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BEYOND MINING: IDENTIFYING KEY SECTORS FOR SUSTAINABLE ECONOMIC GROWTH IN MONGOLIA

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Purpose: This paper aims to identify the key sectors and structural features of the Mongolian economy by analyzing intersectoral linkages derived from input–output (IO) tables. We further examine how these linkages and the overall production structure have evolved over time to reveal broader trends in economic transformation.
Design/methodology/approach: We employed demand-driven IO model for analyzing economic structures using national IO tables that published from 2010 to 2019. The data obtained from the National Statistical Office of Mongolia (NSOM) and we focused on multipliers, type I multipliers.
Findings: Our analysis shows that Mongolia's core drivers of domestic production linkages are the manufacturing (C) and electricity and heat supply (D) sectors, which exhibit the strongest output and GVA Type I multipliers. In contrast, public service sectors (O, P, and Q) and the export-oriented mining sector (B) generate limited domestic spillovers despite mining's large GDP contribution. Structural changes between 2010 and 2019 further indicate a growing divergence between industrial sectors that drive production and service sectors—such as real estate (L) and education (P)—that generate the largest wage, employment, and value-added effects.
Practical implications: The identification of processing industries, electricity supply, and construction as Mongolia's core multiplier-intensive sectors provides a practical basis for targeting investment, industrial diversification, and productivity-enhancing policies toward areas with the strongest economic spillover potential.
Social implications: The weak multipliers observed in public services and primary sectors imply limited diffusion of income and employment benefits across society, underscoring the need for policies that strengthen social-sector linkages to support more inclusive and equitable development.
Originality/value: Unlike previous Mongolian IO studies, this paper offers multi-multiplier, decade-long analysis of Mongolia's economic structure using consistent national IO tables, going beyond earlier studies that relied on a single year or sector-specific assessments. The study provides new empirical insights into Mongolia's key sectors and interindustry linkages, offering practical value for economic planners and researchers working on structural transformation in resource-dependent economies.

Keywords: Input–Output models, production, Empirical Studies of Economic Growth, Industrial Structure.
Category of the paper: Empirical research.

1. Introduction

Mongolia is a landlocked country in East Asian country bordered by China and Russia. The country occupies 1.57 million km^2 (Batima et al., 2005) and has a population of approximately 3.5 million (National Statistical Office of Mongolia, 2023) which gives it the second-to-last position in terms of population density in the world (after Greenland). Until 1989, Mongolia depended on the former USSR for imports and financial aid. Imports accounted for 58% of its GDP, 80% of which came from the USSR. The country's GDP growth rate was 6.1% and 5.7% in the 1970s and 1980s, respectively. From 1940, Mongolia shifted toward a more modern and industrial society, with industry contributing 33% of the national income by 1989, up from 7% in 1940. Agriculture, including animal husbandry, decreased from 76% to 16% during the same period (Aassve, Altankhuyag, 2002). Mongolia has been undergoing dramatic political reforms since 1990 following the collapse of the former Soviet Union. Since the early 1990s, Mongolia's annual GDP growth rate has exhibited volatility, with the rate ranging from a contraction of 20% to an expansion of 17%. This substantial fluctuation is noteworthy globally, potentially representing one of the widest ranges observed internationally.

Since the late 1990s, the Mongolian market has strongly correlated with the fate of Mongolian mining deposits, which are of worldwide interest. Batchuluun & Lin (2010, p. 1) mention that "if these deposits were exploited, the Mongolian capital market would boom and thus strongly affect the whole economic situation". However, Mongolia's natural-resource endowment has driven dynamic yet highly volatile economic growth. Like most economies, GDP declined during the pandemic year but also declined in 2009 (financial crisis) and 2016. The volatility of Mongolian economic growth is related to its reliance on mineral exports. It is vulnerable to global commodity price fluctuations and economic policies in China, its principal trading partner. According to World Bank data, Mongolia is the third country in the world (after Kosovo and Botswana) with the highest share of energy produced from coal, equal to 86.6% in 2022 (for comparison, Norway has the lowest share of coal energy, equal to 0.1%) (World Bank Open Data, 2023).

