

working paper
2019-23

The 2014 Mongolian Social Accounting Matrix

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The 2014 Mongolian Social Accounting Matrix

Abstract

The construction of the Mongolian Social Accounting Matrix (SAM) for 2014 is described. The SAM included fifty-six sectors, seventy commodities, two types of production factors (capital and labor), three types of institutions (households, government and the rest of the world) along with capital accounts, three types of taxes (direct taxes, import duties and indirect taxes on commodities) and investment accounts (public investment, private investment and changes in inventories).

Key words: Social Accounting Matrix, CGE model

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Acknowledgements

This work was carried out in the context of an Institutional Support Project with financial and scientific support from the Partnership for Economic Policy (PEP) and funding from the Department for International Development (DFID) of the United Kingdom (or UK Aid) and the Government of Canada through the International Development Research Center (IDRC). We thank Helene Maisonnave, Lulit Mitik Beyene, and Bernard Decaluwé for useful comments and advice.

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I. Introduction

The Mongolian Social Accounting Matrix (SAM) for 2014 was constructed with primary data sources that comprised Supply and Use Tables (SUTs), government budget data from the National Statistical Office (NSO),¹ and Balance of Payments (BoP) information from the International Monetary Fund (IMF).² The SAM is a square matrix with 210 columns and rows. Its accounts consist of fifty-six sectors and seventy commodities, two production factors (capital and labor), three types of institutions (households, government and rest of the world) along with their capital accounts, three types of taxes (direct taxes, import duties, and indirect taxes on commodities) and investment accounts (public investment, private investment and changes in inventories).³ Income and expenditure of all accounts of the SAM were equivalent (that is, the SAM was balanced).⁴

II. Contributions to the SAM literature

The literature on SAMs covers areas such as construction, estimation, and application of SAMs in policy analysis. Some literature has also considered other methods based on the SAM framework such as multiplier analyses and empirical studies that employed SAMs. This paper concerns the methodology for building SAMs for policy analyses. Regarding this area, the works of J. I. Round should be noted. For example, Pyatt and Round (1977) reported their experience in constructing SAMs for three economies and highlighted problems encountered, solutions adopted, and lessons learned. Round (2003) reviewed progress in constructing SAMs so far and problems ahead.⁵ In addition, a large number of papers describe the construction of SAMs for various economies. For example, Cicowiez and Lofgren (2018) provided a detailed technical description of their construction of a Mongolian SAM

¹ Statistics are drawn from various reports and tables published at <http://www.1212.mn>.

² SUTs and general budget data are compiled by the NSO. BoP data are available at the IMF database website (<http://data.imf.org/?sk=7A51304B-6426-40C0-83DD-CA473CA1FD52>). Other data sources are mentioned in the appropriate sections in this paper.

³ The "households" account includes both firms and households. Therefore, some statements about households are also relevant to firms.

⁴ More information on the balance of the SAM can be found in Appendix 1.

⁵ These papers can be found in the PEP Recommended Readings List which is available from <https://www.pep-net.org/recommended-readings-1#sm>.

for 2015 which was the closest reference for our paper.⁶ There were similarities between this SAM and our SAM in terms of methodology, and these are mentioned in Section 3.2; there are also notable differences, which are discussed in Appendix 2.

III. The “Proto” SAM and Adjustments

3.1. The “Proto” SAM

The first version of the SAM without adjustments or augmentations was called the “proto” SAM. Table 1 shows the “proto” macro SAM as a share (22.2 trillion Mongolian Tugrik or MNT) of nominal Gross Domestic Product (GDP) in 2014.⁷ As Table 1 shows, private consumption contributes more than half of the GDP (57%) while current government spending is 13% of the GDP. Gross fixed-capital formation (GFCF) and inventory changes (VSTK) accounted jointly for 35% of the GDP. The values of both export and import were more than half of the GDP (52% and 57% respectively). The economy was highly capital-intensive (i.e., about 70% of value added was payments to capital owners). The share of value added in the GDP was 90.1%, and the remaining 9.9% came from indirect taxes on commodities (7.7%), import duties (1.6%), and net taxes on production (0.5%).

