431	1,005	510	2,900	1,740	1,633	1,182	347	37	-					38,779
Output	4,885	904	13,038	1,633	479	8,593	8,046	4,807	3,721	1,790	3,141	5,413	1,532	896	4,217	2,089	2,932	2,118	626	37	-	30,911	5,891	22,549	12,543	

Source: Geostat, Authors' calculations

TABLE 10. DOMESTIC AND IMPORTED USE TABLE AT BASIC PRICES, 2018 (MLN. GEL)

	Sectors (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households	Final consumption expenditure by government	Export, total	Gross capital formation	Total Use
Domestic products																										
(1) Products of Agriculture, forestry and fishing	698	2	1,520	0	0	7	24	2	132	0	0	2	3	2	-	4	4	29	0	-	-	1,413	-	450	423	4,717
(2) Mining and quarrying products	2	20	148	0	0	34	2	7	0	-	0	2	0	0	-	0	0	0	0	-	-	-	-	608	14	838
(3) Manufactured products	191	71	1,400	52	30	914	186	292	243	31	20	39	37	18	162	19	182	50	23	-	-	4,316	-	3,062	1,236	12,573
(4) Electricity, gas, steam and air conditioning	17	35	316	112	23	24	89	44	125	36	30	49	6	5	74	30	59	37	12	-	-	476	-	52	11	1,664
(5) Water supply; sewerage, waste management and remediation services	8	0	10	1	3	4	8	3	22	1	4	10	1	1	0	5	10	5	4	-	-	187	48	129	1	462
(6) Constructions and construction works	3	5	121	24	10	1,146	35	17	79	29	13	56	19	3	-	15	36	23	2	-	-	726	6	31	6,267	8,667
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	177	60	1,031	56	25	537	268	275	172	27	22	35	25	20	138	20	123	52	17	-	-	2,617	8	2,017	1,084	8,805
(8) Transportation and storage services	72	23	330	26	7	157	302	406	53	14	29	13	15	45	63	14	34	42	12	-	-	698	2	2,156	133	4,648
(9) Accommodation and food services	3	1	17	3	1	12	35	68	32	10	37	2	10	60	108	65	42	53	22	-	-	537	-	2,534	7	3,659
(10) Information and communication services	0	1	10	37	1	45	81	16	9	218	83	5	10	7	47	12	6	11	5	-	-	649	5	319	198	1,775
(11) Financial and insurance services	112	22	274	41	11	205	183	132	88	41	17	389	33	21	21	15	64	45	11	-	-	1,083	43	272	24	3,147
(12) Real estate services	8	3	170	6	2	123	587	94	243	66	225	126	41	74	108	25	63	212	74	-	-	3,401	1	-	1	5,655
(13) Professional, scientific and technical services	5	1	109	88	2	55	82	35	26	34	130	50	161	6	56	11	19	45	16	-	-	275	73	38	100	1,415
(14) Administrative and support service services	1	2	23	15	1	21	55	42	65	27	25	25	18	28	53	15	43	40	4	-	-	374	-	37	3	919
(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	6	1	0	0	0	3	-	0	3	5	0	0	0	-	-	566	3,405	239	-	4,230
(16) Education services	0	-	1	0	-	1	1	1	1	5	8	0	2	0	4	8	27	0	1	-	-	1,172	823	35	0	2,089
(17) Human health and social work services	-	4	2	1	0	2	0	2	6	0	0	0	2	0	7	8	150	1	-	-	-	1,528	1,138	5	10	2,866
(18) Arts, entertainment and recreation srvices	-	-	0	0	-	0	0	0	0	15	2	4	0	1	39	9	0	102	1	-	-	275	102	1,558	3	2,112
(19) Other services	0	0	2	17	0	0	22	1	10	12	24	1	18	0	-	2	3	5	7	-	-	470	1	24	(0)	618
(20) Services of households as employers; undifferentiated goods and services producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	-	-	-	37
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Imported products																										
(1) Products of Agriculture, forestry and fishing	116	0	253	0	0	1	4	0	22	0	0	0	0	0	-	1	1	5	0	-	-	235	-	75	70	786
(2) Mining and quarrying products	3	28	210	0	0	49	3	10	0	-	0	3	0	0	-	0	0	0	0	-	-	-	-	865	20	1,192
(3) Manufactured products	300	111	2,196	82	47	1,434	291	458	382	49	31	62	58	28	254	30	286	78	37	-	-	6,773	-	4,806	1,939	19,732
(4) Electricity, gas, steam and air conditioning	2	4	34	12	2	3	10	5	14	4	3	5	1	1	8	3	6	4	1	-	-	52	-	6	1	181
(5) Water supply; sewerage, waste management and remediation services	1	0	1	0	0	0	1	0	2	0	0	1	0	0	0	0	1	0	0	-	-	13	3	9	(0)	33
(6) Constructions and construction works	0	0	0	0	0	3	0	0	0	0	0	0	0	0	-	0	0	0	0	-	-	2	0	0	18	25
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	10	3	58	3	1	30	15	15	10	2	1	2	1	1	8	1	7	3	1	-	-	147	0	113	61	495
(8) Transportation and storage services	43	14	197	16	4	94	181	243	32	8	17	8	9	27	38	8	20	25	7	-	-	419	1	1,292	80	2,785
(9) Accommodation and food services	0	0	2	0	0	1	4	8	4	1	4	0	1	7	12	7	5	6	2	-	-	61	-	287	1	414
(10) Information and communication services	0	0	2	7	0	8	15	3	2	41	16	1	2	1	9	2	1	2	1	-	-	122	1	60	37	333
(11) Financial and insurance services	14	3	34	5	1	26	23	16	11	5	2	48	4	3	3	2	8	6	1	-	-	135	5	34	3	392
(12) Real estate services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(13) Professional, scientific and technical services	1	0	14	11	0	7	10	4	3	4	17	6	21	1	7	1	2	6	2	-	-	35	9	5	13	182
(14) Administrative and support service services	0	1	8	5	0	7	19	14	22	9	9	9	6	10	18	5	15	14	2	-	-	128	-	12	1	314
(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	0	0	-	-	26	153	11	-	190
(16) Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-	-	60	42	2	0	107
(17) Human health and social work services	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	-	-	-	18	13	0	0	34
(18) Arts, entertainment and recreation srvices	-	-	0	0	-	0	0	0	0	0	0	0	0	0	1	0	0	3	0	-	-	9	3	50	0	68
(19) Other services	0	0	0	1	0	0	1	0	1	1	1	0	1	0	-	0	0	0	0	-	-	24	0	1	(0)	31
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,789	415	8,494	623	173	4,953	2,544	2,217	1,810	690	774	954	507	375	1,244	337	1,219	907	268	-	-	29,059	5,886	21,194	11,756	98,190
Taxes less subsidies	80	33	603	29	14	427	95	128	111	23	17	28	20	10	73	11	80	28	11	-	-	1,852	4	1,355	787	5,821
Gross Value Added	3,016	457	3,940	980	293	3,213	5,406	2,462	1,800	1,077	2,350	4,431	1,005	510	2,900	1,740	1,633	1,182	347	37	-					38,779
Output	4,885	904	13,038	1,633	479	8,593	8,046	4,807	3,721	1,790	3,141	5,413	1,532	896	4,217	2,089	2,932	2,118	626	37	-	29,059	5,886	21,194	11,756	

Source: Geostat, Authors' calculations

3.1.4. CONVERSION OF SUPPLY-USE TABLES TO INPUT-OUTPUT TABLE

The literature suggests four main transformation models for compiling an Input-Output Table from Supply and Use Tables (United Nations, 2018), based on the following assumptions:

- **Model A - Product technology assumption:** each product is produced in its own specific way, irrespective of the sector where it is produced;
- **Model B - Sector technology assumption:** each sector has its own specific way of production, irrespective of its product mix;
- **Model C - Fixed sector sales structure assumption:** each sector has its own specific sales structure, irrespective of its product mix;
- **Model D - Fixed product sales structure assumption:** each product has its own specific sales structure, irrespective of the sector where it is produced.

Product by Product IOTs are derived from the technology assumptions (models A and B), whereas sector by sector IOTs are constructed around the sales structure (models C and D). Sales structure assumptions are weaker as they only utilize observed sales structures for the current year, while technology assumptions are based on a production theory that cannot be supported by the statistical data. Besides which, models B and C are considered less realistic than A and D, which are commonly used worldwide for official statistics.

Therefore, model D is the most suitable for deriving a Sector by Sector IOT for Georgia. The same method has been fully or partially adopted by Denmark, the Netherlands, Finland, Norway, Canada, the US, and the OECD (Yamano & Ahmad, 2006). One key advantage of the model is that no negative entries appear when deriving IOTs, which simplifies the procedure considerably.

Consequently, a Sector by Sector IOT can be derived from the SUTs represented in Tables 2 and 6, as shown in Box 1. The corresponding Sector by Sector IOT for Georgia at basic prices is illustrated in Table 11 below.

BOX 1. COMPILING A SECTOR BY SECTOR INPUT-OUTPUT TABLE (MODEL D)

Supply Table at basic prices

	Sectors	Output	Imports	Supply
Products	V^T	x	m	q
Total	g^T	x'	m'	q'

Use Table at basic prices

	Sectors	Final use	Use
Domestic products	U_d	Y_d	x
Imported products	U_m	Y_m	m
GVA	w^T		w'
Total	g^T	y	

Input-Output Table at basic prices

	Sectors	Final use	Output
Domestic sectors	$B_d = V * (\hat{x})^{-1} * U_d$	$F_d = V * (\hat{x})^{-1} * Y_d$	g
Imports from sectors	$B_m = V * (\hat{x})^{-1} * U_m$	$F_m = V * (\hat{x})^{-1} * Y_m$	m
GVA	w^T		w'
Output	g^T	y	

V = Output matrix - transpose of Supply matrix (sector by product);
V^T = Supply matrix (product by sector);
U = Use matrix for intermediates (product by sector);
Y = Final use matrix (product by category);
F = Final use matrix (sector by category);
B = Matrix for intermediates (sector by sector);
$\hat{x}$ = Diagonal matrix of product output;
y = Row vector of final use;
w = Column vector of gross value added;
w^T = Row vector of gross value added
x = Column vector of product output;
x^T = Row vector of product output;
g = Column vector of sector output;
g^T = Row vector of sector output;
m = Column vector of total imports;
d = Index for domestic origin;
m = Index for imported origin;
' = Index for the total value of row or column sum
[ ] = empty cells

Source: Handbook on Supply, Use and Input-Output Tables with Extensions and Applications, United Nations (2018)

TABLE 11. SECTOR BY SECTOR IOT FOR GEORGIA AT BASIC PRICES, 2018 (MLN. GEL)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households	Final consumption expenditure by government	Export, total	Gross capital formation	Total Use
Domestic products	(1) Products of Agriculture, forestry and fishing	700	3	1,536	1	0	19	29	7	136	1	1	3	3	2	3	4	7	30	1	-	-	1,464	0	490	444	4,885
	(2) Mining and quarrying products	3	20	148	0	0	40	6	9	2	1	1	3	0	1	1	0	1	1	1	-	-	29	0	599	38	904
	(3) Manufactured products	198	73	1,436	55	31	942	201	304	252	33	23	42	39	21	169	21	188	54	25	-	-	4,419	1	3,163	1,350	13,038
	(4) Electricity, gas, steam and air conditioning	17	34	304	108	22	28	86	43	120	35	30	47	7	5	72	29	57	36	11	-	-	460	0	50	34	1,633
	(5) Water supply; sewerage, waste management and remediation services	8	1	13	2	4	5	9	3	23	1	5	10	1	1	1	5	10	5	4	-	-	192	48	129	1	479
	(6) Constructions and construction works	5	6	132	25	10	1,118	42	22	81	29	15	56	20	4	4	16	37	25	3	-	-	765	6	86	6,084	8,593
	(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	160	55	941	55	23	487	248	251	160	27	23	34	23	19	128	19	114	50	16	-	-	2,395	8	1,828	983	8,046
	(8) Transportation and storage services	74	23	342	27	7	165	310	407	59	16	32	15	17	47	67	14	37	46	13	-	-	773	3	2,161	150	4,807
	(9) Accommodation and food services	4	1	21	3	1	21	45	69	36	11	40	4	11	60	108	63	42	56	23	-	-	590	10	2,463	39	3,721
	(10) Information and communication services	1	1	14	37	1	47	81	17	10	213	82	6	11	7	48	12	7	11	5	-	-	650	5	323	202	1,790
	(11) Financial and insurance services	112	22	273	41	11	205	183	131	88	41	17	388	33	21	21	15	64	45	11	-	-	1,081	43	272	24	3,141
	(12) Real estate services	8	3	164	6	2	121	556	90	231	63	213	120	39	71	103	24	61	202	70	-	-	3,228	1	18	19	5,413
	(13) Professional, scientific and technical services	7	2	124	88	2	63	85	39	28	34	128	49	158	6	57	11	20	45	16	-	-	312	72	70	116	1,532
	(14) Administrative and support service services	1	2	24	15	1	21	53	39	59	29	25	23	17	26	49	14	40	37	4	-	-	360	0	48	9	896
	(15) Public administration and defence; compulsory social security services	-	-	0	0	1	0	6	1	0	0	3	-	0	3	5	0	0	0	0	-	-	565	3,394	238	-	4,217
	(16) Education services	0	0	1	0	0	1	1	1	1	5	8	1	2	0	4	8	27	0	1	-	-	1,171	821	36	0	2,089
	(17) Human health and social work services	1	4	7	2	0	5	4	4	8	1	1	1	2	1	8	8	150	1	0	-	-	1,555	1,138	15	14	2,932
	(18) Arts, entertainment and recreation srvices	0	0	1	0	0	0	1	0	1	15	2	4	1	1	39	9	0	102	1	-	-	282	102	1,551	3	2,118
	(19) Other services	0	0	3	16	0	1	22	1	10	12	24	1	18	0	0	2	3	5	7	-	-	471	1	27	1	626
	(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	-	-	-	37
	(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Imported products	(1) Products of Agriculture, forestry and fishing	118	1	268	1	0	11	6	4	25	0	0	1	1	1	2	1	3	5	0	-	-	280	0	110	83	921
	(2) Mining and quarrying products	3	28	206	0	0	49	3	11	0	0	0	3	0	0	0	0	0	0	0	-	-	6	0	845	21	1,178
	(3) Manufactured products	296	110	2,172	81	46	1,416	289	454	377	48	31	61	57	28	251	30	283	78	36	-	-	6,687	0	4,764	1,915	19,512
	(4) Electricity, gas, steam and air conditioning	2	4	33	12	2	3	9	5	13	4	3	5	1	1	8	3	6	4	1	-	-	50	0	5	1	175
	(5) Water supply; sewerage, waste management and remediation services	1	0	1	0	0	0	1	0	2	0	0	1	0	0	0	0	1	0	0	-	-	14	3	9	(0)	35
	(6) Constructions and construction works	1	1	11	1	0	9	2	3	2	0	0	1	0	0	1	0	1	1	0	-	-	30	0	30	25	121
	(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	9	3	56	3	1	29	15	15	10	2	1	2	1	1	8	1	7	3	1	-	-	142	0	112	57	481
	(8) Transportation and storage services	43	14	198	16	4	95	180	242	32	9	18	8	9	27	38	8	21	26	7	-	-	425	1	1,283	81	2,785
	(9) Accommodation and food services	1	0	3	0	0	2	4	8	4	1	4	0	1	7	12	7	5	6	2	-	-	63	0	281	2	415
	(10) Information and communication services	0	0	2	7	0	8	15	3	2	40	15	1	2	1	9	2	1	2	1	-	-	120	1	59	37	330
	(11) Financial and insurance services	14	3	34	5	1	26	23	16	11	5	2	48	4	3	3	2	8	6	1	-	-	135	5	34	3	392
	(12) Real estate services	0	0	2	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	-	-	7	0	6	2	23
	(13) Professional, scientific and technical services	1	0	15	11	0	8	11	5	3	4	16	6	20	1	7	1	2	6	2	-	-	37	9	7	14	188
	(14) Administrative and support service services	0	1	8	5	0	7	18	13	20	9	8	8	6	9	17	5	14	12	1	-	-	122	0	16	3	302
	(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	0	0	-	-	25	153	11	-	190
	(16) Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-	-	60	42	2	0	108
	(17) Human health and social work services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	-	-	19	13	1	0	36
	(18) Arts, entertainment and recreation srvices	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	-	-	9	3	50	0	68
	(19) Other services	0	0	0	1	0	0	1	0	1	1	1	0	1	0	0	0	0	0	0	-	-	24	0	2	0	33
	(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxes less Subsidies		80	33	603	29	14	427	95	128	111	23	17	28	20	10	73	11	80	28	11	-	-	1,852	4	1,355	787	5,821
Gross Value Added		3,016	457	3,940	980	293	3,213	5,406	2,462	1,800	1,077	2,350	4,431	1,005	510	2,900	1,740	1,633	1,182	347	37	-					38,779
Inputs at Basic prices		4,885	904	13,038	1,633	479	8,593	8,046	4,807	3,721	1,790	3,141	5,413	1,532	896	4,217	2,089	2,932	2,118	626	37	-	30,911	5,891	22,549	12,543	

Source: Geostat, Authors' calculations

The gross value added is divided between employee compensation and its other components. This is simply because the former GVA component is used in computing Type II multipliers at a later stage.

For correctly capturing induced effects in the model, we aggregate the two main sources of employee compensation: the annual salaries of hired people and the self-employed. The distribution of annual salaries of hired employees, by sector, is obtained from Enterprise Survey data, provided by Geostat.[12] We estimate the salary component of the mixed income from entrepreneurial profit to calculate the annual salaries of the self-employed (using the average monthly salaries of waged employees).[13]

Finally, imported products are aggregated in a row vector, as a detailed structure of imports is unnecessary for the calculation of multipliers. Table 12 shows a 21x21 IOT at basic prices for 2018, which acts as the base for calculating input coefficients and constructing the Leontief inverse matrix.