Since the mid-2000s, the mining and quarrying industry has been the backbone of Mongolia's economy, contributing 1/3 of GDP in 2024 (National Statistical Office of Mongolia, 2024a). Mining sector generates over 80% of export revenues. This dependence makes the country vulnerable to price fluctuations in global markets and the lack of direct sea access limits export options and increases logistics costs. Addressing these supply chain risks requires diversifying the economy, investing in infrastructure, and strengthening regulatory

frameworks to ensure sustainable and resilient economic growth. Dominant role of mining sector exposes the country to the stagnation in other sectors such as agriculture and services. The growing role of the mining industry has been accompanied by a decline in agriculture – historically the most important sector in the Mongolian economy. Within the last three decades, agriculture's share has fallen from 38% (in 1996) to 7% in 2024 (National Statistical Office of Mongolia, 2024b). The pivotal role of mining stops Mongolia's transformation from an agriculture-based to a service-based economy, as the share of services decreases since the rise of mining. The below chart shows the strict negative correlation between primary sector and service sector in Mongolia (correlation coefficient: -0.97).

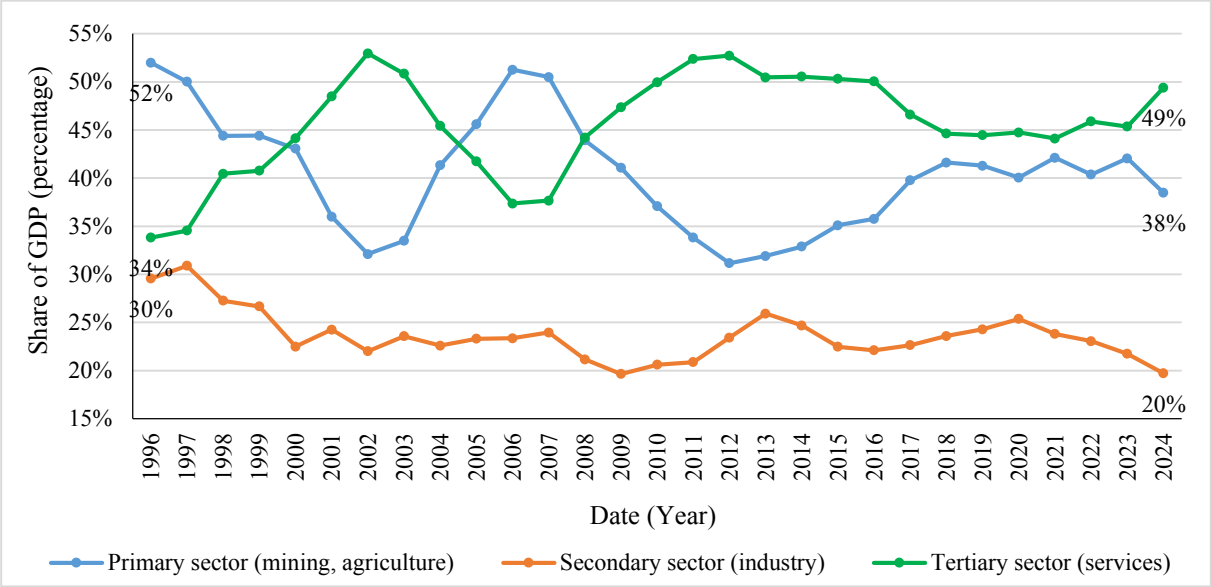

Figure 1. GDP share in three sectors in Mongolia.

Source: Own study based on data from NSOM (2024b).

As the primary sector (mining and agriculture) significantly impact the Mongolian economy, but it is unclear whether they are key sectors in the economy. To clarify this, key sectors need to be defined. Each economy comprises numerous interindustry linkages, with each sector having varying degrees of connections (weak or strong) to others. The size of a sector is not significant in this context, however. A key sector is defined as 'a sector which, on the one hand, is largely dependent on other industries—utilizing their products in its production process—and on the other hand, has its output used as an intermediate product in other sectors' production processes' (Umed, 2004, p. 2). Furthermore, identifying key sectors and understanding the economy's structure are crucial for policymakers to formulate effective strategies for economic development. Here, the economy's structure is the composition of macroeconomic aggregates and the intricate interactions among them (Alatriste-Contreras, 2015).

In this paper, we aim to find key sectors and economic structures in Mongolia, as well as the linkages between sectors and trends in the economy's structure, that emerge from analyzing input–output (IO) tables.

Our analysis of the IO literature indicates a gap and a need for studies that offer a comprehensive analysis of direct and indirect supply–demand interdependencies among economic sectors in Mongolia.