Table 1. The “Proto” Macro SAM 2014 (Percent of GDP)

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Labor								0.4	26.3				26.8
2	Capital								0.0	63.8				63.8
3	Households	25.4	57.6		10.4				2.4					95.7
4	Government			4.7		13.4	1.6	7.7	0.3	0.5	0.0			28.2
5	TD			13.4										13.4
6	TM										1.6			1.6
7	TI										7.7			7.7
8	ROW	1.4	6.3	1.5	0.8						57.1			67.0
9	Sectors										185.8			185.8
10	Commodities			56.6	13.0				52.2	95.1	20.1	28.6	6.6	272.4
11	GFCF			19.6	4.1				11.6					35.2
12	VSTK											6.6		6.6
13	TOTAL	26.8	63.8	95.7	28.2	13.4	1.6	7.7	67.0	185.8	272.4	35.2	6.6	

⁶ We neither used their 2015 SAM nor did we base our SAM on it because, before the authors constructed the 2015 SAM, we had already built a previous version of our SAM for 2014. On the other hand, we applied what we learned from their approach in revising our 2014 SAM. We chose 2014 as the base year because, when we started building our SAM, SUTs were only available for 2014.

⁷ This is a version of the SAM in which all industries and commodities are aggregated into one account.

Note: TD=direct taxes, TM=import duties, TI=indirect taxes on commodities, ROW=rest of the world, GFCF=gross fixed capital formation and VSTK=inventory changes.

3.2. Adjustments in the SAM

In the “proto” SAM, some sectors (trade and livestock, e.g.) were reported as highly capital-intensive. In reality, however, they were likely to have been labor-intensive, which is consistent with the structure of the Mongolian labor force. According to Labor Force Survey (LFS) data for 2013, 2014, and 2015, roughly 27% and 15% of workers were in the livestock and trade sectors respectively.⁸ In that sense, the structure of value added in the “proto” SAM may be unrealistic.

In addition, to be compatible with Computable General Equilibrium (CGE) models, we needed to distribute domestic production of each commodity into domestic and export categories and exports at purchaser price into (trade and transport) margins and exports at basic price.

To make the SAM more realistic and suitable for CGE models, we made a few adjustments, which are explained below. In doing so, we followed the approach of Cicowiez and Lofgren (2018).

3.2.1. Separating “Mixed Income” from Gross Operating Surplus

In the 2014 SUTs, the value added in each sector was composed of employee compensation, consumption of fixed capital, and gross operating surplus. The first was considered labor payments while the latter two were considered capital payments. The structure of value added, meaning the factor intensity in all sectors, is given in Table 2 (Columns “labshr0” and “capshr0”). Because this structure may have been unrealistic, inaccurate analyses and wrong simulation results may have occurred. Capital intensity in some sectors may have been overestimated because gross operating surplus included “mixed income,” which was likely to be a combination of the income of self-employed people, owners of small enterprises, and employers. Although production activities used labor, people in these employment categories tended to consider their income to be profit

⁸ The LFS is an annual survey organized by the NSO which is the main database for generating employment data at the country level. Raw data of this survey is accessible online to be used by researchers and other people.

from their activities and hence reported it as overall operating surplus rather than as labor income. A part of their income, however, which we called “mixed income,” should be considered labor income.

To address this problem, we first calculated the number of salaried and non-salaried workers in each industry (shown in Table 2 under the columns “salaried” and “non-salaried”) using LFS data from 2013, 2014, and 2015. In doing so, we merged LFS data to create a larger database and calculated the aforementioned numbers as a three-year average. The survey participants reported their sectors of activity, which were consistent with the sectors in the SUTs, and their employment status. We used the employment status of workers to define whether they were salaried or non-salaried.

There were six types of employment status in the LFS:

- paid employee;
- employer;
- self-employed;
- member of a producer cooperative;
- employed in animal husbandry;
- unpaid family worker.