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[12] The Enterprise and non-business sector survey data.
[13] Annual salaries for the self-employed are adjusted by the ratio of the normal length of full-time employment (the average number of actually worked hours) for the self-employed and those salaried.

TABLE 12. IOT FOR GEORGIA AT BASIC PRICES, 2018 (MLN. GEL)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households	Final consumption expenditure by government	Export, total	Gross capital formation	Total Use
(1) Products of Agriculture, forestry and fishing	700	3	1,536	1	0	19	29	7	136	1	1	3	3	2	3	4	7	30	1	-	-	1,464	0	490	444	4,885
(2) Mining and quarrying products	3	20	148	0	0	40	6	9	2	1	1	3	0	1	1	0	1	1	1	-	-	29	0	599	38	904
(3) Manufactured products	198	73	1,436	55	31	942	201	304	252	33	23	42	39	21	169	21	188	54	25	-	-	4,419	1	3,163	1,350	13,038
(4) Electricity, gas, steam and air conditioning	17	34	304	108	22	28	86	43	120	35	30	47	7	5	72	29	57	36	11	-	-	460	0	50	34	1,633
(5) Water supply; sewerage, waste management and remediation services	8	1	13	2	4	5	9	3	23	1	5	10	1	1	1	5	10	5	4	-	-	192	48	129	1	479
(6) Constructions and construction works	5	6	132	25	10	1,118	42	22	81	29	15	56	20	4	4	16	37	25	3	-	-	765	6	86	6,084	8,593
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	160	55	941	55	23	487	248	251	160	27	23	34	23	19	128	19	114	50	16	-	-	2,395	8	1,828	983	8,046
(8) Transportation and storage services	74	23	342	27	7	165	310	407	59	16	32	15	17	47	67	14	37	46	13	-	-	773	3	2,161	150	4,807
(9) Accommodation and food services	4	1	21	3	1	21	45	69	36	11	40	4	11	60	108	63	42	56	23	-	-	590	10	2,463	39	3,721
(10) Information and communication services	1	1	14	37	1	47	81	17	10	213	82	6	11	7	48	12	7	11	5	-	-	650	5	323	202	1,790
(11) Financial and insurance services	112	22	273	41	11	205	183	131	88	41	17	388	33	21	21	15	64	45	11	-	-	1,081	43	272	24	3,141
(12) Real estate services	8	3	164	6	2	121	556	90	231	63	213	120	39	71	103	24	61	202	70	-	-	3,228	1	18	19	5,413
(13) Professional, scientific and technical services	7	2	124	88	2	63	85	39	28	34	128	49	158	6	57	11	20	45	16	-	-	312	72	70	116	1,532
(14) Administrative and support service services	1	2	24	15	1	21	53	39	59	29	25	23	17	26	49	14	40	37	4	-	-	360	0	48	9	896
(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	6	1	0	0	3	-	0	3	5	0	0	0	0	-	-	565	3,394	238	-	4,217
(16) Education services	0	0	1	0	0	1	1	1	1	5	8	1	2	0	4	8	27	0	1	-	-	1,171	821	36	0	2,089
(17) Human health and social work services	1	4	7	2	0	5	4	4	8	1	1	1	2	1	8	8	150	3	0	-	-	1,555	1,138	15	14	2,932
(18) Arts, entertainment and recreation srvices	0	0	1	0	0	0	1	0	1	15	2	4	1	1	39	9	0	102	1	-	-	282	102	1,551	3	2,118
(19) Other services	0	0	3	16	0	1	22	1	10	12	24	1	18	0	0	2	3	5	7	-	-	471	1	27	1	626
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	-	-	-	37
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Imported Products	490	164	3,011	143	57	1,664	578	779	503	124	102	146	105	79	358	63	356	153	56	-	-	8,258	233	7,627	2,244	27,293
Taxes less Subsidies	80	33	603	29	14	427	95	128	111	23	17	28	20	10	73	11	80	28	11	-	-	1,852	4	1,355	787	5,821
GVA Compensations of Employees	2,728	160	1,253	288	212	2,121	2,772	1,331	493	507	1,045	241	794	311	1,993	1,364	1,117	558	200	37	-					38,779
Other Components of Gross Values Added	288	298	2,687	692	80	1,093	2,634	1,130	1,307	570	1,305	4,190	210	200	906	376	516	624	147	-	-					
Inputs at Basic prices	4,885	904	13,038	1,633	479	8,593	8,046	4,807	3,721	1,790	3,141	5,413	1,532	896	4,217	2,089	2,932	2,118	626	37	-	30,911	5,891	22,549	12,543	

Source: Geostat, Authors' calculations

3.2. CALCULATING INPUT COEFFICIENTS AND CONSTRUCTING THE LEONTIEF INVERSE MATRIX

3.2.1. INPUT COEFFICIENTS

The basic Leontief model analysis presented in our methodology follows the instructions detailed by Miller and Blair (2009), the UN Handbook (2018), and the Eurostat *Manual of Supply, Use and Input-Output Tables* (2008). The IO analysis for indirect impact assessment begins with the calculation of input coefficients. The inter-sectoral transactions are converted from the Input-Output Table into matrix A of input coefficients, which shows the direct input requirements for each sector in order to produce one unit of output; matrix A is also often referred to as an IO coefficients matrix or technical coefficients matrix. It shows the fixed relationships between a sector's output and inputs, representing the production structure of the economy. Subsequently, it is possible to use the matrix algebra to derive a Leontief inverse matrix and multiplier formula, which can be applied to any number of sectors and various input coefficients.

Table 13, below, displays the input coefficients for the derived Input-Output Table (Table 12). The input coefficients are calculated by dividing the values of each entry of the Input-Output Table by the corresponding column total. The input coefficients for the sectors (1 to 21) can be interpreted as the cost shares for domestic and imported products (goods and services) and primary inputs (elements of gross value added, such as employee compensation) in the total output of a sector. As the input coefficients cover all inputs, including intermediates and gross value added, they combine to unity in columns.

For the intermediate consumption of domestic products, the input coefficients for each sector constitute the elements of matrix A (the blue shaded area in Table 13) and are defined as:

$a_{ij} = x_{ij}/x_j$ – input coefficients of domestic intermediates, where

a_{ij} – monetary input coefficient for domestic goods and services

x_{ij} – value of domestic product of sector i used by sector j

x_j – value of output of sector j

The column vector for household consumption coefficients shows the spending pattern of households by sector. For additional earnings, households are assumed to spend a fixed proportion of their income on each sector's output.

TABLE 13. INPUT COEFFICIENTS OF THE INPUT-OUTPUT TABLE

Industry NACE rev.2 / Product CPA 2008	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households	Final consumption expenditure by government	Export	Gross capital formation
(1) Products of Agriculture, forestry and fishing	0.1434	0.0033	0.1179	0.0005	0.0007	0.0015	0.0035	0.0013	0.0371	0.0003	0.0002	0.0006	0.0020	0.0024	0.0003	0.0019	0.0022	0.0143	0.0008	0.0000	0.0000	0.0479	0.0000	0.0217	0.0348
(2) Mining and quarrying products	0.0005	0.0217	0.0115	0.0002	0.0003	0.0051	0.0008	0.0018	0.0006	0.0003	0.0004	0.0006	0.0003	0.0007	0.0002	0.0001	0.0003	0.0006	0.0012	0.0000	0.0000	0.0009	0.0000	0.0265	0.0030
(3) Manufactured products	0.0505	0.0315	0.1332	0.0083	0.0556	0.1374	0.0188	0.0134	0.1044	0.0067	0.0046	0.0108	0.0256	0.0169	0.0289	0.0088	0.0460	0.0254	0.0254	0.0000	0.0000	0.1581	0.0001	0.1522	0.0318
(4) Electricity, gas, steam and air conditioning	0.0034	0.0375	0.0233	0.0660	0.0457	0.0032	0.0107	0.0089	0.0324	0.0194	0.0095	0.0087	0.0044	0.0051	0.0170	0.0138	0.0194	0.0171	0.0183	0.0000	0.0000	0.0149	0.0000	0.0022	0.0027
(5) Water supply; sewerage, waste management and remediation services	0.0016	0.0006	0.0010	0.0009	0.0076	0.0005	0.0011	0.0007	0.0063	0.0007	0.0015	0.0019	0.0005	0.0016	0.0002	0.0023	0.0034	0.0026	0.0058	0.0000	0.0000	0.0062	0.0081	0.0057	0.0001
(6) Constructions and construction works	0.0010	0.0068	0.0104	0.0151	0.0211	0.1319	0.0053	0.0045	0.0218	0.0164	0.0047	0.0104	0.0127	0.0050	0.0008	0.0076	0.0126	0.0119	0.0042	0.0000	0.0000	0.0246	0.0010	0.0035	0.4847
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	0.0325	0.0804	0.0736	0.0412	0.0449	0.0547	0.0310	0.0646	0.0422	0.0149	0.0068	0.0056	0.0127	0.0212	0.0263	0.0084	0.0547	0.0210	0.0258	0.0000	0.0000	0.0814	0.0014	0.0748	0.0720
(8) Transportation and storage services	0.0152	0.0302	0.0266	0.0183	0.0147	0.0188	0.0385	0.0876	0.0156	0.0089	0.0103	0.0027	0.0105	0.0523	0.0151	0.0068	0.0162	0.0212	0.0212	0.0000	0.0000	0.0259	0.0005	0.0944	0.0105
(9) Accommodation and food services	0.0007	0.0014	0.0016	0.0021	0.0014	0.0026	0.0056	0.0143	0.0097	0.0063	0.0128	0.0008	0.0071	0.0672	0.0255	0.0304	0.0144	0.0262	0.0361	0.0000	0.0000	0.0191	0.0018	0.1092	0.0030
(10) Information and communication services	0.0002	0.0009	0.0011	0.0189	0.0018	0.0035	0.0098	0.0026	0.0026	0.1296	0.0235	0.0011	0.0074	0.0080	0.0129	0.0064	0.0024	0.0051	0.0094	0.0000	0.0000	0.0240	0.0008	0.0137	0.0106
(11) Financial and insurance services	0.0230	0.0247	0.0210	0.0257	0.0220	0.0238	0.0227	0.0278	0.0236	0.0229	0.0053	0.0717	0.0216	0.0236	0.0048	0.0070	0.0224	0.0213	0.0182	0.0000	0.0000	0.0351	0.0073	0.0118	0.0016
(12) Real estate services	0.0017	0.0033	0.0125	0.0034	0.0052	0.0141	0.0691	0.00?8	0.0621	0.0352	0.0679	0.0221	0.0256	0.0789	0.0247	0.0115	0.0206	0.0953	0.1119	0.0000	0.0000	0.1044	0.0002	0.0008	0.0016
(13) Professional, scientific and technical services	0.0014	0.0029	0.0088	0.0558	0.0042	0.0074	0.0097	0.0086	0.0075	0.0184	0.0385	0.0093	0.1001	0.0066	0.0122	0.0051	0.0066	0.0201	0.0227	0.0000	0.0000	0.0106	0.0143	0.0031	0.0097
(14) Administrative and support service services	0.0002	0.0019	0.0018	0.0096	0.0029	0.0028	0.0065	0.0082	0.0160	0.0143	0.0083	0.0043	0.0109	0.0289	0.0115	0.0065	0.0135	0.0174	0.0066	0.0000	0.0000	0.0112	0.0000	0.0022	0.0016
(15) Public administration and defence; compulsory social security services	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0008	0.0003	0.0000	0.0000	0.0010	0.0000	0.0000	0.0038	0.0012	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0183	0.5763	0.0105	0.0000
(16) Education services	0.0000	0.0000	0.0001	0.0002	0.0000	0.0001	0.0001	0.0002	0.0002	0.0026	0.0025	0.0001	0.0015	0.0003	0.0010	0.0037	0.0090	0.0002	0.0013	0.0000	0.0000	0.0379	0.1394	0.0016	0.0000
(17) Human health and social work services	0.0002	0.0047	0.0005	0.0010	0.0002	0.0005	0.0005	0.0009	0.0020	0.0003	0.0004	0.0002	0.0015	0.0007	0.0019	0.0038	0.0513	0.0012	0.0007	0.0000	0.0000	0.0504	0.1928	0.0006	0.0011
(18) Arts, entertainment and recreation srvices	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0002	0.0001	0.0002	0.0085	0.0008	0.0008	0.0005	0.0009	0.0093	0.0044	0.0001	0.0483	0.0012	0.0000	0.0000	0.0091	0.0173	0.0688	0.0003
(19) Other services	0.0001	0.0004	0.0002	0.0101	0.0007	0.0001	0.0028	0.0002	0.0028	0.0067	0.0076	0.0002	0.0115	0.0003	0.0001	0.0009	0.0012	0.0022	0.0109	0.0000	0.0000	0.0152	0.0001	0.0012	0.0001
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000
(21) Services provided by of extra-territorial organisations and bodies	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Imported Products	0.0901	0.1805	0.2014	0.0924	0.1329	0.1729	0.0785	0.1810	0.1015	0.0715	0.0399	0.0251	0.0746	0.0932	0.1005	0.0321	0.1343	0.0770	0.1076	0.0000	0.0000	0.2407	0.0384	0.3414	0.2725
Taxes less Subsidies	0.0169	0.0619	0.0513	0.0297	0.0273	0.0451	0.0122	0.0425	0.0277	0.0142	0.0054	0.0046	0.0131	0.0128	0.0181	0.0055	0.0122	0.0132	0.0169	0.0000	0.0000	0.0629	0.0002	0.0541	0.0584
Compensations of Employees	0.5585	0.1765	0.0961	0.1765	0.4432	0.2468	0.3446	0.2769	0.1326	0.2834	0.3328	0.0446	0.5185	0.3467	0.4727	0.6530	0.3809	0.2636	0.3191	1.0000					
Other Components of Gross Values Added	0.0589	0.3289	0.2061	0.4238	0.1675	0.1272	0.3274	0.2352	0.3512	0.3184	0.4155	0.7739	0.1374	0.2229	0.2149	0.1800	0.1761	0.2947	0.2345	0.0000	0.0000				
Inputs at Basic prices	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000

Source: Authors' calculations

3.2.2. THE LEONTIEF MODEL

Often final demand changes which produces the need for adjustments to the total output. In certain cases, a new plan for the total output may be known and the quantities of final demand, available at a new output level, are of interest. The objective of this analysis is to calculate the levels of unknown activity (e.g., output) for each sector (endogenous variables), with the exogenously given final uses. To resolve this issue, a matrix algebra is used for the Input-Output system, the best-known of which is the Leontief model.

Our Input-Output model takes a linear form, based on Leontief production functions and a vector of final uses. When considering a sector as productive, besides final demand or consumption (used, for example, in governmental institutions and households), one can suggest the output of a sector is used as an input for many other areas. This relation is typically provided in IOT rows, and can be expressed as a general equation of an i-th row:

$\sum_{j=1}^{n} x_{ij} + y_i = x_i$, where

x_{ij}= value of intermediates from sector i that is used in sector j

y_i= value of products of i-th sector for final use

x_i = value of total output of sector i

For example, the equation of the first row is thus: $\sum_{j=1}^{n} x_{1j} + y_1 = x_1$

To further explain the logic behind this model, we have represented an economy with three sectors. The equations below describe the balance between the total inputs (intermediate use and final use) and outputs:

$$x_{11} + x_{12} + x_{13} + y_1 = x_1 \quad (1)$$
$$x_{21} + x_{22} + x_{23} + y_2 = x_2 \quad (2)$$
$$x_{31} + x_{32} + x_{33} + y_3 = x_3 \quad (3)$$

Assuming that all sectors of the economy produce with linear Leontief production functions, it entails using fixed (technologically pre-determined) proportions for all inputs (intermediate consumption, capital, labor) in relation to output. There is no input substitution allowed in the model, therefore price changes do not affect the technical input coefficients.

From the input coefficients formula derived above, $a_{ij=}x_{ij}/x_j$, it is possible to define the requirements for intermediate consumption as $x_{ij=}a_{ij}x_j$ – the set of input coefficients weighted with the corresponding sectors' output levels. In these first three equations, one can substitute x_{ij} with $a_{ij}x_j$ to discern the Input-Output system in the following form:

$$a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + y_1 = x_1 \quad (4)$$
$$a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + y_2 = x_2 \quad (5)$$
$$a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + y_3 = x_3 \quad (6)$$

Applying the rules of multiplication, it can be rewritten as:

$$\begin{bmatrix} a_{11} & \cdots & a_{13} \\ \vdots & \ddots & \vdots \\ a_{31} & \cdots & a_{33} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

or

$$Ax + y = x \quad (7)$$

Thereafter, to transform these equations into the Leontief system, one can isolate the final demand (exogenous variable y) on the right-side of the equation to obtain the Leontief matrix:

$$(1 - a_{11})x_1 - a_{12}x_2 - a_{13}x_3 = y_1 \qquad (8)$$
$$- a_{21}x_1 + (1 - a_{22})x_2 - a_{23}x_3 = y_2 \qquad (9)$$
$$- a_{31}x_1 - a_{32}x_2 + (1 - a_{33})x_3 = y_3 \qquad (10)$$

The diagonal elements of a Leontief matrix $(I - A)$, given in Table 14 below, reveal the net output (output less intra-sector internal consumption) for each sector with positive coefficients (revenues). The remaining elements of the matrix show the input requirements with the negative coefficients (costs).