2. Methodology

The IO tables offer detailed insights into the interactions between domestic suppliers and users of locally produced raw materials, industrial components, and services. These inter-industry transactions offer valuable information about the structure of production processes and the intricacy of the supply chains that support economic activity (Lenzen et al., 2012; Leontief, 1936; Suh, 2010; Wixted et al., 2006). Mongolian Statistical Office offers 20x20 input-output tables according to the International Standard Industrial Classification of All Economic Activities (ISIC) rev. 4 classification – see Table 1.

Table 1.
*Sections according to the ISIC Vol. 4 classification**

	Sectors		**Sectors**
A	Agriculture, forestry and fishing	K	Financial and insurance activities
B	Mining and quarrying	L	Real estate activities
C	Processing industries (manufacturing)	M	Professional, scientific and technical activities
D	Electricity, gas, steam, air conditioning supply	N	Administrative and support service activities
E	Water supply; sewerage, waste management and remediation activities	O	Public administration and defence; compulsory social insurance
F	Construction	P	Education services
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	Q	Human health and social work activities
H	Transportation and storage	R	Arts, entertainment and recreation
I	Accommodation and food service activities	S	Other service activities
J	Information and communication	T	Activities of households as employers

*We use “sectors” and “sections” interchangeably for clarity and simplicity of description. However, we always mean sections in the sense of the ISIC classification. This classification follows a coherent and consistent structure for classifying economic activities based on a set of internationally agreed-upon concepts, definitions, principles, and classification rules.

Source: Adopted from International Standard Industrial Classification of all Economic Activities by UN, 2008, Vol. 4, p. 43.

Our selection of the IO model for this analysis is based primarily on data availability. The Mongolian National Statistical Office (NSOM) is the principal data source for this study, with the most recent table available (at the end of 2025) for 2019 (20 x 20 IO table). The NSOM published IO tables annually for 2010-2019, although many countries publish IO tables every five years. Unfortunately, NSOM will not publish the input-output table for 2020 due to

COVID-19 and other methodological issues (as they inform the authors via email). NSOM is working on producing IOT for 2024, which will be published in 2026 or later.

In this study, we use the demand-driven IO model in which the total output of a sector is expressed as a function of the demand for the various commodities produced in the economy:

$$\mathbf{X} = \mathrm{L}\mathbf{Y}, \tag{1}$$

where:

X is 20x1 vector of total production (total output) in a given section (see Table 1),

Y – is 20x1 vector of final demand in a given section,

L = (I − A) $^{-1}$ is an 20 × 20 Leontief matrix with elements l_{ij},

A is a 19x19 matrix of input (technical) coefficients as the ratio of input supplied by sector *i* and purchased by sector *j* over the output of sector *j*: $a_{ij} = x_{ij} / X_j$.

There are possibility of calculating multipliers which quantify the total effects of an increase in one unit of final demand in each section on output, income, employment, and value-added in the whole economy in IO analysis (Miller, Blair, 2009). Calculations of multipliers rely on Leontief matrix L and proportion of employment, wages and GVA in total production – as shown in table 2.

Table 2.
The formulae for multipliers

Output Multiplier	**Income Multiplier**	**Labor Multiplier**	**Value-Added Multiplier**
$j = \sum_{i=1}^{20} l_{ij}$	$W_J = \sum_{i=1}^{20} w_i \cdot l_{ij}$	$L_j = \sum_{i=1}^{20} l_i \cdot l_{ij}$	$V_j = \sum_{i=1}^{20} v_i \cdot l_{ij}$
Designation as in formula (1)	Where w_i is the ratio between wage and total input	Where l_i is the ratio between labour and total output	Where v_i is the ratio between value added and total output

Source: Adopted from Handbook of Input-Output table compilation and analysis, by United Nations, 1999, p. 264.

3. Results

In below table there are 4 types of multipliers which shows how the 1 unit growth in final demand in given section increase output (Table 3), income (Table 4), employment/labour (Table 5), and gross value-added (Table 6) in the whole economy.