Paid employees and unpaid family workers were considered “salaried” while employers, self-employed people, members of producer cooperatives and people employed in animal husbandry were considered “non-salaried.” Because we also knew each worker’s sector of activity from LFS data, we were able to obtain the number of workers of each type in each sector. The average wage for each industry was then calculated using the original employee-compensation values in the SUTs and the number of salaried workers (computed from the LFS). By multiplying the number of non-salaried workers by the average wage, we found “mixed income” values for each sector. Finally, these values were added to the original compensation of employees while being subtracted from the original capital payments. After this adjustment, labor and capital intensity in each sector were recalculated (also shown in Table 2 in Columns “labshr1” and “capshr1”).⁹ As a result, capital intensity in some sectors decreased significantly and some sectors turned out to be more labor-intensive. Sectors

⁹ The “mixed income” adjustment was made for sectors in which compensation of employees contributed less than half of value added. If an adjusted capital payment turned negative, the share of labor payment in the value added was assumed to be 2/3 for that particular sector.

relatively more affected by this adjustment were livestock, agriculture, apparel, leather, printing, repair and installation, trade, and land and water transport because all of these sectors included more “non-salaried” workers. Generally, the magnitude of the change depended upon the average wage and the number of non-salaried people.

Table 2. Structure of Value Added (before/after Adjustment) and Number of Salaried/Non-Salaried Workers by Sector

	non_salaried	salaried	labshr0	capshr0	labshr1	capshr1
crop	7,091	5,922	19%	81%	41%	59%
animal	278,445	21,038	6%	94%	88%	12%
for	1,436	1,617	53%	47%	53%	47%
fish	64	64	7%	93%	14%	86%
coal	801	15,924	36%	64%	38%	62%
oil	-	762	3%	97%	3%	97%
metore	3,071	17,304	21%	79%	25%	75%
othmin	888	2,748	64%	36%	64%	36%
minsup	479	4,088	37%	63%	42%	58%
food	3,370	12,845	10%	90%	13%	87%
bev	175	4,656	22%	78%	23%	77%
tob	-	228	2%	98%	2%	98%
textile	1,589	4,100	20%	80%	28%	72%
wear	9,493	5,400	25%	75%	69%	31%
leather	4,320	2,325	33%	67%	95%	5%
wood	5,194	2,216	76%	24%	76%	24%
paper	-	361	62%	38%	62%	38%
print	413	1,378	47%	53%	62%	38%
coke	-	264	5%	95%	5%	95%
chem	181	173	41%	59%	85%	15%
pharma	393	1,141	34%	66%	46%	54%
rubplast	166	430	30%	70%	41%	59%
nonmetmin	1,852	5,654	31%	69%	42%	58%
basmet	178	2,330	19%	81%	21%	79%
fabmet	1,112	772	46%	54%	67%	33%
com	54	304	73%	27%	73%	27%
mach	-	414	19%	81%	19%	81%
motveh	86	193	12%	88%	18%	82%
furn	2,201	2,524	25%	75%	46%	54%
othman	1,514	528	41%	59%	67%	33%
med	-	130	43%	57%	43%	57%
repins	2,115	1,184	36%	64%	100%	0%
elec	156	14,723	59%	41%	59%	41%
water	679	4,402	62%	38%	62%	38%
waste	423	1,550	61%	39%	61%	39%
cons	16,533	65,597	34%	66%	42%	58%
trade	100,834	65,046	27%	73%	68%	32%
lw-trans	40,022	21,079	37%	63%	67%	33%
a-trans	-	4,090	27%	73%	27%	73%
warehouse	514	1,557	31%	69%	41%	59%
post	363	1,079	64%	36%	64%	36%
accom	8,350	26,522	48%	52%	64%	36%
info	2,224	14,709	29%	71%	34%	66%
fin	1,188	18,751	27%	73%	28%	72%
insu	-	1,375	52%	48%	52%	48%
auxfin	219	921	22%	78%	27%	73%
real	242	789	3%	97%	3%	97%
pro	3,295	9,863	40%	60%	54%	46%
adm	2,041	12,133	48%	52%	57%	43%
pubad	398	65,538	80%	20%	80%	20%
edu	1,107	88,137	81%	19%	81%	19%

health	1,327	37,240	85%	15%	85%	15%
art	2,270	8,403	74%	26%	74%	26%
othser	11,934	7,647	41%	59%	67%	33%
othact	724	2,549	0%	100%	0%	100%

Note: Names of the sectors are abbreviated here. See Appendix 3 for their full names.