As a matrix, equations (8), (9), and (10) can be expressed as:

$$\begin{bmatrix} 1 - a_{11} & \cdots & -a_{13} \\ \vdots & \ddots & \vdots \\ -a_{31} & \cdots & 1 - a_{33} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$$

or defined as:

$$x - Ax = y \qquad (11)$$

$$(I - A)x = y. \quad (12)$$

If the input coefficients and total output are known, the vector of final demand can be found using equation (12). To find the total output, when the input coefficients and final demand are identifiable, one must solve equation (12) for vector x, to acquire a solution for the IO system:

$$x = (I - A)^{-1}y \quad (13), \text{ where}$$

A = matrix of monetary input coefficients for intermediate consumption with $A = a_{ij}$

I = unit matrix

$(I - A)$ = Leontief matrix

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

y = vector of exogenous aggregate final demand (value)

x = vector of output (value)

From the Leontief inverse matrix $(I - A)^{-1}$, the solution to the IO system indicates that total output production on the economy is determined by the final demand. The Leontief inverse, $(I - A)^{-1}$ shown in Table 15, reflects the direct and indirect requirements for domestic intermediates for one unit of a product for final use. Therefore, for the derivation of sector-specific multipliers, the Leontief inverse matrix is key.

TABLE 14. LEONTIEF MATRIX $(I - A)$

Product CPA 2008 \ Industry NACE rev.2	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1) Products of Agriculture, forestry and fishing	0.8568	(0.0036)	(0.1178)	(0.0006)	(0.0009)	(0.0022)	(0.0036)	(0.0015)	(0.0365)	(0.0004)	(0.0003)	(0.0006)	(0.0022)	(0.0026)	(0.0006)	(0.0020)	(0.0022)	(0.0143)	(0.0010)	-	-
(2) Mining and quarrying products	(0.0005)	0.9783	(0.0114)	(0.0003)	(0.0003)	(0.0046)	(0.0008)	(0.0018)	(0.0006)	(0.0003)	(0.0004)	(0.0006)	(0.0003)	(0.0007)	(0.0003)	(0.0001)	(0.0003)	(0.0006)	(0.0012)	-	-
(3) Manufactured products	(0.0405)	(0.0807)	0.8899	(0.0336)	(0.0643)	(0.1097)	(0.0250)	(0.0633)	(0.0677)	(0.0185)	(0.0072)	(0.0078)	(0.0252)	(0.0230)	(0.0400)	(0.0102)	(0.0641)	(0.0257)	(0.0394)	-	-
(4) Electricity, gas, steam and air conditioning	(0.0034)	(0.0375)	(0.0233)	0.9339	(0.0457)	(0.0032)	(0.0107)	(0.0089)	(0.0324)	(0.0194)	(0.0094)	(0.0087)	(0.0044)	(0.0051)	(0.0170)	(0.0138)	(0.0194)	(0.0171)	(0.0183)	-	-
(5) Water supply; sewerage, waste management and remediation services	(0.0016)	(0.0006)	(0.0010)	(0.0009)	0.9924	(0.0005)	(0.0011)	(0.0007)	(0.0063)	(0.0007)	(0.0015)	(0.0019)	(0.0005)	(0.0016)	(0.0002)	(0.0023)	(0.0034)	(0.0026)	(0.0058)	-	-
(6) Constructions and construction works	(0.0011)	(0.0066)	(0.0101)	(0.0152)	(0.0211)	0.8699	(0.0053)	(0.0046)	(0.0219)	(0.0165)	(0.0047)	(0.0103)	(0.0128)	(0.0050)	(0.0009)	(0.0077)	(0.0127)	(0.0120)	(0.0043)	-	-
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	(0.0328)	(0.0610)	(0.0722)	(0.0336)	(0.0477)	(0.0567)	0.9692	(0.0521)	(0.0431)	(0.0148)	(0.0073)	(0.0062)	(0.0153)	(0.0209)	(0.0303)	(0.0090)	(0.0387)	(0.0235)	(0.0262)	-	-
(8) Transportation and storage services	(0.0151)	(0.0258)	(0.0262)	(0.0166)	(0.0153)	(0.0192)	(0.0385)	0.9153	(0.0158)	(0.0089)	(0.0103)	(0.0029)	(0.0110)	(0.0522)	(0.0159)	(0.0069)	(0.0125)	(0.0217)	(0.0212)	-	-
(9) Accommodation and food services	(0.0007)	(0.0013)	(0.0016)	(0.0021)	(0.0014)	(0.0024)	(0.0056)	(0.0143)	0.9903	(0.0063)	(0.0128)	(0.0008)	(0.0071)	(0.0672)	(0.0255)	(0.0304)	(0.0144)	(0.0263)	(0.0361)	-	-
(10) Information and communication services	(0.0002)	(0.0012)	(0.0011)	(0.0224)	(0.0016)	(0.0055)	(0.0101)	(0.0036)	(0.0027)	0.8811	(0.0262)	(0.0011)	(0.0073)	(0.0077)	(0.0113)	(0.0059)	(0.0022)	(0.0054)	(0.0085)	-	-
(11) Financial and insurance services	(0.0230)	(0.0239)	(0.0209)	(0.0253)	(0.0221)	(0.0239)	(0.0227)	(0.0273)	(0.0237)	(0.0229)	0.9947	(0.0717)	(0.0217)	(0.0236)	(0.0049)	(0.0070)	(0.0218)	(0.0214)	(0.0182)	-	-
(12) Real estate services	(0.0017)	(0.0033)	(0.0126)	(0.0034)	(0.0050)	(0.0141)	(0.0691)	(0.0187)	(0.0621)	(0.0352)	(0.0678)	0.9779	(0.0256)	(0.0789)	(0.0244)	(0.0115)	(0.0206)	(0.0952)	(0.1119)	-	-
(13) Professional, scientific and technical services	(0.0015)	(0.0025)	(0.0095)	(0.0537)	(0.0042)	(0.0073)	(0.0105)	(0.0081)	(0.0076)	(0.0187)	(0.0406)	(0.0091)	0.8965	(0.0067)	(0.0053)	(0.0069)	(0.0135)	(0.0211)	(0.0258)	-	-
(14) Administrative and support service services	(0.0002)	(0.0018)	(0.0018)	(0.0091)	(0.0029)	(0.0025)	(0.0065)	(0.0081)	(0.0159)	(0.0164)	(0.0078)	(0.0043)	(0.0109)	0.9710	(0.0117)	(0.0066)	(0.0135)	(0.0173)	(0.0067)	-	-
(15) Public administration and defence; compulsory social security services	-	-	(0.0000)	(0.0001)	-	(0.0000)	(0.0008)	(0.0003)	(0.0000)	(0.0000)	(0.0010)	-	(0.0000)	(0.0038)	0.9988	(0.0001)	(0.0000)	(0.0001)	(0.0000)	-	-
(16) Education services	(0.0000)	(0.0000)	(0.0001)	(0.0002)	(0.0000)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0026)	(0.0025)	(0.0001)	(0.0015)	(0.0003)	(0.0010)	0.9963	(0.0090)	(0.0002)	(0.0013)	-	-
(17) Human health and social work services	(0.0002)	(0.0046)	(0.0005)	(0.0010)	(0.0003)	(0.0005)	(0.0005)	(0.0008)	(0.0020)	(0.0003)	(0.0005)	(0.0002)	(0.0016)	(0.0007)	(0.0019)	(0.0038)	0.9487	(0.0013)	(0.0007)	-	-
(18) Arts, entertainment and recreation srvices	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0002)	(0.0001)	(0.0002)	(0.0085)	(0.0007)	(0.0008)	(0.0005)	(0.0009)	(0.0093)	(0.0044)	(0.0001)	0.9517	(0.0012)	-	-
(19) Other services	(0.0001)	(0.0004)	(0.0002)	(0.0101)	(0.0007)	(0.0001)	(0.0027)	(0.0002)	(0.0028)	(0.0067)	(0.0076)	(0.0002)	(0.0115)	(0.0003)	(0.0000)	(0.0009)	(0.0012)	(0.0022)	0.9891	-	-
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0000	-
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0000

Source: Authors' calculations

TABLE 15. LEONTIEF INVERSE $(I - A)^{-1}$

Industry NACE rev.2 Product CPA 2008	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1) Products of Agriculture, forestry and fishing	1.1756	0.0193	0.1581	0.0087	0.0132	0.0245	0.0102	0.0150	0.0564	0.0062	0.0036	0.0030	0.0091	0.0125	0.0099	0.0066	0.0160	0.0255	0.0113	-	-
(2) Mining and quarrying products	0.0014	1.0236	0.0137	0.0012	0.0016	0.0074	0.0015	0.0032	0.0021	0.0010	0.0008	0.0009	0.0010	0.0016	0.0011	0.0005	0.0016	0.0016	0.0022	-	-
(3) Manufactured products	0.0582	0.1035	1.1430	0.0515	0.0838	0.1511	0.0379	0.0860	0.0916	0.0338	0.0164	0.0139	0.0397	0.0426	0.0542	0.0192	0.0867	0.0442	0.0576	-	-
(4) Electricity, gas, steam and air conditioning	0.0073	0.0461	0.0323	1.0751	0.0534	0.0107	0.0154	0.0153	0.0406	0.0271	0.0136	0.0114	0.0086	0.0122	0.0226	0.0177	0.0270	0.0246	0.0259	-	-
(5) Water supply; sewerage, waste management and remediation services	0.0022	0.0010	0.0017	0.0014	1.0081	0.0011	0.0016	0.0013	0.0070	0.0013	0.0020	0.0022	0.0010	0.0026	0.0007	0.0027	0.0042	0.0035	0.0067	-	-
(6) Constructions and construction works	0.0032	0.0113	0.0161	0.0221	0.0277	1.1535	0.0093	0.0091	0.0297	0.0245	0.0090	0.0135	0.0186	0.0109	0.0045	0.0112	0.0191	0.0191	0.0103	-	-
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	0.0466	0.0782	0.0969	0.0471	0.0622	0.0835	1.0407	0.0694	0.0607	0.0261	0.0140	0.0106	0.0254	0.0355	0.0409	0.0155	0.0548	0.0373	0.0395	-	-
(8) Transportation and storage services	0.0240	0.0375	0.0419	0.0264	0.0246	0.0341	0.0473	1.1006	0.0273	0.0171	0.0153	0.0062	0.0184	0.0648	0.0237	0.0111	0.0226	0.0323	0.0305	-	-
(9) Accommodation and food services	0.0022	0.0036	0.0043	0.0056	0.0034	0.0052	0.0082	0.0180	1.0131	0.0107	0.0153	0.0027	0.0106	0.0723	0.0283	0.0323	0.0183	0.0312	0.0395	-	-
(10) Information and communication services	0.0021	0.0050	0.0049	0.0300	0.0054	0.0101	0.0140	0.0073	0.0068	1.1380	0.0316	0.0043	0.0114	0.0119	0.0149	0.0081	0.0057	0.0096	0.0129	-	-
(11) Financial and insurance services	0.0314	0.0332	0.0354	0.0352	0.0304	0.0377	0.0337	0.0383	0.0380	0.0349	1.0153	0.0764	0.0312	0.0383	0.0133	0.0120	0.0322	0.0376	0.0344	-	-
(12) Real estate services	0.0094	0.0150	0.0270	0.0168	0.0152	0.0295	0.0801	0.0328	0.0764	0.0517	0.0776	1.0306	0.0383	0.0963	0.0353	0.0184	0.1145	0.1275		-	-
(13) Professional, scientific and technical services	0.0055	0.0100	0.0181	0.0688	0.0118	0.0153	0.0170	0.0152	0.0162	0.0293	0.0493	0.0153	1.1197	0.0138	0.0197	0.0091	0.0140	0.0313	0.0358	-	-
(14) Administrative and support service services	0.0014	0.0041	0.0043	0.0126	0.0050	0.0051	0.0089	0.0110	0.0189	0.0212	0.0104	0.0058	0.0140	1.0333	0.0143	0.0083	0.0168	0.0216	0.0101	-	-
(15) Public administration and defence; compulsory social security services	0.0001	0.0001	0.0002	0.0003	0.0001	0.0001	0.0009	0.0004	0.0002	0.0002	0.0010	0.0001	0.0001	0.0040	1.0013	0.0001	0.0002	0.0003	0.0002	-	-
(16) Education services	0.0001	0.0002	0.0003	0.0005	0.0002	0.0003	0.0003	0.0004	0.0004	0.0031	0.0027	0.0003	0.0018	0.0005	0.0012	1.0038	0.0097	0.0004	0.0016	-	-
(17) Human health and social work services	0.0003	0.0052	0.0009	0.0014	0.0005	0.0010	0.0008	0.0012	0.0024	0.0006	0.0007	0.0003	0.0020	0.0011	0.0023	0.0042	1.0544	0.0017	0.0011	-	-
(18) Arts, entertainment and recreation srvices	0.0001	0.0001	0.0002	0.0005	0.0001	0.0002	0.0005	0.0003	0.0005	0.0104	0.0012	0.0010	0.0008	0.0013	0.0100	0.0047	0.0003	1.0510	0.0016	-	-
(19) Other services	0.0006	0.0016	0.0014	0.0124	0.0019	0.0011	0.0037	0.0011	0.0040	0.0088	0.0088	0.0011	0.0136	0.0013	0.0010	0.0015	0.0022	0.0035	1.0123	-	-
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0000	-
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0000
Σ	1.3717	1.3987	1.6005	1.4176	1.3485	1.5717	1.3318	1.4258	1.4924	1.4459	1.2887	1.1997	1.3651	1.4569	1.2991	1.1871	1.4197	1.4907	1.4608	-	-

Source: Authors' calculations

The column sums in the Leontief inverse matrix are interpreted as output multipliers that capture the intermediate use of all goods and services from each sector (by different sectors at every stage of production).

3.2.3. INPUT INDICATORS

Most production activities require not only intermediate products (x_{ij}) but also labor (L), and capital goods (C). Hence, in extended matrix A, the set of technical input coefficients can be represented as:

$a_{ij=}z_{ij}/x_j$, where

a_{ij} = input coefficient

z_{ij} = input of type i in sector j (such as intermediates, capital, labor, etc.)

x_j = output of sector j

The input coefficients of intermediate products are discussed, in section 3.2.1, for the different economic sectors. Thus, this stage will introduce the technical input indicators for investments, employment and, as part of gross value added, employee compensation. The row vector for these indicators can later derive multipliers for significant economic variables.

- Investments

For a measure of investment to the economy, the data from 2018, on investments in fixed capital (the equivalent of gross fixed capital formation GFCF), is taken from Geostat (Table 16). For each sector, investments in fixed capital are divided by the level of output (Table 12 above) within that sector, resulting in corresponding input indicators; for example, in the agricultural sector, per million GEL of output, 94,500 GEL was invested.

- Total full-time equivalent (FTE) employment

To calculate the input indicators for employment, firstly employment data from two different sources was employed. The total full-time equivalent employment in Table 16 shows the sum of the FTE for both hired employees and the self-employed. For the FTE hired employees Enterprise Survey[14] data on employment, measured by occupied job positions, was used.[15] Whereas, the Labor Force Survey was analyzed for the FTEs in self-employment.[16] Across different economic sectors, we take the total sum of hours worked weekly on primary and secondary jobs by self-employed individuals and divide this number by normal length of weekly full-time employment in that particular sector. The latter indicator for each sector is calculated as the average hours actually worked in a week by both salaried and self-employed workers in their primary jobs, given

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[14] The Enterprise Survey and non-business sector survey, Geostat (2018).
[15] The Enterprise Survey does not contain data about employees hired in households, and for this sector we have taken the FTE employment data from the Labor Force Survey (calculated similar to other economic sectors).
[16] Labor Force Survey, Geostat (2018).

they have worked more than 30 hours in that week. A constraint of minimum hours was introduced to distinguish between full-time employees (30+ hours a week in their primary job) from part-time employees (under 30 hours).[17] Thus, the study avoids outlier part-time workers that distort the measure of full-time employment length. To account for the self-employed who failed to indicate their hours worked in the survey, the missing values have been imputed with the average hours worked; measured separately for primary and secondary jobs without a minimum hours worked constraint.

To observe the effects of exogenous shocks on different labor market participants, we further disaggregate FTE employment by gender and age.

Disaggregation by age

For age disaggregation, employees are distinguished between those aged 15-30 and those over 30. As the Enterprise Survey does not provide age-disaggregated data for hired employment, the Labor Force Survey is used for calculation, alongside a similar measure for the self-employed. The resulting disaggregation structure thereafter can be adjusted and decomposed for the total (the sum of FTE hired individuals from the Enterprise Survey and the FTE self-employed from the Labor Force Survey) FTE employment by age.

Firstly, FTE employment is calculated separately for each subgroup:

FTE employment for individuals from 15 to 30/above 30 = FTE hired individuals from 15 to 30/above 30 + FTE self-employed individuals from 15 to 30/above 30

Components of the right-hand sum are calculated in the following manner:

FTE hired individuals 15-30 and above 30 - across different economic sectors, we take the sum of total weekly hours worked in primary and secondary jobs by hired individuals aged 15-30/above 30 and divide it by normal length of weekly full-time employment for individuals of all age in their sector.

FTE self-employed individuals 15-30 and above 30 - across different economic sectors, we take the sum of total weekly hours worked in primary and secondary jobs by self-employed individuals aged 15-30/above 30 and divide it by normal length of weekly full-time employment for individuals of all age in their sector.

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[17] The definition of full-time and part-time employment, Statistics Canada –
Alongside Canada, Chile, Colombia, and Japan are also using 30-hour constraints – Labor Force Statistics in OECD countries (2019); http://www.oecd.org/els/emp/LFS%20Definitions%20-%20Tables.pdf

The resulting disaggregated FTE employment data is presented in Table 16 below.

Disaggregation by gender

The total FTE employment is further decomposed by gender. Since the gender distribution of hired employees is provided by Geostat (the Enterprise Survey), only the FTE self-employment from the Labor Force Survey has been disaggregated by gender, and added up to the respective number of hired workers by gender.