Table 3.
Output multiplier

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Annual growth
A	1.30	1.34	1.28	1.29	1.31	1.30	1.38	1.32	1.32	1.32	**0.3%**
B	1.41	1.29	1.36	1.40	1.49	1.44	1.41	1.37	1.36	1.40	**0.2%**
C	1.78	1.71	1.70	1.65	1.67	1.77	1.74	1.72	1.77	1.78	**0.3%**
D	2.28	2.16	2.17	2.32	1.65	1.79	1.86	1.86	1.93	1.95	**-2.1%**
E	2.11	2.06	1.97	2.04	1.79	1.57	1.61	1.66	1.62	1.59	**-3.5%**
F	1.73	1.61	1.62	1.54	1.64	1.64	1.67	1.54	1.56	1.64	**-0.4%**
G	1.42	1.25	1.30	1.32	1.36	1.34	1.34	1.32	1.36	1.34	**0.1%**
H	1.30	1.31	1.43	1.41	1.39	1.29	1.31	1.32	1.29	1.31	**-0.4%**
I	1.76	1.77	1.63	1.65	1.64	1.67	1.66	1.67	1.74	1.72	**-0.1%**
J	1.44	1.45	1.43	1.34	1.33	1.38	1.38	1.51	1.48	1.47	**0.4%**
K	1.35	1.34	1.23	1.26	1.20	1.34	1.36	1.32	1.28	1.34	**0.2%**
L	1.29	1.11	1.25	1.27	1.29	1.28	1.26	1.24	1.25	1.31	**0.5%**
M	1.53	1.60	1.34	1.56	1.37	1.42	1.39	1.41	1.47	1.43	**-0.8%**
N	1.58	1.73	1.51	1.79	1.69	1.62	1.61	1.62	1.65	1.70	**0.2%**
O	1.37	1.50	1.39	1.53	1.29	1.21	1.19	1.18	1.18	1.18	**-2.8%**
P	1.40	1.40	1.32	1.38	1.26	1.32	1.31	1.33	1.34	1.31	**-0.6%**
Q	1.45	1.45	1.33	1.30	1.28	1.28	1.27	1.27	1.28	1.31	**-1.2%**
R	1.61	1.71	1.33	1.53	1.44	1.41	1.42	1.36	1.37	1.39	**-1.8%**
S	1.47	1.77	1.36	1.52	1.73	1.62	1.58	1.61	1.64	1.66	**0.9%**
CoV*	**17.5%**	**17.7%**	**17.0%**	**18.0%**	**12.9%**	**12.3%**	**12.8%**	**13.1%**	**14.0%**	**14.0%**	

*Coefficient of variation.

Source: Our own calculation.

The output multiplier indicates how a one-unit increase in final demand in a given sector affects total output across the entire economy.

The most significant values are for industry Sections (C and D) and some service Sections (I, N). The output multiplier for Section D has the highest value at 1.94 in 2019 indicating that a 1 unit (1 MNT - Mongolian currency, the tugrik) increase in final demand for this sector results in a 1.94 unit (MNT) increase in output across all sectors; the lowest level of participation in global production in terms of meeting final demand is Section O. The last column shows that, in most sections, the output multipliers are stable over time; a significant downward trend appears in the D, C, and O sectors. The falling trend indicates that less and less production is required to meet the final demand in a given sector. This suggests the more economical uses of intermediate goods in production.

Table 4.
Income multiplier

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Annual growth
A	0.05	0.12	0.10	0.09	0.10	0.10	0.11	0.10	0.10	0.10	**2.4%**
B	0.11	0.14	0.19	0.18	0.16	0.16	0.16	0.13	0.13	0.13	**-0.6%**
C	0.11	0.12	0.13	0.13	0.13	0.14	0.15	0.14	0.14	0.14	**2.5%**
D	0.30	0.35	0.36	0.40	0.34	0.31	0.32	0.30	0.27	0.25	**-2.9%**
E	0.38	0.43	0.41	0.41	0.37	0.40	0.42	0.41	0.39	0.40	**-0.2%**
F	0.16	0.12	0.11	0.12	0.16	0.18	0.20	0.20	0.20	0.20	**6.6%**
G	0.18	0.13	0.18	0.21	0.22	0.22	0.27	0.25	0.23	0.24	**5.3%**
H	0.14	0.16	0.18	0.18	0.20	0.20	0.21	0.21	0.20	0.20	**3.5%**
I	0.22	0.24	0.23	0.27	0.26	0.28	0.29	0.27	0.25	0.25	**1.6%**
J	0.20	0.21	0.21	0.22	0.21	0.24	0.22	0.23	0.22	0.21	**0.7%**

Cont. table 4.