To measure FTE self-employed female/male, across different economic sectors, total weekly hours worked in primary and secondary jobs by self-employed female/male is divided by normal length of weekly full-time employment for female/male in a particular sector.

Here we consider the disparities between the normal length of full-time work for men and women in self-employment. If we do not account for these differences and use same normal length of full-time employment different levels will be found for both genders in self-employment.

The resulting decomposition structure of self-employment can be used to adjust and disaggregate the total FTE of self-employment by gender, and correlate this measure to the corresponding group of hired employees from the Enterprise Survey. The gender disaggregated total FTE employments are presented in Table 16 below; (gender disaggregation of total FTE employment, developed by applying the same normal length of full-time employment for each gender with the corresponding input indicators (presented in Appendix A2.)

To calculate the input indicator for employment across sectors, the FTE employment (total and for each subgroup) is divided by the level of output in a particular sector (Table 16). The resulting input indicator for total FTE employment reveals that, for example, in the agricultural sector, labor intensity per million GEL of output amounts to 94 people; from which 11 are individuals aged 15-30 and 83 are above 30; while 44 are female and 50 male.

- Employee compensation

The input indicator for employee compensation represents the salaries generated for full-time employees per million GEL of output in a particular sector; for the agricultural sector, this indicator amounts to 558,500 GEL.

TABLE 16. LEVELS OF GROSS FIXED CAPITAL FORMATION, TOTAL FULL-TIME EQUIVALENT EMPLOYMENT, AND INPUT INDICATORS FOR PRODUCTION PER UNIT OF OUTPUT, ACROSS SECTORS.

	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning	Water supply; sewerage, waste management and remediation activities	Construction	Wholesale and retail trade; repair of motor vehicles and motorcycles	Transportation and storage	Accommodation and food service activities	Information and communication	Financial and insurance activities	Real estate activities	Professional, scientific and technical activities	Administrative and support service activities	Public administration and defence; compulsory social security	Education	Human health and social work activities	Arts, entertainment and recreation	Other service activities	Activities of households as employers	Activities of extra-territorial organisations and bodies	Notations for row vectors of input indicators
Gross Fixed Capital Formation (mln GEL)	462	101	979	918	248	1,646	1,199	808	367	646	96	174	82	105	2,732	145	292	207	8	-	-	
Total full-time equivalent (FTE) employment	458,608	9,047	106,226	14,905	21,399	109,308	230,037	81,463	46,928	26,685	36,477	17,025	36,439	30,407	122,677	178,602	88,662	43,857	19,005	18,558	-	
Gender Disaggregated Employment (with disaggregated normal length of full-time employment)																						
Total full-time equivalent (FTE) employment, Female	215,400	922	35,979	2,614	6,096	8,034	103,177	11,834	25,222	11,421	22,478	5,765	16,719	11,594	36,752	138,513	64,248	20,770	11,031	18,397	-	
Total full-time equivalent (FTE) employment, Male	243,208	8,125	70,247	12,291	15,304	101,274	126,860	69,630	21,707	15,264	13,998	11,260	19,720	18,813	85,925	40,088	24,414	23,087	7,974	162	-	
Age Disaggregated Employment																						
Total full-time equivalent (FTE) employment, age 15-30	53,198	1,178	21,895	2,803	2,204	22,598	66,641	12,235	12,488	10,150	20,402	1,612	12,629	7,464	28,335	16,851	16,070	10,024	5,830	961	-	
Total full-time equivalent (FTE) employment, age 30 +	405,410	7,869	84,331	12,101	19,195	86,710	163,396	69,228	34,440	16,534	16,074	15,413	23,811	22,944	94,342	161,751	72,592	33,832	13,174	17,597	-	
Compensation of employees (mln GEL)	2,728	160	1,253	288	212	2,121	2,772	1,331	493	507	1,045	241	794	311	1,993	1,364	1,117	558	200	37	-	
Input Indicators																						
Gross Fixed Capital Formation (mln GEL)	0.0945	0.1120	0.0751	0.5622	0.5183	0.1916	0.1490	0.1681	0.0987	0.3607	0.0307	0.0321	0.0538	0.1171	0.6479	0.0695	0.0994	0.0977	0.0134	-	-	in
Total full-time equivalent (FTE) employment	94	10	8	9	45	13	29	17	13	15	12	3	24	34	29	86	30	21	30	503	-	e
Gender Disaggregated Employment (with disaggregated normal length of full-time employment)																						
Total full-time equivalent (FTE) employment, Female	44	1	3	2	13	1	13	2	7	6	7	1	11	13	9	66	22	10	18	498	-	e_{f1}
Total full-time equivalent (FTE) employment, Male	50	9	5	8	32	12	16	14	6	9	4	2	13	21	20	19	8	11	13	4	-	e_{m1}
Age Disaggregated Employment																						
Total full-time equivalent (FTE) employment, age 15-30	11	1	2	2	5	3	8	3	3	6	6	0	8	8	7	8	5	5	9	26	-	e_y
Total full-time equivalent (FTE) employment, age 30 +	83	9	6	7	40	10	20	14	9	9	5	3	16	26	22	77	25	16	21	477	-	e_a
Compensation of employees (mln GEL)	0.5585	0.1765	0.0961	0.1765	0.4432	0.2468	0.3446	0.2769	0.1326	0.2834	0.3328	0.0446	0.5185	0.3467	0.4727	0.6530	0.3809	0.2636	0.3191	1.0000	-	

Source: Geostat, Authors' calculations

3.3.   CONSTRUCTING MULTIPLIERS (TYPE I AND TYPE II)

The Input-Output model is often used to study the impact of exogenous changes in final demand on the economy. As previously described, the total economic impact of an exogenous shock to the final demand in a sector can be represented as a sum of the (1) initial, (2) direct, (3) indirect, and (4) induced effects throughout the economy. The initial impact captures changes in immediate sectoral economic activity as a primary consequence of a shock. Direct and indirect effects comprise changes in business-to-business activities following the initial shock (typically associated with changes in demand for inputs). Whereas, induced effects are generated in response to changes in income and household spending (associated with changes in the level of economic activity in a given and supporting sectors). When calculating the economic effects of a shock, certain studies do not include the initial stimulus in their multipliers. With output multipliers, for instance, 1 unit of currency worth of the new final demand for sector j turns into the same value of the sector's new output, which is not included in the multiplier effect (Miller & Blair, 2009). For computational adjustments, this would simply imply subtracting 1 from each sectors' output multiplier.

In addition to measuring the impact of a shock to final demand on output and revenue, one might also opt for assessing its impact on job creation, investments, value added, capital, etc. Appropriate extensions of the IO system allow the estimation of such impacts of the changes in final use on the economic variables of interest. One such extension of the IO equation (13) offers the following approach for its respective analysis:

$z = b(I - A)^{-1}\hat{Y}$ (15), where

b = vector of input coefficients for specific variables under investigation (investments, employment, etc.)

I = unit matrix

A = matrix of input coefficients for intermediate consumption

$\hat{Y}$ = diagonal matrix of final demand of goods and services

z = vector with results for direct and indirect requirements (intermediates, investments, employment, etc.) for produced goods and services

The three consecutive methodological sections below explain how sector-specific output (cumulative revenues), employment, and investment multipliers, are derived in order to study how an exogenous shock to final demand in each sectors would affect the national economy. A comprehensive methodology for estimating Type I and Type II multipliers to capture direct, indirect, and induced effects of the change in final demand on job creation, revenues, and investment are also detailed.[18] In the calculation of Type I multipliers, the final household demand

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[18] The initial effect of a shock to final demand of a sector's output is included in both types of multiplier.

is treated as exogenous (an assumption that is relaxed in the calculation of Type II multipliers) to measure the induced impacts via higher demand from increased household labor income. For this analysis, it is assumed that all additional household income is spent on final household consumption.[19] Closing the Leontief model with the household sector generates a wider dimension in the inverse matrix of (n+1) by (n+1). The input coefficient matrix thus becomes a household augmented technical coefficients matrix ($\tilde{A}$) (Table 17), which requires an additional row for household income coefficients and a column for household consumption coefficients in the initial matrix (A). The elements of the extended Leontief inverse matrix, $\tilde{L} = (I_{n+1} - \tilde{A})^{-1}$ (Table 18), thereafter incorporate the direct and indirect as well as the induced effects in output production due to the changes in the exogenous final demand.

Because household behavior is absent from the model, Type I multipliers are generally believed to underestimate the true economic effects of the increase in final demand. Whereas, Type II multipliers may overestimate the overall impact due to rigid assumptions on consumer spending patterns.[20] Consequently, Oosterhaven, Peik, and Stedler (1986) suggest regarding Type I and Type II multipliers as the lower and upper bounds of the true economic impacts of increases in final demand. The authors believe that a realistic estimate of the indirect effect therefore lies half-way between these two multipliers.

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[19] This assumption may lead multipliers to significantly overestimate the real effect.
[20] Miller, R. E. and Blair, P. D. (2009). *Input-Output Analysis: Foundations and Extensions.* Cambridge University Press.

TABLE 17. HOUSEHOLD AUGMENTED TECHNICAL COEFFICIENTS MATRIX (Ã)

Industry NACE rev.2 / Product CPA 2008	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households
(1) Products of Agriculture, forestry and fishing	0.1432	0.0036	0.1178	0.0006	0.0009	0.0022	0.0036	0.0015	0.0365	0.0004	0.0003	0.0006	0.0022	0.0026	0.0006	0.0020	0.0022	0.0143	0.0010	-	-	0.0474
(2) Mining and quarrying products	0.0005	0.0217	0.0114	0.0003	0.0003	0.0046	0.0008	0.0018	0.0006	0.0003	0.0004	0.0006	0.0003	0.0007	0.0003	0.0001	0.0003	0.0006	0.0012	-	-	0.0009
(3) Manufactured products	0.0405	0.0807	0.1101	0.0336	0.0643	0.1097	0.0250	0.0633	0.0677	0.0185	0.0072	0.0078	0.0252	0.0230	0.0400	0.0102	0.0641	0.0257	0.0394	-	-	0.1429
(4) Electricity, gas, steam and air conditioning	0.0034	0.0375	0.0233	0.0661	0.0457	0.0032	0.0107	0.0089	0.0324	0.0194	0.0094	0.0087	0.0044	0.0051	0.0170	0.0138	0.0194	0.0171	0.0183	-	-	0.0149
(5) Water supply; sewerage, waste management and remediation services	0.0016	0.0006	0.0010	0.0009	0.0076	0.0005	0.0011	0.0007	0.0063	0.0007	0.0015	0.0019	0.0005	0.0016	0.0002	0.0023	0.0034	0.0026	0.0058	-	-	0.0062
(6) Constructions and construction works	0.0011	0.0066	0.0101	0.0152	0.0211	0.1301	0.0053	0.0046	0.0219	0.0165	0.0047	0.0103	0.0128	0.0050	0.0009	0.0077	0.0127	0.0120	0.0043	-	-	0.0248
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	0.0328	0.0610	0.0722	0.0336	0.0477	0.0567	0.0308	0.0521	0.0431	0.0148	0.0073	0.0062	0.0153	0.0209	0.0303	0.0090	0.0387	0.0235	0.0262	-	-	0.0775
(8) Transportation and storage services	0.0151	0.0258	0.0262	0.0166	0.0153	0.0192	0.0385	0.0847	0.0158	0.0089	0.0103	0.0029	0.0110	0.0522	0.0159	0.0069	0.0125	0.0217	0.0212	-	-	0.0250
(9) Accommodation and food services	0.0007	0.0013	0.0016	0.0021	0.0014	0.0024	0.0056	0.0143	0.0097	0.0063	0.0128	0.0008	0.0071	0.0672	0.0255	0.0304	0.0144	0.0263	0.0361	-	-	0.0191
(10) Information and communication services	0.0002	0.0012	0.0011	0.0224	0.0016	0.0055	0.0101	0.0036	0.0027	0.1189	0.0262	0.0011	0.0073	0.0077	0.0113	0.0059	0.0022	0.0054	0.0085	-	-	0.0210
(11) Financial and insurance services	0.0230	0.0239	0.0209	0.0253	0.0221	0.0239	0.0227	0.0273	0.0237	0.0229	0.0053	0.0717	0.0217	0.0236	0.0049	0.0070	0.0218	0.0214	0.0182	-	-	0.0350
(12) Real estate services	0.0017	0.0033	0.0126	0.0034	0.0050	0.0141	0.0691	0.0187	0.0621	0.0352	0.0678	0.0221	0.0256	0.0789	0.0244	0.0115	0.0206	0.0952	0.1119	-	-	0.1044
(13) Professional, scientific and technical services	0.0015	0.0025	0.0095	0.0537	0.0042	0.0073	0.0105	0.0081	0.0076	0.0187	0.0406	0.0091	0.1035	0.0067	0.0135	0.0053	0.0069	0.0211	0.0258	-	-	0.0101
(14) Administrative and support service services	0.0002	0.0018	0.0018	0.0091	0.0029	0.0025	0.0065	0.0081	0.0159	0.0164	0.0078	0.0043	0.0109	0.0290	0.0117	0.0066	0.0135	0.0173	0.0067	-	-	0.0117
(15) Public administration and defence; compulsory social security services	-	-	0.0000	0.0001	-	0.0000	0.0008	0.0003	0.0000	0.0000	0.0010	-	0.0000	0.0038	0.0012	0.0001	0.0000	0.0001	0.0000	-	-	0.0183
(16) Education services	0.0000	0.0000	0.0001	0.0002	0.0000	0.0001	0.0001	0.0002	0.0002	0.0026	0.0025	0.0001	0.0015	0.0003	0.0010	0.0037	0.0090	0.0002	0.0013	-	-	0.0379
(17) Human health and social work services	0.0002	0.0046	0.0005	0.0010	0.0003	0.0005	0.0005	0.0008	0.0020	0.0003	0.0005	0.0002	0.0016	0.0007	0.0019	0.0038	0.0513	0.0013	0.0007	-	-	0.0503
(18) Arts, entertainment and recreation srvices	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0002	0.0001	0.0002	0.0085	0.0007	0.0008	0.0005	0.0009	0.0093	0.0044	0.0001	0.0483	0.0012	-	-	0.0091
(19) Other services	0.0001	0.0004	0.0002	0.0101	0.0007	0.0001	0.0027	0.0002	0.0028	0.0067	0.0076	0.0002	0.0115	0.0003	0.0000	0.0009	0.0012	0.0022	0.0109	-	-	0.0152
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0012
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compensations of Employees	0.5585	0.1765	0.0961	0.1765	0.4432	0.2468	0.3446	0.2769	0.1326	0.2834	0.3328	0.0446	0.5185	0.3467	0.4727	0.6530	0.3809	0.2636	0.3191	1.0000	-	-

Source: Authors' calculations

TABLE 18. EXTENDED LEONTIEF INVERSE MATRIX $\tilde{L} = (I_{n+1} - \tilde{A})^{-1}$

Industry NACE rev.2 / Product CPA 2008	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Final consumption expenditure by households and non-profit organisations serving households
(1) Products of Agriculture, forestry and	1.2548	0.0500	0.1899	0.0420	0.0727	0.0676	0.0576	0.0581	0.0853	0.0513	0.0492	0.0141	0.0809	0.0627	0.0712	0.0853	0.0713	0.0681	0.0583	0.1125	-	0.1125
(2) Mining and quarrying products	0.0050	1.0250	0.0151	0.0027	0.0042	0.0093	0.0036	0.0051	0.0034	0.0031	0.0029	0.0014	0.0042	0.0039	0.0038	0.0040	0.0041	0.0035	0.0043	0.0051	-	0.0051
(3) Manufactured products	0.2368	0.1728	1.2148	0.1267	0.2180	0.2483	0.1447	0.1832	0.1568	0.1354	0.1194	0.0389	0.2016	0.1559	0.1923	0.1966	0.2117	0.1403	0.1635	0.2538	-	0.2538
(4) Electricity, gas, steam and air conditioning	0.0351	0.0569	0.0435	1.0868	0.0743	0.0258	0.0321	0.0305	0.0508	0.0429	0.0296	0.0153	0.0338	0.0299	0.0441	0.0454	0.0465	0.0395	0.0424	0.0396	-	0.0396
(5) Water supply; sewerage, waste management and remediation services	0.0095	0.0039	0.0047	0.0045	1.0136	0.0051	0.0060	0.0053	0.0097	0.0055	0.0062	0.0032	0.0077	0.0072	0.0064	0.0100	0.0093	0.0074	0.0111	0.0104	-	0.0104
(6) Constructions and construction works	0.0386	0.0250	0.0303	0.0370	0.0542	1.1727	0.0304	0.0283	0.0426	0.0446	0.0293	0.0185	0.0507	0.0333	0.0318	0.0462	0.0438	0.0381	0.0312	0.0502	-	0.0502
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	0.1511	0.1187	0.1389	0.0911	0.1407	0.1404	1.1032	0.1263	0.0988	0.0855	0.0742	0.0253	0.1202	0.1018	0.1218	0.1193	0.1279	0.0935	0.1015	0.1486	-	0.1486
(8) Transportation and storage services	0.0669	0.0542	0.0592	0.0444	0.0569	0.0575	0.0730	1.1240	0.0430	0.0415	0.0401	0.0122	0.0573	0.0920	0.0569	0.0538	0.0526	0.0554	0.0560	0.0611	-	0.0611
(9) Accommodation and food services	0.0276	0.0135	0.0145	0.0163	0.0225	0.0190	0.0234	0.0318	1.0224	0.0252	0.0300	0.0063	0.0337	0.0884	0.0480	0.0575	0.0361	0.0449	0.0545	0.0361	-	0.0361
(10) Information and communication services	0.0303	0.0159	0.0163	0.0419	0.0266	0.0254	0.0308	0.0227	0.0171	1.1540	0.0478	0.0083	0.0369	0.0297	0.0367	0.0361	0.0254	0.0248	0.0296	0.0400	-	0.0400
(11) Financial and insurance services	0.0887	0.0555	0.0584	0.0593	0.0734	0.0689	0.0680	0.0695	0.0589	0.0675	1.0484	0.0845	0.0831	0.0747	0.0576	0.0689	0.0723	0.0685	0.0684	0.0815	-	0.0815
(12) Real estate services	0.1349	0.0637	0.0774	0.0696	0.1095	0.0978	0.1552	0.1012	0.1222	0.1230	0.1499	1.0482	0.1521	0.1759	0.1323	0.1431	0.1216	0.1820	0.2019	0.1783	-	0.1783
(13) Professional, scientific and technical services	0.0281	0.0188	0.0272	0.0783	0.0288	0.0277	0.0305	0.0275	0.0245	0.0422	0.0624	0.0185	1.1402	0.0282	0.0372	0.0316	0.0299	0.0435	0.0492	0.0322	-	0.0322
(14) Administrative and support service services	0.0182	0.0106	0.0111	0.0196	0.0176	0.0142	0.0189	0.0201	0.0250	0.0307	0.0200	0.0082	0.0292	1.0439	0.0273	0.0250	0.0285	0.0306	0.0200	0.0238	-	0.0238
(15) Public administration and defence; compulsory social security services	0.0176	0.0069	0.0072	0.0076	0.0133	0.0097	0.0113	0.0100	0.0066	0.0101	0.0111	0.0026	0.0160	0.0151	1.0149	0.0175	0.0124	0.0097	0.0105	0.0249	-	0.0249
(16) Education services	0.0369	0.0145	0.0150	0.0160	0.0278	0.0203	0.0223	0.0204	0.0138	0.0240	0.0239	0.0055	0.0351	0.0238	0.0296	1.0403	0.0354	0.0202	0.0234	0.0522	-	0.0522
(17) Human health and social work services	0.0511	0.0249	0.0213	0.0227	0.0386	0.0286	0.0311	0.0288	0.0210	0.0295	0.0300	0.0074	0.0480	0.0333	0.0415	0.0546	1.0899	0.0290	0.0312	0.0721	-	0.0721
(18) Arts, entertainment and recreation srvices	0.0100	0.0040	0.0042	0.0047	0.0076	0.0056	0.0064	0.0056	0.0041	0.0160	0.0069	0.0024	0.0097	0.0076	0.0177	0.0146	0.0073	1.0563	0.0074	0.0141	-	0.0141
(19) Other services	0.0169	0.0079	0.0080	0.0193	0.0141	0.0100	0.0134	0.0100	0.0100	0.0181	0.0182	0.0034	0.0284	0.0116	0.0136	0.0177	0.0136	0.0123	1.0220	0.0232	-	0.0232
(20) Services of households as employers; undifferentiated goods and servicies producing activities of household for own use	0.0011	0.0004	0.0005	0.0005	0.0008	0.0006	0.0007	0.0006	0.0004	0.0006	0.0007	0.0002	0.0010	0.0007	0.0009	0.0011	0.0008	0.0006	0.0007	1.0016	-	0.0016
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0000	-
Compensations of Employees	0.9446	0.3665	0.3797	0.3976	0.7095	0.5141	0.5650	0.5143	0.3446	0.5374	0.5443	0.1325	0.8566	0.5992	0.7303	0.9383	0.6607	0.5081	0.5602	1.3424	-	1.342371
Σ	3.2039	2.1096	2.3371	2.1889	2.7246	2.5687	2.4276	2.4233	2.1607	2.4882	2.3444	1.4566	3.0266	2.6190	2.7156	3.0069	2.7012	2.4762	2.5474			

Source: Authors' calculations

3.3.1. REVENUE/OUTPUT MULTIPLIERS

The output (cumulative revenue) multiplier for sector j is defined as the total value of production, in all economic sectors, necessary at every stage of production in order to satisfy 1 unit of currency worth of additional final demand for its output. The Type I output multiplier that captures only initial, direct, and indirect effects in Table 15 corresponds to the column sum of the Leontief inverse matrix. While the Type II output multiplier is the respective column sum of the household augmented Leontief inverse matrix, shown in Table 18. Specifically, they equate as:

$O_j = \sum_{i=1}^{n} l_{ij}$ Type I output (cumulative revenue) multiplier

$\tilde{O}_j = \sum_{i=1}^{n} \tilde{l}_{ij}$ Type II output (cumulative revenue) multiplier, where

l_{ij} = elements of the Leontief inverse matrix

$\tilde{l}_{ij}$ = elements of the household augmented Leontief inverse matrix

The resulting output multiplier for sector j is defined as the total production value of all sectors, needed to produce 1 GEL worth of sector j's output for final use. Hence, it reflects the cumulative revenues of the economy generated by 1 additional unit of currency of final demand for a product.

The results obtained from the derivation of both Type I and Type II output (revenue) multipliers within the different sectors of the Georgian economy are presented in Table 19.[21] Moreover, Appendix A5 portrays the decomposition of output multipliers between the direct, indirect, and induced effects associated with a 1 million GEL increase in final demand.

Within the Type I output multipliers, the four highest ranking sectors are, respectively, (3) manufacturing; (6) construction; (9) accommodation and food service activities; and (18) arts, entertainment, and recreation. The manufacturing sector stands out with the highest (1.60) output multiplier, indicating that if final demand for domestically manufactured products increases by 1.0 mln. GEL, cumulative revenues of 1.60 mln. GEL would be generated throughout the economy. The output multiplier represents 1 unit of final use (1.0), and the direct and indirect requirements for domestic intermediates, for example, in the manufacturing sector are 0.60.

By introducing induced effects into the model, captured by Type II multipliers, upward pressure is generated on the multiplier effects for all sectors of the economy, however it changes their ranking in terms of economic impact related to the increased final demand for their products. Strong induced effects are exhibited by (1) the agriculture, forestry, and fishing sector, ranking first, with 3.20 Type II multipliers; followed by (13) professional, scientific, and technical activities, and (16) education with multiplier values of 3.03 and 3.01, respectively. Thereafter comes (5)

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[21] The output (revenue) multipliers obtained from the IOT, as derived from a 38x38 dimensional SUT, are presented in Appendix A4.

water supply, sewerage, waste management, and remediation activities, 2.72; (15) public administration and defense, compulsory social security, 2.72; and (17) human health and social work with a Type II multiplier value of 2.70. Other sectors, such as (12) real estate, reveal relatively weak induced effects.[22]

TABLE 19. TYPE I AND TYPE II OUTPUT (REVENUE) MULTIPLIERS		
Sector	Type I Multipliers	Type II Multipliers
(1) Agriculture, forestry, and fishing	1.37	3.20
(2) Mining and quarrying	1.40	2.11
(3) Manufacturing	1.60	2.34
(4) Electricity, gas, steam, and air conditioning supply	1.42	2.19
(5) Water supply, sewerage, waste management, and remediation activities	1.35	2.72
(6) Construction	1.57	2.57
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	1.33	2.43
(8) Transportation and storage	1.43	2.42
(9) Accommodation and food service activities	1.49	2.16
(10) Information and communication	1.45	2.49
(11) Financial and insurance activities	1.29	2.34
(12) Real estate activities	1.20	1.46
(13) Professional, scientific, and technical activities	1.37	3.03
(14) Administrative and support service activities	1.46	2.62
(15) Public administration and defense; compulsory social security	1.30	2.72
(16) Education	1.19	3.01
(17) Human health and social work activities	1.42	2.70
(18) Arts, entertainment, and recreation	1.49	2.48
(19) Other service activities	1.46	2.55

Source: Authors' calculations

Interpreting, for example, the Type II multipliers for (1) the agriculture, forestry, and fishing sector, in Table 19, every GEL of final demand generates on average 3.20 GEL of revenue. Of this amount, 1.37 GEL is generated throughout the economy due to the linkages with other sectors that provide inputs. In response to the additional output required to satisfy increased household consumption spending, an additional 1.83 GEL is produced for the economy. It is noteworthy that the Type II multipliers for (16) the education sector almost triple compared to its Type I multipliers. This may highlight that increased demand for educational services leads to an extremely high value added in this sector, which translates to increased employee compensation that ultimately generates one of the largest overall levels of induced effects. It is vital to consider that the magnitude of induced effects relies on the assumption that all additional household income generated will be spent on final consumption.

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[22] Potentially as a large part of the mixed income in real estate is generated by the informal economy and, therefore, is never obtained by the National Accounts Statistics. Consequently, the respective induced effects may be underestimated.

3.3.2. FULL-TIME EQUIVALENT (FTE) EMPLOYMENT MULTIPLIERS

Employment multipliers assess the impact of changes in final demand for a sector's output on FTE job creation across the economy (the Revenue-to-Job multipliers). Physical labor input indicators are used during the calculation of employment multipliers. The extended equation of the IO system is used to estimate the direct and indirect requirements for labor, incorporated as one unit of currency worth of output for final use. The employment multipliers for total FTE employment as well as the disaggregated employment levels for age and gender have each been calculated.[23]

Type I employment multipliers for the total and (age/gender) disaggregated employment is calculated within the following formula:

$z = e \, (I - A)^{-1}$ (16)

$z_d = e_d (I - A)^{-1}$ (17), where

e = vector of input indicators for total employment, per mln. GEL of output

e_d = vector of input indicators for employment, per mln. GEL of output, where d changes with respect to employment disaggregation: e_{f1}, e_{m1}, e_y, e_a (see Table 16)

z = vector with results for direct and indirect requirements for labor (number of FTE jobs)

z_d = vector with results for direct and indirect requirements for female/male and young/adult employees

For calculating Type II employment multipliers, equations (16) and (17) become:

$\tilde{z} = \tilde{e}\left(I_{n+1} - \tilde{A}\right)^{-1}$ and $\widetilde{z_d} = \widetilde{e_d}\left(I_{n+1} - \tilde{A}\right)^{-1}$, respectively, where,

$\tilde{z}$ and $\widetilde{z_d}$ vectors now include the results for direct, indirect, induced requirements for labor

$\widetilde{e_d}$ is expanded input indicator vector (Appendix A3.)

The resulting Type I and Type II employment multipliers for the various sectors of the Georgian economy are presented in Table 20.[24]

For the Type I total FTE employment multipliers, the two highest multipliers are observed in (1) agriculture, forestry, and fishing and in (16) education.

The Type I total FTE employment multiplier for agriculture, forestry and fishing suggests, for example, that if demand for agricultural products increases by 1 million GEL, 113 FTE jobs would

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[23] For gender disaggregation two sets of multipliers have been calculated, corresponding to sets of input indicators calculated in section 3.2.3.
[24] Employment multipliers obtained from the IOT, as derived from a 38x38 dimensional SUT, are presented in Appendix A4.

be created, in other words, the direct and indirect requirements for labor produce 1 million GEL worth of agricultural product for final use.

Looking at the total Type II FTE multipliers, where induced effects are also incorporated, the ranking of top two sectors does not change, however, the multipliers are now higher. For the agricultural sector, the multiplier indicates that 137 FTE jobs would be created per 1 million GEL of additional demand. Of these 137 positions, 113 FTE jobs are developed from agricultural linkages with other industries, providing domestic intermediates. To meet the increased intermediate input requirements, other sectors, in turn, increase the labor contribution for production. The remaining 24 FTEs highlight that jobs are also created in response to the extra labor input required to satisfy the additional rounds of household spending.

It is important to note that the relatively high levels of both Type I and Type II multipliers in agriculture and education are due to the labor-intensive nature of these sectors. For example, when demand for educational services increases, the input requirements to satisfy the need mostly translates into further labor.

Within this study, we further calculate the employment multipliers at a different base: per each 100 jobs in a given sector, rather than per million GEL final demand. The resulting multipliers show the effect on total FTE jobs throughout the economy, per 100 direct FTE jobs created in the originating sector. By assumption, the direct jobs correspond to the additional demand for output (as an initial shock). Such resulting multipliers are referred to as a Job-to-Job FTE total employment multiplier (see Appendix A6.)

In Appendices A6.3-A6.4, we further provide the gender and age disaggregated Job-to-Job FTE employment multiplier; based on the assumption that the initial 100 direct jobs in each sector are divided between female and male workers and in two different age groups (15-30 and 30+), with the same proportions as the current (2018) FTE employment, disaggregated by gender and age.

3.3.2.1.   GENDER DISAGGREGATED FTE EMPLOYMENT MULTIPLIERS

Considering gender disaggregated multipliers (Table 20), we can say that while agricultural sector creates 113 FTE jobs (Type I) in the economy, from this total 53 FTE jobs are created for women and 60 – for men. Whereas with the Type II multipliers, of the 137 FTE jobs supported, 65 are for women and 72 for men. Looking in detail, with both types of multiplier, it is evident that, for example, demand shock in (2) the mining and quarrying sector; (5) water supply, sewerage, and waste management; (6) construction; and in (8) the transportation and storage sectors generates notably more FTE jobs for men than women; most of the labor requirements within these sectors are, relatively, male dominated. For the increases in final demand within female dominated sectors, like (16) education, further FTE jobs are created for women. For example, a 1 million GEL increase in demand for the education sector (using the Type II multipliers), creates, throughout the economy, 79 FTE jobs for women, but only 33 for men.

The employment multipliers that consider the same normal length of full-time employment for women and men are presented in Appendix A7.

TABLE 20. TYPE I AND TYPE II EMPLOYMENT MULTIPLIERS WITH GENDER DISAGGREGATION[25] (REVENUE-TO-JOB)						
	Type I multipliers			Type II multipliers		
Sectors	Total FTE employment	FTE employment, female	FTE employment, male	Total FTE employment	FTE employment, female	FTE employment, male
(1) Agriculture, forestry, and fishing	113.5	53.1	60.4	136.5	64.7	71.8
(2) Mining and quarrying	17.5	4.0	13.5	26.5	8.5	18.0
(3) Manufacturing	29.7	12.2	17.4	38.9	16.9	22.0
(4) Electricity, gas, steam, and air conditioning supply	16.7	4.7	12.1	26.4	9.5	16.9
(5) Water supply, sewerage, waste management, and remediation activities	51.0	15.1	35.9	68.3	23.9	44.5
(6) Construction	22.8	4.5	18.3	35.3	10.8	24.5
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	34.0	15.0	19.1	47.8	21.9	25.9
(8) Transportation and storage	24.8	5.4	19.4	37.4	11.7	25.6
(9) Accommodation and food service activities	24.2	11.6	12.5	32.6	15.8	16.7
(10) Information and communication	22.4	9.5	12.8	35.5	16.1	19.3
(11) Financial and insurance activities	16.3	9.2	7.1	29.5	15.9	13.7
(12) Real estate activities	6.1	2.4	3.7	9.3	4.0	5.3
(13) Professional, scientific, and technical activities	31.1	14.1	17.0	52.0	24.7	27.3
(14) Administrative and support service activities	41.5	15.9	25.6	56.1	23.3	32.8
(15) Public administration and defense; compulsory social security	34.6	11.0	23.6	52.4	20.0	32.4
(16) Education	89.2	68.0	21.2	112.0	79.5	32.6
(17) Human health and social work activities	39.3	26.4	12.9	55.5	34.5	20.9
(18) Arts, entertainment, and recreation	29.8	13.6	16.2	42.2	19.9	22.3
(19) Other service activities	37.5	20.6	16.9	51.1	27.5	23.6
(20) Activities of households as employers; undifferentiated goods and services producing activities of household for own use	502.5	498.2	4.4	535.3	514.7	20.6

Source: Author's calculations

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[25] (20) Activities of households as employers has the highest Type II employment multiplier, of 535.3, but its impact should be interpreted with caution due to the unreliable and potentially misreported data from this sector.

3.3.2.2.   AGE DISAGGREGATED FTE EMPLOYMENT MULTIPLIERS

Table 21 below presents the Type I and Type II multipliers for different age groups (15-30 and 30+). In both of the multipliers, demand shock in sectors like (1) agriculture, forestry, and fishing and (16) education highlights the visible differences in FTE job creation for young and adult employees. For example, from the total 137 jobs generated (using Type II multipliers – from a 1 million GEL increase in final demand for agricultural products), only 18 FTE positions are made for the young, while there are 119 for older employees. It should also be noted that the FTE employment multipliers in this report do not fully capture job creation in the informal sector.[26]

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[26] Analysis of the 2018 Labor Force Survey does not allow us to capture informal sector employment, by comparing the number of hired employees observed in labor force survey and official statistics of hired employees provided by Geostat Enterprise and Non-business Sector Survey.

TABLE 21. TYPE I AND TYPE II EMPLOYMENT MULTIPLIERS WITH AGE DISAGGREGATION[27]						
	Type I multipliers			Type II multipliers		
Sectors	Total FTE employment	FTE employment, aged 15-30	FTE employment, aged above 30	Total FTE employment	FTE employment, aged 15-30	FTE employment, aged above 30
(1) Agriculture, forestry, and fishing	113.5	13.7	99.8	136.5	17.9	118.6
(2) Mining and quarrying	17.5	3.0	14.5	26.5	4.6	21.8
(3) Manufacturing	29.7	5.2	24.5	38.9	6.9	32.1
(4) Electricity, gas, steam, and air conditioning supply	16.7	3.8	13.0	26.4	5.6	20.9
(5) Water supply, sewerage, waste management, and remediation activities	51.0	6.1	45.0	68.3	9.2	59.1
(6) Construction	22.8	4.9	17.9	35.3	7.2	28.1
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	34.0	9.6	24.4	47.8	12.1	35.7
(8) Transportation and storage	24.8	4.3	20.5	37.4	6.6	30.7
(9) Accommodation and food service activities	24.2	5.6	18.6	32.6	7.1	25.4
(10) Information and communication	22.4	7.8	14.6	35.5	10.2	25.3
(11) Financial and insurance activities	16.3	7.7	8.5	29.5	10.2	19.4
(12) Real estate activities	6.1	1.3	4.8	9.3	1.8	7.4
(13) Professional, scientific, and technical activities	31.1	10.3	20.8	52.0	14.1	37.9
(14) Administrative and support service activities	41.5	10.1	31.4	56.1	12.8	43.4
(15) Public administration and defense; compulsory social security	34.6	8.0	26.6	52.4	11.3	41.1
(16) Education	89.2	8.9	80.3	112.0	13.1	99.0
(17) Human health and social work activities	39.3	7.4	31.9	55.5	10.3	45.1
(18) Arts, entertainment, and recreation	29.8	6.8	23.0	42.2	9.0	33.2
(19) Other service activities	37.5	11.0	26.4	51.1	13.5	37.6
(20) Activities of households as employers; undifferentiated goods and services producing activities of household for own use	502.5	26.0	476.5	535.3	32.0	503.3

Source: Author's calculations

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[27] (20) Activities of households as employers has the highest Type II employment multiplier, of 535.3, but its impact should be interpreted with caution due to the unreliable and potentially misreported data from this sector.