K	0.31	0.27	0.27	0.21	0.24	0.32	0.32	0.27	0.28	0.26	**0.2%**
L	0.04	0.03	0.04	0.04	0.05	0.06	0.06	0.06	0.06	0.07	**8.1%**
M	0.38	0.39	0.38	0.27	0.28	0.35	0.39	0.38	0.33	0.32	**-1.0%**
N	0.32	0.26	0.25	0.21	0.27	0.32	0.34	0.31	0.29	0.29	**1.6%**
O	0.49	0.48	0.51	0.55	0.53	0.46	0.41	0.41	0.40	0.39	**-3.3%**
P	0.62	0.62	0.65	0.65	0.65	0.66	0.66	0.65	0.64	0.64	**0.3%**
Q	0.51	0.53	0.55	0.55	0.56	0.56	0.51	0.47	0.47	0.46	**-1.6%**
R	0.51	0.55	0.51	0.54	0.54	0.53	0.48	0.49	0.48	0.48	**-1.2%**
S	0.34	0.35	0.21	0.24	0.30	0.34	0.34	0.35	0.32	0.32	**1.7%**
CoV*	**59.4%**	**59.7%**	**59.3%**	**61.2%**	**57.4%**	**53.0%**	**48.3%**	**50.3%**	**50.9%**	**51.1%**	

*Coefficient of variation.

Source: Our own calculation.

The highest income multiplier for Section P (education) informs us that a 1 unit increase in final demand in 2019 leads to a 0.64 increase in wages across all the sectors. At the same time, growth in demand for Section L (real estate) needs nearly 10 times less in terms of increases in global wages. It is connected with a high (low) share of wages in Section P (Section L) and its global production. The annual rates of growth of income multipliers are often positive, which indicates a growing impact of final demand on wages. It occurs particularly in Sections F, G, H, and L, which have the lowest value multipliers in 2010. These growing values suggest that the share of wages in sectors grows faster than the share of production.

Table 5.
Labour multiplier

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Annual growth**
A	0.14	0.13	0.12	0.10	0.08	0.07	0.07	0.07	0.06	0.06	**-9.1%**
B	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	**-4.9%**
C	0.07	0.06	0.05	0.05	0.04	0.05	0.04	0.04	0.04	0.04	**-5.7%**
D	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.01	0.02	**-6.4%**
E	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.02	0.02	0.03	**-1.7%**
F	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	**-5.7%**
G	0.06	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	**-3.4%**
H	0.05	0.04	0.03	0.03	0.03	0.04	0.03	0.03	0.02	0.02	**-8.6%**
I	0.05	0.05	0.06	0.06	0.07	0.07	0.06	0.06	0.05	0.05	**-0.6%**
J	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	**-5.3%**
K	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	**-9.3%**
L	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	**0.9%**
M	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	**-2.0%**
N	0.04	0.03	0.05	0.04	0.04	0.05	0.04	0.05	0.04	0.04	**0.2%**
O	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	**0.6%**
P	0.05	0.05	0.06	0.06	0.06	0.05	0.06	0.06	0.05	0.05	**0.0%**
Q	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	**-2.8%**
R	0.05	0.05	0.06	0.06	0.07	0.07	0.05	0.05	0.07	0.08	**3.5%**
S	0.09	0.07	0.09	0.08	0.07	0.07	0.06	0.07	0.06	0.06	**-4.2%**
CoV*	**61.0%**	**66.9%**	**65.7%**	**55.3%**	**55.3%**	**52.9%**	**51.1%**	**55.2%**	**57.4%**	**62.1%**	**-1.2%**

*Coefficient of variation.

Source: Our own calculation.

The labour multiplier is most pronounced in Section R (other service activities) with a value of 0.083, implying that a 1 unit increase in final demand for these service activities generates an employment increase in the whole economy of more than 0.08 unit. In other world 100 MNT

increase in final demand in Section R increases employment by 8 persons. The values of the labour multiplier are strongly influenced, apart from IO flows, by the labour intensity of production - the higher/lower the labour intensity (which is the inverse of labour productivity), the higher/lower the labour multiplier. The high position of Section R suggests high work intensity (low productivity).

The annual rates of growth of labour multipliers are only negative, indicating a declining impact of final demand on employment and a corresponding decline in the share of employment in output. As the work intensity (measured as a share of employment in output) decreases, the productivity of work increases, which is a positive sign for Mongolian economy.

Table 6.
Gross Value-added multiplier

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Annual growth
A	0.83	0.86	0.89	0.92	0.9	0.84	0.85	0.84	0.82	0.83	**-0.5%**
B	0.68	0.58	0.64	0.65	0.63	0.7	0.71	0.68	0.65	0.68	**0.8%**
C	0.72	0.69	0.72	0.76	0.75	0.75	0.72	0.72	0.7	0.7	**-0.2%**
D	0.76	0.74	0.7	0.78	0.63	0.64	0.67	0.57	0.56	0.56	**-3.6%**
E	0.71	0.72	0.76	0.78	0.74	0.63	0.72	0.68	0.66	0.66	**-1.4%**
F	0.51	0.46	0.52	0.5	0.52	0.53	0.54	0.47	0.43	0.46	**-0.9%**
G	0.79	0.84	0.86	0.86	0.83	0.79	0.77	0.76	0.72	0.75	**-1.5%**
H	0.61	0.56	0.58	0.51	0.61	0.61	0.64	0.55	0.52	0.5	**-1.1%**
I	0.58	0.6	0.69	0.74	0.72	0.74	0.72	0.69	0.65	0.67	**1.1%**
J	0.75	0.75	0.72	0.72	0.71	0.69	0.63	0.63	0.59	0.59	**-3.0%**
K	0.83	0.8	0.9	0.88	0.9	0.85	0.86	0.85	0.8	0.83	**-0.3%**
L	0.91	0.92	0.9	0.92	0.91	0.9	0.9	0.89	0.89	0.88	**-0.5%**
M	0.66	0.67	0.78	0.67	0.74	0.72	0.71	0.68	0.62	0.64	**-0.8%**
N	0.72	0.63	0.73	0.71	0.68	0.67	0.67	0.65	0.6	0.58	**-1.8%**
O	0.77	0.77	0.77	0.8	0.75	0.79	0.71	0.75	0.74	0.71	**-0.9%**
P	0.84	0.86	0.89	0.88	0.89	0.87	0.88	0.87	0.85	0.87	**0.0%**
Q	0.74	0.72	0.79	0.75	0.75	0.74	0.7	0.65	0.64	0.68	**-1.7%**
R	0.8	0.78	0.88	0.87	0.85	0.78	0.72	0.77	0.75	0.76	**-1.3%**
S	0.74	0.68	0.83	0.84	0.81	0.76	0.76	0.73	0.69	0.7	**-0.8%**
CoV*	**13.3%**	**16.4%**	**14.7%**	**15.7%**	**14.7%**	**12.9%**	**12.6%**	**15.6%**	**17.2%**	**16.9%**	

*Coefficient of variation.

Source: Our own calculation.

Finally, the gross value added (GVA) multiplier is highest for Section L (real estate) at 0.87 and Section P (education) at 0.86, demonstrating these sectors' significant contributions to the overall creation of economic value added. This is the most interesting of all the multipliers because, contrary to the output multipliers, it has the potential to stimulate GDP. It may seem that sectors with a high output multiplier will also have the greatest potential to contribute to GDP. However, this is not the case, as evidenced by the different positions of the sectors in the first and last columns of Table 6. The negative relationship between these two multipliers is confirmed by the correlation coefficient, which is equal to −0.48 (for 2019) and is statistically significant. The negative correlation between output and GVA multipliers results from the fact the sectors that boost output the most may, due to their high intermediate consumption, have a relatively low GVA multiplier. Section L offers the best evidence of this, which is in

one of the last places in terms of output multipliers and in the first place in terms of GVA multipliers. This is because this section's share of GVA in output is the highest (at 79%), in contrast to, for example, Section F, for which the share of GVA in output is only 19%. Therefore, Section F, which had a relatively good record in terms of output multipliers, is in last place in terms of GVA multipliers.

The above observation shows that the values of multipliers are strongly influenced by the shares of a given variable (wages, employment, GVA) in output. In general, the higher/lower the share, the higher/lower the value of the multiplier. We showed earlier that this depreciates sectors with high material intensity (like F and H sectors being in the last positions in terms of GVA multipliers). However, it also depreciates sectors with high productivity such as B and L sectors being in the last positions in terms of labor multipliers. This is why we decide to calculate type I multipliers by dividing income, labour, and GVA multipliers (Table 7) by the share of a given variable in output (Miller, Blair, 2009).