3.3.3. INVESTMENT MULTIPLIERS

The input indicators for Gross Fixed Capital Formation (GFCF), in Table 16, provide data on investments per million GEL of output for various sectors, measuring the total investment in fixed assets for different sectors over a year. The monetary input coefficients for GFCF will be used to calculate the impact of increases in final demand for sector j's output on investments generated in the economy in all stages of production. The resulting multipliers are identified as Revenue-to-Investment multipliers.

The Type I investment multiplier is calculated using the following formula:

$z = in \, (I - A)^{-1}$ (18), where

in = vector of input indicators for Gross Fixed Capital Formation (see Table 16)

z = vector with results for direct and indirect effects on investments

For calculating Type II investment multipliers, equation (18) becomes $\tilde{z} = \tilde{in}\left(I_{n+1} - \tilde{A}\right)^{-1}$
Where, vector $\tilde{z}$ now includes the results for direct, indirect, induced effects on investments. $\tilde{in}$ is the expanded input indicator vector (Appendix A3.)

The resulting Type I and Type II multipliers for different sectors of economy are presented in Table 22.[28]

The three sectors with the highest Type I investment multipliers are: (4) electricity, gas, steam, and air conditioning supply (0.644); (5) water supply, sewerage, and waste management (0.584); and (10) information and communication (0.450). Interpreting this investment multiplier, for example, highlights that for the information and communication sector, a 1 million GEL increase in final demand for this sectors' output generates, throughout the economy, 450,000 GEL of investments in fixed assets at all stages of production.

While for Type II investment multipliers, for which induced effects are introduced, the ranking of the top three sectors does not change, however, the multipliers are now higher. For the information and communication sector, the Type II multipliers indicate that 514,000 GEL of investments in fixed capital would be generated per 1 million GEL of additional demand. Thus, the induced effects generate an additional 64,000 GEL of investment to the economy.

The relatively high levels of both Type I and Type II multipliers in (4) the electricity, gas, steam and air conditioning supply; (5) the water supply, sewerage, and waste management; and (10) the

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[28] Investment multipliers obtained from the IOT, as derived from a 38x38 dimensional SUT, are presented in Appendix A4.

information and communication sectors could emphasize the capital-intensive nature of these sectors.

TABLE 22. TYPE I AND TYPE II INVESTMENT MULTIPLIERS [29] (REVENUE-TO-INVESTMENT)		
Sectors	Type I multipliers	Type II multipliers
(1) Agriculture, forestry, and fishing	0.135	0.247
(2) Mining and quarrying	0.176	0.220
(3) Manufacturing	0.152	0.197
(4) Electricity, gas, steam, and air conditioning supply	0.644	0.692
(5) Water supply, sewerage, waste management, and remediation activities	0.584	0.668
(6) Construction	0.268	0.329
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	0.190	0.257
(8) Transportation and storage	0.224	0.285
(9) Accommodation and food service activities	0.168	0.209
(10) Information and communication	0.450	0.514
(11) Financial and insurance activities	0.068	0.133
(12) Real estate activities	0.053	0.069
(13) Professional, scientific, and technical activities	0.090	0.191
(14) Administrative and support service activities	0.171	0.243
(15) Public administration and defense; compulsory social security	0.692	0.778
(16) Education	0.099	0.210
(17) Human health and social work activities	0.156	0.234
(18) Arts, entertainment, and recreation	0.155	0.215
(19) Other service activities	0.068	0.134

Source: Author's calculations

[29] (15) Public administration and defense; compulsory social security has the highest Type I and II investment multipliers, though its impact should be regarded with caution. Here, one should not compare the relative significance of other sectors against this particular one in terms of economy-wide investment generation capacity, since investments (not necessarily part of public administration output) are accounted statistically in this sector, while directed towards the rest of the economy, resulting in overestimated investment multipliers.

The investment multipliers are moreover calculated at a different base: per every million GEL of investment in a given sector, rather than per million GEL of final demand. The resulting multipliers can reveal the effect on total investments to the economy (per million GEL of initial direct investment created in the originating sector). By assumption, such direct investment is a result of increased output of a sector due to further corresponding final demand (as an initial shock). The resulting multipliers can be regarded as Investment-to-Investment multipliers (see Appendix A8.)

CONCLUSION

The sector-specific multipliers derived by this study on the Georgian economy portray the potential spillover effects, to the whole economy, of an increase in final demand for the products of a given sector; in terms of revenue (output), employment, and investment generation capacity. The multipliers presented capture the total economic impacts potentially generated from exogenous shocks to final demand.

The Type I and Type II multipliers derived reflect all possible effects (initial, direct, indirect, and induced) that increased demand or spending in each sector cause throughout the economy in terms of jobs creation, investment and revenues enhancement. While Type I multipliers incorporate the initial, direct, and indirect effects, the sum of the initial, direct, indirect, and induced effects are defined by Type II multipliers.

When comparing the Type I output multiplier measures at the sectoral level, manufacturing has the highest level,1.60; followed by the accommodation and food service sector; and arts, entertainment, and recreation, each with an output multiplier of 1.49. These effects are amplified further still when capturing the induced effects of the initial expenditure, which also leads to changes in their relative ranking in terms of economy-wide impacts. A comparison of the output (revenue) Type II multipliers indicates that initial expenditure in agriculture; professional, scientific, and technical activities; and in education have the greatest impact in terms of revenue generated for the economy, with output multipliers of 3.20, 3.03, and 3.01, respectively. Although, one should bear in mind that the Type II multipliers overestimate the real effects of initial expenditure because of the rigid consumer consumption behavior assumed in the model. Type II multipliers are generally considered to be the upper bound of economic impact, where Oosterhaven, Peik, and Stedler (1986) believe a realistic estimate lies half-way between Type I and Type II multipliers.

Regarding a job creation capacity of the sector, a comparison of the full-time equivalent (FTE) employment multipliers indicates that the labor intensive sectors of agriculture, forestry, and fishing and education rank the highest, with respective Type II employment multiplier values of 136.5 and 112.0. These results suggest that the additional final demand, per million GEL, for agricultural products and education services would create around 137 and 112 FTE jobs in the whole economy, respectively. Moreover, disaggregating the employment multipliers by gender and age, one can conclude that the capacity to generate full-time equivalent employment for female is higher in Education; equivalent to approximately 80 (of 112) FTE jobs annually. Whereas, the least opportunistic sectors for women are construction and transportation. The age-disaggregated employment multipliers also result in notable FTE job creation differences for young (aged between 15-30) and adult employees (above 30). For instance, of the total 137 jobs created, from a 1 million GEL increase in final demand for agricultural products, with only 18 FTE jobs are created for young, but 119 for adult employees.

Furthermore, when determining the sector in which additional spending would generate the highest investments as a whole, both the Type I and Type II investment multipliers highlight that electricity, gas, steam, and air conditioning supply; water supply, sewerage, and waste management; and information and communication are highest ranked sectors, emphasizing their

capital-intensive nature. For example, the Type II multipliers show that 1 million GEL of additional demand in the electricity, gas, steam, and air conditioning sector generates 644,000 GEL of capital investments to the economy.

The use of national multipliers is restricted by the Input-Output model, simplifying the assumptions and limitations that should be factored into their application. The explicitly invoked assumptions for fixed production input structure, fixed prices, and unlimited factor resources may change how the economy behaves in response to increased final demands. Despite the fact that Georgia is an open economy and may be less affected by supply constraints, the notion of an unlimited supply of input materials and labor in the model leads to an overestimate of the multiplier effects. Some sectors may operate at full capacity and substitute inputs in their production. Therefore, the true effects would be expected to be somewhat lower than predicted by such multipliers.

It can moreover be argued that IO multipliers provide a distorted view of reality, which only worsens looking to the future, as relationships between, and within, sectors are not treated dynamically, and the possible bottlenecks or increased costs due to factor supply rigidity are ignored. The IO multipliers predictions, therefore, should be taken with a pinch of salt, and considered as reasonable approximations for short-term effects, while the greater the time from the original calculation, the less reliable they become. This is a core reasons as to why IO multipliers should be recalculated yearly, and their stability and consistency tested over time.

Although, the sector-specific multipliers derived in this study should be used with caution in policy-making, they are, nevertheless, relatively effective measures that can suggest the possible magnitude of broader impacts on the Georgian economy, generated as a result of increased final demand for each sector.

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APPENDICES

APPENDIX A1. A 21X21 IOT FOR GEORGIA AT BASIC PRICES DERIVED FROM A 38X38 SUT, MLN. GEL (2018)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	Total intermediate consumption	Final consumption expenditure by households and non-profit organisations serving households	Final consumption expenditure by government	Final consumption expenditure	Export of goods	Export of services	Export, total	Gross fixed capital formation	Changes in inventories	Gross capital formation	Total final uses	Total Use
Domestic products																																	
(1) Products of Agriculture, forestry and fishing	701	3	1,537	1	0	13	28	6	138	1	1	3	3	2	1	4	6	30	0	-	-	2,479	1,481	0	1,481	475	14	489	374	62	437	2,406	4,885
(2) Mining and quarrying products	2	20	149	0	0	44	6	8	2	1	1	3	0	1	1	0	1	1	1	-	-	243	28	0	28	594	2	596	22	15	37	661	904
(3) Manufactured products	247	28	1,736	14	27	1,181	151	64	389	12	14	58	39	15	122	18	135	54	16	-	-	4,320	4,886	1	4,886	2,740	692	3,432	285	114	399	8,717	13,038
(4) Electricity, gas, steam and air conditioning	17	34	304	108	22	28	86	43	120	35	30	47	7	5	72	29	57	36	11	-	-	1,089	460	0	460	50	0	50	23	11	34	543	1,633
(5) Water supply; sewerage, waste management and remediation services	8	1	13	2	4	5	9	3	23	1	5	10	1	1	1	5	10	5	4	-	-	110	192	48	239	129	0	129	2	(1)	1	369	479
(6) Constructions and construction works	5	6	136	25	10	1,134	43	22	81	29	15	56	20	4	3	16	37	25	3	-	-	1,669	760	6	766	16	64	79	5,974	105	6,079	6,925	8,593
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	159	73	960	67	22	470	249	311	157	27	21	31	19	19	111	17	160	45	16	-	-	2,933	2,515	8	2,524	1,171	515	1,686	436	467	903	5,113	8,046
(8) Transportation and storage services	74	27	346	30	7	161	310	421	58	16	32	15	16	47	64	14	47	45	13	-	-	1,744	800	3	803	269	1,859	2,128	104	28	131	3,062	4,807
(9) Accommodation and food services	4	1	21	3	1	22	45	68	36	11	40	5	11	60	108	63	42	56	23	-	-	620	590	10	600	1	2,461	2,462	31	7	38	3,101	3,721
(10) Information and communication services	1	1	15	31	1	30	79	12	10	232	74	6	11	7	54	13	7	11	6	-	-	601	743	5	748	6	303	309	110	22	132	1,189	1,790
(11) Financial and insurance services	112	22	274	42	11	204	183	134	88	41	17	388	33	21	20	15	66	45	11	-	-	1,726	1,085	43	1,128	45	221	266	17	4	20	1,415	3,141
(12) Real estate services	8	3	164	6	2	121	556	90	231	63	213	120	39	71	104	24	60	202	70	-	-	2,147	3,228	1	3,229	2	15	17	17	2	20	3,266	5,413
(13) Professional, scientific and technical services	7	3	114	91	2	63	78	41	28	33	121	51	153	6	52	11	19	43	14	-	-	929	326	84	411	20	49	70	112	10	122	603	1,532
(14) Administrative and support service services	1	2	23	16	1	24	52	40	59	26	26	23	17	26	49	14	40	37	4	-	-	478	347	0	347	3	48	50	18	2	20	417	896
(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	6	1	0	0	3	-	0	3	5	0	0	0	0	-	-	20	565	3,394	3,959	-	238	238	-	-	-	4,197	4,217
(16) Education services	0	0	1	0	0	1	1	1	1	5	8	1	2	0	4	8	27	0	1	-	-	60	1,172	821	1,993	0	36	36	0	0	0	2,029	2,089
(17) Human health and social work services	1	4	7	2	0	5	4	4	8	1	1	1	2	1	8	8	150	3	0	-	-	210	1,559	1,136	2,694	5	9	14	4	2	12	2,722	2,932
(18) Arts, entertainment and recreation srvices	0	0	1	0	0	0	2	0	1	15	2	4	1	1	39	9	0	102	1	-	-	180	282	102	384	0	1,551	1,551	0	3	3	1,938	2,118
(19) Other services	0	0	3	16	0	22	1	0	10	12	24	1	18	0	0	2	3	5	7	-	-	127	471	1	472	1	25	26	1	0	1	500	626
(20) Services of households as employers; undifferentiated goods and services producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	-	37	-	-	-	-	-	-	37	37
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,346	228	5,804	453	110	3,507	1,910	1,271	1,440	559	648	822	393	290	817	270	869	744	202	-	-	21,685	21,526	5,663	27,189	5,529	8,101	13,631	7,528	863	8,391	49,211	70,896
Domestic products																																	
(1) Products of Agriculture, forestry and fishing	118	0	259	0	0	2	5	1	24	0	0	1	1	0	1	1	1	5	0	-	-	417	256	0	256	84	5	88	61	10	71	416	833
(2) Mining and quarrying products	3	28	206	0	0	52	3	10	0	0	0	4	0	0	0	0	0	0	0	-	-	307	3	0	3	841	1	842	0	19	19	864	1,172
(3) Manufactured products	248	106	1,787	84	53	1,219	339	533	254	71	42	52	64	33	319	35	314	87	47	-	-	5,688	5,985	0	5,985	3,587	1,298	4,885	2,766	296	3,062	13,932	19,620
(4) Electricity, gas, steam and air conditioning	2	4	33	12	2	3	9	5	13	4	3	5	1	1	8	3	6	4	1	-	-	118	50	0	50	5	0	5	0	1	1	56	175
(5) Water supply; sewerage, waste management and remediation services	1	0	1	0	0	0	1	0	2	0	0	1	0	0	0	0	1	0	0	-	-	8	14	3	17	9	0	9	0	(0)	(0)	26	35
(6) Constructions and construction works	0	1	11	0	0	21	2	2	1	0	0	1	0	0	0	0	1	0	0	-	-	42	15	0	15	9	8	17	18	1	19	50	92
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	9	4	58	4	1	28	15	18	10	2	2	2	1	1	7	1	9	3	1	-	-	177	147	0	148	71	32	102	26	26	52	302	479
(8) Transportation and storage services	44	16	201	17	4	93	181	249	32	9	17	8	9	27	37	8	27	25	7	-	-	1,012	445	1	446	158	1,112	1,271	62	14	76	1,792	2,804
(9) Accommodation and food services	0	0	3	0	0	3	4	8	4	1	4	0	1	7	12	7	5	6	2	-	-	69	62	0	62	1	278	279	0	1	1	342	411
(10) Information and communication services	0	0	2	10	0	20	14	7	2	21	21	1	2	1	3	1	1	3	1	-	-	111	40	0	40	0	66	67	86	0	86	193	304
(11) Financial and insurance services	14	3	34	5	1	25	23	17	11	5	2	48	4	3	3	2	8	6	1	-	-	215	135	5	141	6	28	33	2	0	3	176	392
(12) Real estate services	0	0	1	0	0	1	1	2	1	0	0	0	0	0	4	0	0	1	0	-	-	13	8	0	8	2	4	6	4	0	5	18	31
(13) Professional, scientific and technical services	1	0	21	9	0	7	14	4	4	5	20	5	23	1	10	2	3	7	3	-	-	140	30	1	31	1	5	6	8	1	9	45	186
(14) Administrative and support service services	0	1	8	6	1	10	18	14	20	9	10	8	6	9	17	5	14	13	1	-	-	170	118	0	118	1	21	22	14	0	15	154	324
(15) Public administration and defence; compulsory social security services	-	-	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	0	0	-	-	1	25	153	178	-	11	11	-	-	-	189	190
(16) Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-	-	3	60	42	102	0	2	2	0	0	0	104	108
(17) Human health and social work services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	-	-	3	16	16	32	0	0	1	0	0	0	33	36
(18) Arts, entertainment and recreation srvices	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	-	-	6	9	3	12	0	50	50	0	0	0	62	68
(19) Other services	0	0	0	1	0	0	1	0	1	1	1	0	1	0	0	0	0	0	0	-	-	7	24	0	24	0	1	2	0	0	0	26	33
(20) Services of households as employers; undifferentiated goods and services producing activities of household for own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(21) Services provided by of extra-territorial organisations and bodies	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Imported	440	163	2,625	151	64	1,486	632	870	378	128	125	136	114	83	424	67	394	163	67	-	-	8,510	7,442	226	7,668	4,776	2,921	7,697	3,048	371	3,418	18,783	27,293
Total (Imported + domestic)	1,786	391	8,429	604	174	4,993	2,542	2,141	1,818	687	774	957	507	374	1,241	337	1,263	907	269	-	-	30,195	28,968	5,889	34,857	10,306	11,022	21,328	10,576	1,234	11,810	67,995	98,190
Taxes less Subsidies	83	56	668	48	13	387	98	205	103	25	17	25	20	11	77	11	36	28	11	-	-	1,923	1,943	1	1,944	863	358	1,221	640	93	733	3,898	5,821
Gross Values Added	3,016	457	3,940	980	293	3,213	5,406	2,462	1,800	1,077	2,350	4,431	1,005	510	2,900	1,740	1,633	1,182	347	37	-	38,779											38,779
Inputs at Basic prices	4,885	904	13,038	1,633	479	8,593	8,046	4,807	3,721	1,790	3,141	5,413	1,532	896	4,217	2,089	2,932	2,118	626	37	-	70,896	30,911	5,891	36,801	11,168	11,380	22,549	11,216	1,327	12,543	71,893	