Table 7.
*Output, income, gross value-added type I multiplier in 2019**

	Output multiplier	Income multiplier	Labour multiplier	Value-added multiplier
A	132	181	115	125
B	140	165	255	133
C	178	220	370	250
D	195	197	215	228
E	159	133	139	153
F	164	175	203	242
G	134	126	119	125
H	131	135	145	141
I	172	144	143	185
J	147	152	185	151
K	134	126	144	124
L	131	232	930	112
M	143	128	141	146
N	170	160	144	208
O	118	109	110	112
P	131	108	109	116
Q	131	110	114	123
R	139	113	106	123
S	166	140	121	167

Source: Our own calculation.

*value of original multipliers from Table 3-6 divided by the share of wages/employment/GVA in output and multiplied by 100 (for simplicity of interpretation).

The type I output multiplier showing how global production reacts to changes in the final demands of given sectors is the same as in Table 3 (with the highest value for D sector). The type I income multiplier is the highest for the L (real estate) sector, showing that 100 MNT growth in L sector wages (triggered by growth in final demand) increases the wages in the whole economy by 232 MNT. Type I labor multiplier is the highest in the real estate (Section L), in which employment growth by 100 persons increases total employment by 932 persons. On the other hand, processing industry (Section C) has the highest GVA

multiplier by showing that 100 MNT GVA growth in the sector increases the GVA in the whole economy by 250. **These sectoral differences become clearer when comparing the full set of type I multipliers across industries, as illustrated in Figure 2, which separates economic and social factors of growth**.

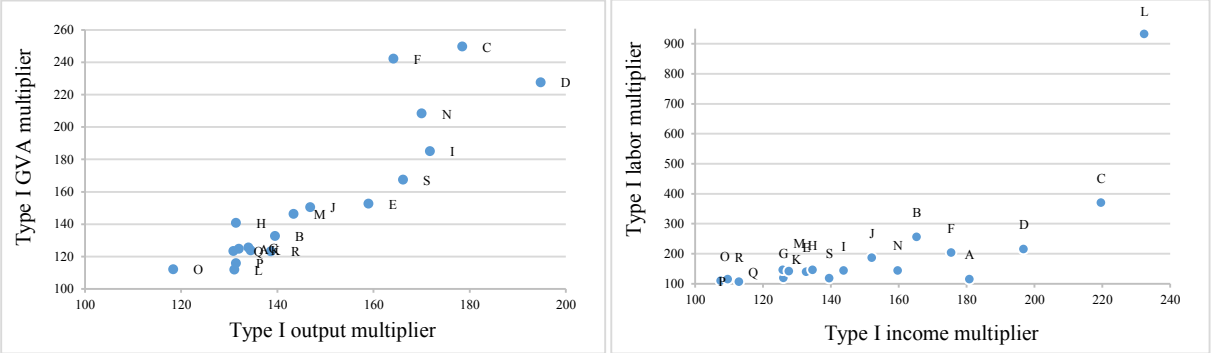

Figure 2. Output, income, labor, gross value-added type I multipliers in 2019 with division into economic (left chart) and social (right chart) factors of growth.

Source: Own study based on data from Table 7.

Suppose the income and labour multipliers are social-oriented inter-sectoral flows and output, and GVA multipliers are economic-oriented. The left graph shows that the sectors driving Mongolia's economic flows and supply chains are the C and D sectors, followed by the F, N, I, S, and E sectors. The right graph shows that the key sector supporting the social flows is primarily the L (with very high labour productivity), followed by the C and D sectors. From both charts, the least important in the context of supply chains are non-market services, mainly public services (Section O, P, Q).

It is worth noting that the non-mentioning above sectors of agriculture (Section A) and mining (Section B) have the highest contribution to GDP (cf. Fig. 1). Despite this, their role in input-output analysis focusing on intersectoral flows is low. In the case of mining (Section B), this is because most of the production is exported, so it does not participate in the domestic supply chain. On the other hand, agriculture (Section A) is primarily consumed in the domestic market.

4. Discussion and conclusion

In this paper, we identified the key sectors in the Mongolian economy that are understood as having their output used as an intermediate product in other sectors' production processes. From this perspective, the most important sectors in Mongolia are processing industries (Section C) and electricity, gas, steam, air conditioning supply (Section D). These sections are particularly susceptible to fluctuations in the business cycle, with changes in demand having significant implications for the entire industrial ecosystem.