Source: Geostat, Authors' calculations

APPENDIX A2. LEVELS OF GENDER DISAGGREGATED FTE EMPLOYMENT AND INPUT INDICATORS, CONSIDERING THE SAME NORMAL LENGTH OF FULL-TIME EMPLOYMENT[30]

	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Water supply; sewerage, waste management and remediation activities	Construction	Wholesale and retail trade; repair of motor vehicles and motorcycles	Transportation and storage	Accommodation and food service activities	Information and communication	Financial and insurance activities	Real estate activities	Professional, scientific and technical activities	Administrative and support service activities	Public administration and defence; compulsory social security	Education	Human health and social work activities	Arts, entertainment and recreation	Other service activities	Activities of households as employers	Activities of extra-territorial organisations and bodies	Notations for row vectors of input indicators
Total full-time equivalent (FTE) employment	458,608	9,047	106,226	14,905	21,399	109,308	230,037	81,463	46,928	26,685	36,477	17,025	36,439	30,407	122,677	178,602	88,662	43,857	19,005	18,558	-	
Gender Disaggregated Employment (with same normal length of full-time employment)																						
Total full-time equivalent (FTE) employment, Female	206,993	922	35,791	2,614	6,096	7,937	103,115	11,834	25,144	11,379	22,473	5,757	16,640	11,445	36,752	138,348	64,190	20,763	11,055	18,397	-	
Total full-time equivalent (FTE) employment, Male	251,615	8,125	70,434	12,291	15,304	101,371	126,922	69,630	21,785	15,306	14,004	11,269	19,800	18,963	85,925	40,253	24,472	23,094	7,949	162	-	
Input Indicators																						
Total full-time equivalent (FTE) employment	94	10	8	9	45	13	29	17	13	15	12	3	24	34	29	86	30	21	30	503	-	e
Gender Disaggregated Employment (with same normal length of full-time employment)																						
Total full-time equivalent (FTE) employment, Female	42	1	3	2	13	1	13	2	7	6	7	1	11	13	9	66	22	10	18	498	-	e_{f2}
Total full-time equivalent (FTE) employment, Male	52	9	5	8	32	12	16	14	6	9	4	2	13	21	20	19	8	11	13	4	-	e_{m2}

Source: Geostat, Authors' calculations

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[30] In this case, the FTE self-employed female/male is measured the following way – across the different economic sectors, the total weekly hours worked in primary and secondary jobs by self-employed female/male is divided by the normal length of weekly full-time weekly employment for all (female and male together) in a particular sector.

	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Water supply; sewerage, waste management and remediation activities	Construction	Wholesale and retail trade; repair of motor vehicles and motorcycles	Transportation and storage	Accommodation and food service activities	Information and communication	Financial and insurance activities	Real estate activities	Professional, scientific and technical activities	Administrative and support service activities	Public administration and defence; compulsory social security	Education	Human health and social work activities	Arts, entertainment and recreation	Other service activities	Activities of households as employers	Activities of extra-territorial organisations and bodies	Final consumption expenditure by households and non-profit organisations serving households (NPISH)	Notations for expanded input indicator vectors
Input Indicators																							
Gross Fixed Capital Formation (mln GEL)	0.0945	0.1120	0.0751	0.5622	0.5183	0.1916	0.1490	0.1681	0.0987	0.3607	0.0307	0.0321	0.0538	0.1171	0.6479	0.0695	0.0994	0.0977	0.0134	-	-	-	$\widetilde{in}$
Total full-time equivalent (FTE) employment	94	10	8	9	45	13	29	17	13	15	12	3	24	34	29	86	30	21	30	503	-	-	$\widetilde{e}$
Gender Disaggregated Employment (with disaggregated normal length of full-time employment)																							
Total full-time equivalent (FTE) employment, Female	44	1	3	2	13	1	13	2	7	6	7	1	11	13	9	66	22	10	18	498	-	-	$\widetilde{e_{f1}}$
Total full-time equivalent (FTE) employment, Male	50	9	5	8	32	12	16	14	6	9	4	2	13	21	20	19	8	11	13	4	-	-	$\widetilde{e_{m1}}$
Gender Disaggregated Employment (with same normal length of full-time employment)																							
Total full-time equivalent (FTE) employment, Female	42	1	3	2	13	1	13	2	7	6	7	1	11	13	9	66	22	10	18	498	-	-	$\widetilde{e_{f2}}$
Total full-time equivalent (FTE) employment, Male	52	9	5	8	32	12	16	14	6	9	4	2	13	21	20	19	8	11	13	4	-	-	$\widetilde{e_{m2}}$
Age Disaggregated Employment																							
Total full-time equivalent (FTE) employment, age 15-30	11	1	2	2	5	3	8	3	3	6	6	0	8	8	7	8	5	5	9	26	-	-	$\widetilde{e_y}$
Total full-time equivalent (FTE) employment, age 30 +	83	9	6	7	40	10	20	14	9	9	5	3	16	26	22	77	25	16	21	477	-	-	$\widetilde{e_a}$

Source: Geostat, Authors' calculations

Sectors	Output (Revenue) Multipliers		Investment Multipliers		Full-time Equivalent (FTE) Employement Multipliers									
					Total FTEs	Female FTEs	Male FTEs	FTEs aged 15-30	FTEs aged above 30	Total FTEs	Female FTEs	Male FTEs	FTEs aged 15-30	FTEs aged above 30
	Type I	Type II	Type I	Type II	Type I					Type II				
(1) Agriculture, forestry and fishing	1.39	3.29	0.137	0.256	113.8	53.2	60.6	13.7	100.1	138.1	65.4	72.7	18.2	119.9
(2) Mining and quarrying	1.35	2.07	0.173	0.218	16.8	3.7	13.1	2.9	13.8	26.0	8.3	17.7	4.6	21.3
(3) Manufacturing	1.64	2.43	0.156	0.205	30.5	12.6	17.9	5.3	25.2	40.4	17.6	22.9	7.1	33.3
(4) Electricity, gas, steam and air conditioning supply	1.38	2.17	0.641	0.690	16.2	4.4	11.8	3.7	12.5	26.2	9.5	16.8	5.6	20.7
(5) Water supply; sewerage, waste management and remediation activities	1.33	2.74	0.582	0.670	50.7	15.0	35.7	6.0	44.7	68.6	24.0	44.6	9.3	59.3
(6) Construction	1.62	2.68	0.273	0.338	23.6	4.8	18.8	5.0	18.6	37.1	11.5	25.5	7.5	29.6
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	1.32	2.44	0.189	0.260	33.8	14.8	18.9	9.5	24.2	48.1	22.0	26.1	12.2	35.9
(8) Transportation and storage	1.36	2.37	0.218	0.281	23.7	5.0	18.8	4.2	19.5	36.6	11.4	25.2	6.6	30.0
(9) Accommodation and food service activities	1.55	2.27	0.174	0.219	25.3	12.1	13.2	5.8	19.6	34.5	16.7	17.8	7.5	27.0
(10) Information and communication	1.44	2.51	0.453	0.521	22.1	9.4	12.7	7.8	14.3	35.8	16.3	19.5	10.3	25.5
(11) Financial and insurance activities	1.28	2.36	0.067	0.134	16.0	9.1	7.0	7.7	8.4	29.8	16.0	13.8	10.2	19.6
(12) Real estate activities	1.20	1.47	0.053	0.070	6.1	2.4	3.7	1.3	4.9	9.5	4.1	5.4	1.9	7.6
(13) Professional, scientific and technical activities	1.36	3.06	0.089	0.196	30.9	14.0	16.9	10.2	20.7	52.6	24.9	27.7	14.2	38.4
(14) Administrative and support service activities	1.45	2.65	0.171	0.246	41.4	15.9	25.5	10.1	31.3	56.6	23.5	33.1	12.9	43.7
(15) Public administration and defence; compulsory social security	1.27	2.72	0.690	0.780	34.1	10.8	23.3	7.9	26.1	52.5	20.0	32.5	11.3	41.2
(16) Education	1.19	3.07	0.099	0.217	89.1	67.9	21.2	8.9	80.3	113.1	79.9	33.1	13.3	99.8
(17) Human health and social work activities	1.42	2.75	0.157	0.240	39.5	26.5	13.0	7.5	32.0	56.4	35.0	21.5	10.6	45.8
(18) Arts, entertainment and recreation	1.48	2.50	0.154	0.217	29.6	13.6	16.1	6.7	22.9	42.5	20.0	22.5	9.1	33.5
(19) Other service activities	1.44	2.54	0.066	0.135	37.0	20.4	16.6	10.9	26.0	51.1	27.5	23.6	13.5	37.5
(20) Activities of households as employers; undifferentiated goods and servicies producing activities of household for own use					502.5	498.2	4.4	26.0	476.5	536.8	515.3	21.5	32.3	504.5

Source: Authors' calculations

Appendix A5.

With the help of a power series approximation of the Leontief inverse matrix, one can separate the initial, direct, and indirect effects of a shock to final demand (Appendix A5.1.)

$$(I - A)^{-1} = I + A + A^2 + A^3 + \cdots + A^n \quad \text{the power series approximation}$$

In this equation of the power series of A matrices, the diagonal elements of the unit matrix (I) denote the initial unit of product for final use. Matrix A represents the direct effects capturing the direct input requirements of production, and the remaining matrices (from A^2 to A^n) represent the indirect effects measuring the indirect input requirements of a producer. Besides the initial effects, the differences between the Leontief inverse matrix (Tables 15 and 18) and the input coefficients matrix A (Tables 13 and 17) correspond to the indirect effects. While, the differences between Type I and Type II multipliers reveal the induced effects.

Sectors	Initial effect 1 mln. GEL	Direct effect	Indirect effect	Type I multipliers	Induced effect	Type II multipliers
APPENDIX. A5.1. DECOMPOSITION OF OUTPUT MULTIPLIERS BETWEEN DIRECT, INDIRECT, AND INDUCED EFFECTS – PER 1 MLN. GEL FINAL DEMAND						
(1) Agriculture, forestry, and fishing	1.000	0.266	0.106	1.372	1.832	3.204
(2) Mining and quarrying	1.000	0.277	0.122	1.399	0.711	2.110
(3) Manufacturing	1.000	0.421	0.180	1.601	0.737	2.337
(4) Electricity, gas, steam, and air conditioning supply	1.000	0.294	0.123	1.418	0.771	2.189
(5) Water supply, sewerage, waste management, and remediation activities	1.000	0.241	0.107	1.348	1.376	2.725
(6) Construction	1.000	0.383	0.189	1.572	0.997	2.569
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	1.000	0.244	0.087	1.332	1.096	2.428
(8) Transportation and storage	1.000	0.299	0.127	1.426	0.997	2.423
(9) Accommodation and food service activities	1.000	0.351	0.141	1.492	0.668	2.161
(10) Information and communication	1.000	0.316	0.130	1.446	1.042	2.488
(11) Financial and insurance activities	1.000	0.214	0.075	1.289	1.056	2.344
(12) Real estate activities	1.000	0.149	0.050	1.200	0.257	1.457
(13) Professional, scientific, and technical activities	1.000	0.263	0.102	1.365	1.661	3.027
(14) Administrative and support service activities	1.000	0.330	0.127	1.457	1.162	2.619
(15) Public administration and defense; compulsory social security	1.000	0.210	0.089	1.299	1.416	2.716
(16) Education	1.000	0.132	0.056	1.187	1.820	3.007
(17) Human health and social work activities	1.000	0.295	0.125	1.420	1.281	2.701
(18) Arts, entertainment, and recreation	1.000	0.356	0.134	1.491	0.986	2.476
(19) Other service activities	1.000	0.339	0.122	1.461	1.087	2.547

Source: Authors' calculations

Appendix A6.

To calculate the Job-to-Job FTE employment multipliers, we first decompose the direct, indirect, and induced effects from the Type I and Type II Revenue-to-Job total FTE employment multipliers (see Appendix A6.1.), and then normalize the direct effects to 100 jobs. In this case, the initial direct effects are given by the elements of the vector of employment-output ratios (elements of vector *e*). The estimates for indirect and induced effects supported per 100 direct jobs in the given sector are then calculated using the following equations[31]:

Job-to-Job indirect effect: $\frac{Type\ I\ FTE\ Empl.\ Multiplier - Direct\ empl.\ effect}{Direct\ empl.\ effect} * 100$

Job-to-Job induced effect: $\frac{Type\ II\ Empl.\ Multiplier - Type\ I\ Empl.\ Multiplier}{Direct\ empl.\ effect} * 100$

The resulting Job-to-Job FTE total employment multipliers are presented below in Appendix A6.2. Provided 100 FTE jobs are created in manufacturing – 263.9 FTE jobs would also be supported indirectly in other related sectors (including itself) that offer inputs to manufacturing. When also considering the induced effects, this increase in direct job creation in manufacturing would lead to the creation of 477.6 new FTE jobs; ranking highest overall, relative to other sectors.

Assuming an initial 100 direct jobs in the manufacturing sector are created for both female and male workers, with the same proportional gender disaggregation structure of labor from 2018, of the total 477.6 FTE jobs – 207.5 FTE positions would be created for women and 270.1 for men (see Appendix A6.3.) Applying the same logic for age-disaggregation, per total 100 direct FTE jobs in manufacturing – 84.2 FTE positions would be created for young workers (aged between 15-30), while 393.4 FTE jobs would be supported for adults (30+) (see Appendix A6.4.)

It is notable that, comparing sectors' employment multipliers on a per-job basis is comparing very different levels of initial shock to final demand in each sector. Thus, one should not consider these results contradictory to Revenue-to-Job multipliers that suggest highest FTE employment multiplier for agricultural sector rather than the one for manufacturing per million GEL of final demand. In sectors with high labor productivity (such as manufacturing), it takes much higher increase in final demand to support 100 direct jobs, compared to sectors with low productivity (such as agriculture). In agriculture, with 93.9 direct FTE jobs per 1 mln. GEL of final demand (output), it takes only 1.07 mln. GEL to support 100 direct jobs. While in manufacturing, with 8.1 direct jobs per 1 mln. GEL of final demand, it takes 12.4 mln. GEL of final demand to generate

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[31]The transformation of Revenue-to-Job multipliers into Job-to-Job multipliers follows the methodological instructions provided by Bivens (2019) that gives an exemplary application of Job-to-Job employment multipliers in the context of factory closure.

100 direct FTE jobs. Therefore the impact of manufacturing sector on the rest of the economy is higher as depicted by Job-to-Job multipliers due to much higher initial increase (12.4 mln.) in its output.