While the above-mentioned industry sectors are the leading suppliers and consumers of global production, the service sectors significantly impact wages, employment, and value added in the Mongolian economy. Simple multipliers analysis shows that the increase in final demand will result in the highest growth in wages in education (Section P), employment in other services (Section S), and value-added in real estate (Section L) and education (Section P). We were surprised by these results, especially by the different positions of sections in the ranking of output and GVA multipliers. We expected that sections with high output linkages would have high GVA linkages. However, results show something opposite – sections with high output multiplier values have low GVA multipliers. The reason is that simple GVA multiplier depreciates sectors with high material intensity, like energy production (Section D) or particularly construction (Section F), and appreciates sectors with low material intensity such as real estate (Section L) or education (Section P). A similar inconsistency applies to simple labour multipliers which depreciates sectors with high productivity, mining (Section B) and real estate (Section L). **It is important to note that sectors such as real estate and finance contain significant asset-driven valuation components (e.g., imputed rents), which do not necessarily reflect productive economic activity or employment generation. As a result, labour multipliers in these sectors may be distorted and should be interpreted with caution, as high output or value-added levels may not translate into proportional labour demand**. We calculated first type multipliers to bypass these biases of simple multipliers. The results show that the sectors most driving Mongolia's economic flows and supply chains are the C and D sectors (having the highest value of output and GVA first-type multipliers). The key sector supporting the social flows is real estate (L) with very high labour productivity, followed by the C and D sectors. On the other hand, the least important in the context of production supply chains are non-market services, mainly public services (Section O, P, and Q). This is interesting that the mining sector (B) having the highest contribution to GDP (from all sections of ISIC) are not mentioned above as its role in intersectoral flows is low. This is because most of the production (nearly 90%) is exported, so it does not participate in the domestic supply chain.

In literature there are limited studies explored the effects of industry linkages in Mongolia. The Global Trade Analysis Project (GTAP) created the first IO table for Mongolia, based on the 2005 cross-sectoral balance table produced by the National Statistical Office of Mongolia (Begg et al., 2012). Since then, only a few studies have used this table to analyze the impact of specific sectors on the Mongolian economy: Hong-Bi (2013) uses it for R&D analysis, Tungalag et al., (2019) examine the impact of copper production on other sectors of the economy (Byambasuren, 2022), studies the influence and interrelationship between the financial sector and other leading sectors, Zagdbazar et al. (2018), measured the FDI inflow. The methodology most similar to ours was used in the article by Tegshjargal & Tsend-Ayush (2015). This article (which is accessible only in Mongolian languages), uses tables from 2015 and has a limited range because it includes a disclaimer that the report reflects the views of the

employees who conducted the study based on their respective positions. As a result, the backward linkage effects (comparable with output multiplier in this article) in the top three places are sections: E (water supply, sewage disposal systems, waste management, and sanitizing operations), N (administrative and support service activities and F (construction). On the other hand, the manufacturing (C); electricity, gas, steam, and air conditioning supply (D); and financial and insurance activities (K) sectors rank first in terms of forward linkage effects. The agricultural sector's efficiency is weak compared to that of other sectors in terms of backward and forward linkages. Among the leading sectors, the sector with the highest direct impact is the electricity, gas, steam, and air conditioning supply sector (D), while the direct impact of the manufacturing (C) sector is weakest. Byambasuren (2022) conducted the study 'influence and interrelationship between the financial sector and other leading sectors', defining forward and backward linkages using the IO table for 2010-2019. Their results indicate that the manufacturing (C); electricity, gas, steam, and air conditioning (D); and administrative and support service activities (N) sectors are leading in backward linkages.

In our analysis we could confirm that C, D, F, and N sectors have the greatest potential to stimulate of economic growth (as shown in left panel of Fig. 2). Time series analysis allows additionally for the observation of increasing/decreasing position of the multipliers what shows a structural change in the Mongolian economy. Decreasing position in output multipliers, like in public service sectors (O and Q), but also arts services (R) and water supply (E), means that less and less global production is needed to satisfy the growing final demand in this section. This might mean that some positive structural change happened (but also that more demand is satisfied by imports).

We also identify which sections may have the most significant impact on social development, as measured by the potential to increase wages and employment across the economy. The Section L connected to the real estate market should be mentioned here. This is the section with the highest productivity, which supports the wage and employment flows the most.

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