Sectors	Direct effect	Indirect effect	Type I multipliers	Induced effect	Type II multipliers
(1) Agriculture, forestry, and fishing	93.9	19.6	113.5	23.0	136.5
(2) Mining and quarrying	10.0	7.5	17.5	8.9	26.5
(3) Manufacturing	8.1	21.5	29.7	9.3	38.9
(4) Electricity, gas, steam, and air conditioning supply	9.1	7.6	16.7	9.7	26.4
(5) Water supply, sewerage, waste management, and remediation activities	44.6	6.4	51.0	17.3	68.3
(6) Construction	12.7	10.1	22.8	12.5	35.3
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	28.6	5.4	34.0	13.8	47.8
(8) Transportation and storage	16.9	7.9	24.8	12.5	37.4
(9) Accommodation and food service activities	12.6	11.5	24.2	8.4	32.6
(10) Information and communication	14.9	7.5	22.4	13.1	35.5
(11) Financial and insurance activities	11.6	4.7	16.3	13.3	29.5
(12) Real estate activities	3.1	2.9	6.1	3.2	9.3
(13) Professional, scientific, and technical activities	23.8	7.3	31.1	20.9	52.0
(14) Administrative and support service activities	34.0	7.6	41.5	14.6	56.1
(15) Public administration and defense; compulsory social security	29.1	5.5	34.6	17.8	52.4
(16) Education	85.5	3.7	89.2	22.9	112.0
(17) Human health and social work activities	30.2	9.1	39.3	16.1	55.5
(18) Arts, entertainment, and recreation	20.7	9.1	29.8	12.4	42.2
(19) Other service activities	30.3	7.1	37.5	13.7	51.1
(20) Activities of households as employers; undifferentiated goods and services producing activities of household for own use	502.5	0.0	502.5	32.7	535.3

APPENDIX A6.1. FULL-TIME EQUIVALENT TOTAL EMPLOYMENT MULTIPLIERS (REVENUE-TO-JOB) – PER 1 MLN. GEL FINAL DEMAND

Source: Authors' calculations

APPENDIX A6.2. FULL-TIME EQUIVALENT TOTAL EMPLOYMENT MULTIPLIERS (JOB-TO-JOB) – PER 100 DIRECT FTE JOBS					
Sectors	Direct effect	Indirect effect	Type I multipliers	Induced effect	Type II multipliers
(1) Agriculture, forestry, and fishing	100.0	20.9	120.9	24.5	145.4
(2) Mining and quarrying	100.0	75.3	175.3	89.4	264.6
(3) Manufacturing	100.0	263.9	363.9	113.6	477.6
(4) Electricity, gas, steam, and air conditioning supply	100.0	83.2	183.2	106.2	289.4
(5) Water supply, sewerage, waste management, and remediation activities	100.0	14.3	114.3	38.7	153.1
(6) Construction	100.0	79.0	179.0	98.5	277.6
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	100.0	19.0	119.0	48.2	167.2
(8) Transportation and storage	100.0	46.5	146.5	74.0	220.5
(9) Accommodation and food service activities	100.0	91.5	191.5	66.6	258.1
(10) Information and communication	100.0	50.1	150.1	87.9	238.0
(11) Financial and insurance activities	100.0	40.1	140.1	114.3	254.4
(12) Real estate activities	100.0	92.8	192.8	102.7	295.5
(13) Professional, scientific, and technical activities	100.0	30.8	130.8	87.8	218.6
(14) Administrative and support service activities	100.0	22.3	122.3	43.0	165.3
(15) Public administration and defense; compulsory social security	100.0	18.9	118.9	61.2	180.1
(16) Education	100.0	4.3	104.3	26.8	131.0
(17) Human health and social work activities	100.0	30.1	130.1	53.3	183.4
(18) Arts, entertainment, and recreation	100.0	43.8	143.8	59.8	203.6
(19) Other service activities	100.0	23.5	123.5	45.0	168.5
(20) Activities of households as employers; undifferentiated goods and services producing activities of household for own use	100.0	0.0	100.0	6.5	106.5

Source: Authors' calculations

APPENDIX A6.3. FULL-TIME EQUIVALENT (FTE) EMPLOYEMENT MULTIPLIERS BY GENDER (JOB-TO-JOB) - PER 100 TOTAL DIRECT JOBS														
	Direct effect			Indirect effect			Type I Multipliers			Induced effect			Type II Multipliers		
Sectors	total	F.	M.	total	F.	M.	total	F.	M.	total	F.	M.	total	F.	M.
(1) Agriculture, forestry and fishing	100.0	47.0	53.0	20.9	9.6	11.3	120.9	56.5	64.3	24.5	12.4	12.2	145.4	68.9	76.5
(2) Mining and quarrying	100.0	10.2	89.8	75.3	29.8	45.5	175.3	40.0	135.3	89.4	45.0	44.3	264.6	85.1	179.6
(3) Manufacturing	100.0	33.9	66.1	263.9	116.3	147.6	363.9	150.2	213.8	113.6	57.3	56.3	477.6	207.5	270.1
(4) Electricity, gas, steam and air conditioning supply	100.0	17.5	82.5	83.2	33.5	49.7	183.2	51.0	132.2	106.2	53.5	52.7	289.4	104.6	184.8
(5) Water supply; sewerage, waste management and remediation activities	100.0	28.5	71.5	14.3	5.4	8.9	114.3	33.9	80.4	38.7	19.5	19.2	153.1	53.5	99.6
(6) Construction	100.0	7.4	92.6	79.0	27.8	51.3	179.0	35.1	143.9	98.5	49.7	48.9	277.6	84.8	192.8
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	100.0	44.9	55.1	19.0	7.5	11.5	119.0	52.3	66.7	48.2	24.3	23.9	167.2	76.6	90.6
(8) Transportation and storage	100.0	14.5	85.5	46.5	17.4	29.1	146.5	31.9	114.6	74.0	37.3	36.7	220.5	69.2	151.2
(9) Accommodation and food service activities	100.0	53.7	46.3	91.5	38.3	53.2	191.5	92.1	99.5	66.6	33.6	33.0	258.1	125.6	132.5
(10) Information and communication	100.0	42.8	57.2	50.1	21.2	28.9	150.1	64.0	86.1	87.9	44.3	43.6	238.0	108.3	129.7
(11) Financial and insurance activities	100.0	61.6	38.4	40.1	17.4	22.7	140.1	79.0	61.1	114.3	57.6	56.7	254.4	136.6	117.7
(12) Real estate activities	100.0	33.9	66.1	92.8	41.5	51.3	192.8	75.4	117.4	102.7	51.8	50.9	295.5	127.2	168.4
(13) Professional, scientific and technical activities	100.0	45.9	54.1	30.8	13.6	17.3	130.8	59.5	71.4	87.8	44.3	43.5	218.6	103.7	114.9
(14) Administrative and support service activities	100.0	38.1	61.9	22.3	8.8	13.5	122.3	47.0	75.3	43.0	21.7	21.3	165.3	68.7	96.7
(15) Public administration and defense; compulsory social security	100.0	30.0	70.0	18.9	7.9	11.0	118.9	37.8	81.0	61.2	30.9	30.4	180.1	68.7	111.4
(16) Education	100.0	77.6	22.4	4.3	1.9	2.4	104.3	79.5	24.8	26.8	13.5	13.3	131.0	93.0	38.1
(17) Human health and social work activities	100.0	72.5	27.5	30.1	14.9	15.2	130.1	87.3	42.8	53.3	26.9	26.4	183.4	114.2	69.2
(18) Arts, entertainment and recreation	100.0	47.4	52.6	43.8	18.5	25.4	143.8	65.8	78.0	59.8	30.2	29.7	203.6	96.0	107.7
(19) Other service activities	100.0	58.0	42.0	23.5	9.9	13.6	123.5	67.9	55.6	45.0	22.7	22.3	168.5	90.6	77.9
(20) Activities of households as employers	100.0	99.1	0.9	0.0	0.0	0.0	100.0	99.1	0.9	6.5	3.3	3.2	106.5	102.4	4.1

Source: Authors' calculations

APPENDIX A6.4 FULL-TIME EQUIVALENT (FTE) EMPLOYMENT MULTIPLIERS BY AGE (JOB-TO-JOB) - PER 100 TOTAL DIRECT JOBS														
	Direct effect			Indirect Effect			Type I Multiplier			Induced effect			Type II Multiplier		
Sectors	total	15-30	30+	total	15-30	30+	total	15-30	30+	total	15-30	30+	total	15-30	30+
(1) Agriculture, forestry and fishing	100.0	11.6	88.4	20.9	3.0	17.9	120.9	14.6	106.3	24.5	4.5	20.0	145.4	19.1	126.3
(2) Mining and quarrying	100.0	13.0	87.0	75.3	16.9	58.3	175.3	30.0	145.3	89.4	16.4	73.0	264.6	46.3	218.3
(3) Manufacturing	100.0	20.6	79.4	263.9	42.7	221.2	363.9	63.4	300.6	113.6	20.8	92.8	477.6	84.2	393.4
(4) Electricity, gas, steam and air conditioning supply	100.0	18.8	81.2	83.2	22.6	60.7	183.2	41.4	141.9	106.2	19.4	86.8	289.4	60.8	228.6
(5) Water supply; sewerage, waste management and remediation activities	100.0	10.3	89.7	14.3	3.3	11.0	114.3	13.6	100.7	38.7	7.1	31.7	153.1	20.7	132.4
(6) Construction	100.0	20.7	79.3	79.0	17.7	61.3	179.0	38.4	140.7	98.5	18.0	80.5	277.6	56.4	221.2
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	100.0	29.0	71.0	19.0	4.6	14.4	119.0	33.5	85.5	48.2	8.8	39.4	167.2	42.4	124.8
(8) Transportation and storage	100.0	15.0	85.0	46.5	10.6	35.9	146.5	25.6	120.9	74.0	13.5	60.4	220.5	39.2	181.3
(9) Accommodation and food service activities	100.0	26.6	73.4	91.5	17.6	73.9	191.5	44.2	147.3	66.6	12.2	54.4	258.1	56.4	201.7
(10) Information and communication	100.0	38.0	62.0	50.1	14.4	35.7	150.1	52.4	97.7	87.9	16.1	71.8	238.0	68.5	169.5
(11) Financial and insurance activities	100.0	55.9	44.1	40.1	10.7	29.4	140.1	66.7	73.4	114.3	20.9	93.4	254.4	87.6	166.8
(12) Real estate activities	100.0	9.5	90.5	92.8	30.5	62.3	192.8	40.0	152.9	102.7	18.8	83.9	295.5	58.8	236.8
(13) Professional, scientific and technical activities	100.0	34.7	65.3	30.8	8.7	22.2	130.8	43.3	87.5	87.8	16.1	71.7	218.6	59.4	159.2
(14) Administrative and support service activities	100.0	24.5	75.5	22.3	5.2	17.1	122.3	29.7	92.6	43.0	7.9	35.2	165.3	37.6	127.7
(15) Public administration and defense; compulsory social security	100.0	23.1	76.9	18.9	4.5	14.4	118.9	27.6	91.3	61.2	11.2	50.0	180.1	38.8	141.3
(16) Education	100.0	9.4	90.6	4.3	0.9	3.3	104.3	10.4	93.9	26.8	4.9	21.9	131.0	15.3	115.8
(17) Human health and social work activities	100.0	18.1	81.9	30.1	6.3	23.8	130.1	24.5	105.6	53.3	9.8	43.5	183.4	34.2	149.2
(18) Arts, entertainment and recreation	100.0	22.9	77.1	43.8	9.7	34.1	143.8	32.6	111.2	59.8	11.0	48.9	203.6	43.6	160.1
(19) Other service activities	100.0	30.7	69.3	23.5	5.7	17.8	123.5	36.3	87.2	45.0	8.2	36.8	168.5	44.6	123.9
(20) Activities of households as employers	100.0	5.2	94.8	0.0	0.0	0.0	100.0	5.2	94.8	6.5	1.2	5.3	106.5	6.4	100.1

Source: Authors' calculations

APPENDIX A7. EMPLOYMENT MULTIPLIERS, WHERE SAME NORMAL LENGTH OF FULL-TIME EMPLOYMENT IS CONSIDERED FOR BOTH SEXES						
	Type I multipliers			Type II multipliers		
Sectors	Total FTE employment	FTE employment, female	FTE employment, male	Total FTE employment	FTE employment, female	FTE employment, male
(1) Agriculture, forestry, and fishing	113.5	51.0	62.4	136.5	62.5	74.0
(2) Mining and quarrying	17.5	4.0	13.6	26.5	8.4	18.1
(3) Manufacturing	29.7	11.9	17.7	38.9	16.6	22.4
(4) Electricity, gas, steam, and air conditioning supply	16.7	4.6	12.1	26.4	9.5	17.0
(5) Water supply, sewerage, waste management, and remediation activities	51.0	15.1	35.9	68.3	23.7	44.6
(6) Construction	22.8	4.4	18.4	35.3	10.6	24.7
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	34.0	14.9	19.1	47.8	21.8	26.0
(8) Transportation and storage	24.8	5.4	19.4	37.4	11.6	25.7
(9) Accommodation and food service activities	24.2	11.5	12.7	32.6	15.7	16.9
(10) Information and communication	22.4	9.5	12.9	35.5	16.0	19.5
(11) Financial and insurance activities	16.3	9.2	7.1	29.5	15.8	13.8
(12) Real estate activities	6.1	2.4	3.7	9.3	4.0	5.3
(13) Professional, scientific, and technical activities	31.1	14.1	17.1	52.0	24.5	27.6
(14) Administrative and support service activities	41.5	15.8	25.8	56.1	23.0	33.1
(15) Public administration and defense; compulsory social security	34.6	11.0	23.6	52.4	19.8	32.5
(16) Education	89.2	67.9	21.3	112.0	79.3	32.8
(17) Human health and social work activities	39.3	26.4	13.0	55.5	34.4	21.1
(18) Arts, entertainment, and recreation	29.8	13.6	16.2	42.2	19.7	22.4
(19) Other service activities	37.5	20.6	16.9	51.1	27.4	23.7
(20) Activities of households as employers; undifferentiated goods and services producing activities of household for own use	502.5	498.2	4.4	535.3	514.5	20.8

Source: Geostat, Authors' calculations

Appendix A8.

To calculate the Investment-to-Investment multipliers, we first decompose the direct, indirect, and induced effects from the Type I and Type II Revenue-to-Job investment multipliers (see Appendix A8.1.) and then normalize the direct effects to 1 million GEL of investment. In this case, the initial direct effects are given by the vector of investment-output ratios (elements of vector in – input indicators for Gross Fixed Capital Formation). The estimates for indirect and induced effects, per million GEL investment in a given sector, are then calculated using the following equations:

Investment-to-Investment indirect effect: $\frac{Type\ I\ Inv.\ Multiplier - Direct\ inv.\ effect}{Direct\ inv.effect} * \mathbf{100}$

Investment-to-Investment induced effect: $\frac{Type\ II\ Inv.\ Multiplier - Type\ I\ Inv.\ Multiplier}{Direct\ inv.effect} * \mathbf{100}$

The resulting Investment-to-Investment multipliers are presented below in Appendix A8.2. Provided that 1 million GEL of investments are made in the financial and insurance sector – 1.226 mln. GEL of investment would be generated indirectly in related sectors that offer inputs. Considering the induced effects, the same initial direct investment increase in the financial and insurance sector would lead to a total of 4.330 mln. GEL of investment to the economy; the greatest amount, relative to other sectors.

Here again, one should not consider Investment-to-Investment multipliers contradictory to the results obtained from Revenue-to-Investment multipliers, that rank electricity, gas, steam and air conditioning supply sector on the first place in terms of economy-wide investment generation capacity. The reason behind it is that comparing sectors' investment multipliers per 1 mln. GEL direct investment is comparing very different levels of initial shock to final demand in each sector. In sectors with lower value of investments per 1 mln. GEL of output (such as financial and insurance activities), it takes higher increase in final demand to generate 1 mln. GEL direct investments, compared to other sectors with greater investment/output ratios (such as electricity, gas, steam and air conditioning supply). Therefore the impact of the former sectors on the rest of the economy would be higher due to much higher initial increase in their output level.

APPENDIX A8.1. INVESTMENT MULTIPLIERS (MLN. GEL), (REVENUE-TO-INVESTMENT) – PER 1 MLN. GEL FINAL DEMAND					
Sectors	Direct effect	Indirect effect	Type I multipliers	Induced effect	Type II multipliers
(1) Agriculture, forestry, and fishing	0.094	0.041	0.135	0.112	0.247
(2) Mining and quarrying	0.112	0.064	0.176	0.043	0.220
(3) Manufacturing	0.075	0.077	0.152	0.045	0.197
(4) Electricity, gas, steam, and air conditioning supply	0.562	0.082	0.644	0.047	0.692
(5) Water supply, sewerage, waste management, and remediation activities	0.518	0.066	0.584	0.084	0.668
(6) Construction	0.192	0.077	0.268	0.061	0.329
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	0.149	0.041	0.190	0.067	0.257
(8) Transportation and storage	0.168	0.056	0.224	0.061	0.285
(9) Accommodation and food service activities	0.099	0.069	0.168	0.041	0.209
(10) Information and communication	0.361	0.090	0.450	0.064	0.514
(11) Financial and insurance activities	0.031	0.038	0.068	0.065	0.133
(12) Real estate activities	0.032	0.021	0.053	0.016	0.069
(13) Professional, scientific, and technical activities	0.054	0.036	0.090	0.102	0.191
(14) Administrative and support service activities	0.117	0.054	0.171	0.071	0.243
(15) Public administration and defense; compulsory social security	0.648	0.044	0.692	0.087	0.778
(16) Education	0.069	0.030	0.099	0.111	0.210
(17) Human health and social work activities	0.099	0.056	0.156	0.078	0.234
(18) Arts, entertainment, and recreation	0.098	0.057	0.155	0.060	0.215
(19) Other service activities	0.013	0.054	0.068	0.066	0.134

Source: Authors' calculations

APPENDIX. A8.2. INVESTMENT MULTIPLIERS (MLN. GEL), (INVESTMENT-TO-INVESTMENT) – PER 1 MLN. GEL INVESTMENT					
Sectors	Direct effect	Indirect effect	Type I multipliers	Induced effect	Type II multipliers
(1) Agriculture, forestry, and fishing	1.000	0.431	1.431	1.186	2.618
(2) Mining and quarrying	1.000	0.572	1.572	0.388	1.961
(3) Manufacturing	1.000	1.022	2.022	0.600	2.622
(4) Electricity, gas, steam, and air conditioning supply	1.000	0.146	1.146	0.084	1.230
(5) Water supply, sewerage, waste management, and remediation activities	1.000	0.127	1.127	0.162	1.289
(6) Construction	1.000	0.400	1.400	0.318	1.718
(7) Wholesale and retail trade; repair of motor vehicles and motorcycles	1.000	0.278	1.278	0.450	1.728
(8) Transportation and storage	1.000	0.331	1.331	0.363	1.694
(9) Accommodation and food service activities	1.000	0.701	1.701	0.414	2.115
(10) Information and communication	1.000	0.249	1.249	0.177	1.426
(11) Financial and insurance activities	1.000	1.226	2.226	2.104	4.330
(12) Real estate activities	1.000	0.655	1.655	0.489	2.145
(13) Professional, scientific, and technical activities	1.000	0.666	1.666	1.889	3.555
(14) Administrative and support service activities	1.000	0.463	1.463	0.607	2.070
(15) Public administration and defense; compulsory social security	1.000	0.067	1.067	0.134	1.201
(16) Education	1.000	0.426	1.426	1.603	3.029
(17) Human health and social work activities	1.000	0.564	1.564	0.788	2.353
(18) Arts, entertainment, and recreation	1.000	0.585	1.585	0.617	2.202
(19) Other service activities	1.000	4.034	5.034	4.956	9.991

Source: Authors' calculations