3.2.2. Adjustments in Re-Exports

The exports of some commodities in the SUTs (crude oil, metal ores, other minerals; general-purpose machinery; special-purpose machinery; office, accounting and computing machinery; communication equipment; and transport equipment) were greater than domestic production. This is known as a re-export problem in CGE models and could exist in real life because stock accumulated in previous years could be exported even in the absence of new domestic production. CGE models do not take this feature into account, however, and we were forced to adjust exports exceeding domestic production to make the SAM consistent with CGE models.

To address this problem, we reduced the imports and exports of the aforementioned commodities simultaneously by the value exceeded. This adjustment was not possible for some commodities, however (crude oil, metal ores, and other minerals) because imports were too small or zero. Note, however, that exports were at purchaser price, meaning that they include trade and transport margins. On the other hand, domestic production was at basic price. Thus, we needed to calculate exports at basic price, excluding margins. To do so, we used a small model that distributed margins into domestic transactions and exports (see below). Once export margins were subtracted from purchaser-price exports, the re-export was solved for two of the three commodities (crude oil and metal ores).¹⁰

Exports at basic price still exceeded domestic production at basic price for one commodity, however: other minerals. For this commodity, we reduced exports at purchaser price by the exceeded value and simultaneously increased inventory changes by the same value. Inventory changes for this commodity were initially negative and then that negative number shrank—in other words, we eliminated some changes in inventories because we assumed that exports at purchaser price included the value of exports from accumulated stock. CGE models, conversely, specify exports and stock variations separately and do not

¹⁰ There were no export taxes for re-exported commodities. Thus, subtracting only the export margins gave us exports at basic price.

take this feature into account; they assume that commodities are exported solely from current production and not from accumulated stock.

According to the SUTs, forestry products were not exported. A value for export tax was included, however, for that commodity. To eliminate this inconsistency, we included this value in the export tax of livestock products while transferring the same amount from indirect taxes on livestock products to indirect taxes on forestry products.

3.2.3. Distributing margins into domestic transactions and exports

In the SUTs, trade and transport margins appear by commodity. There is, however, no information on how the margins were distributed among different transactions (domestic sales, imports, and exports). To distribute the margins among these transactions, we employed the transaction-cost model of Cicowiez and Lofgren (2018). In doing so, we first aggregated trade and transport margins to find the total margin for each commodity. The transaction-cost model then split the total margin into different transactions.¹¹ From the results we separated trade and transport margins for each commodity using the original structures. Imports and domestic sales were considered jointly as domestic transactions.

IV. New Accounts in the SAM

4.1 New Sectors/Commodities

4.1.1 Exported Coal

We separated the existing coal sector/commodity in the SUTs into domestic coal ("coal") and exported coal ("excoal"). The exported coal sector may represent coking-coal reserves such as Tavan Tolgoi and Nariin Sukhait. These are the largest coking-coal reserves in Mongolia and most exported coal is extracted from these reserves. On the other hand, the domestic-coal sector may represent such thermal coal reserves as Baganuur and Shivee-Ovoo which jointly supply most domestically-consumed coal.

¹¹ For a detailed explanation of how the transaction-cost model works, see Appendix 4.

The cost structure of these two sectors was assumed to be identical because we had no data to permit disaggregation. Output of the “excoal” sector was equal to the value of the original coal sector’s exports. On the other hand, output of “coal” sector was equal to the original coal sector’s domestic output. Domestic demand for the original coal was then considered demand for the “coal” commodity.

4.1.2 Railway

We created a new sector/commodity for railway.¹² The railway sector was extracted from the original transport sector and was assumed to have the same cost structure as the whole railway system in the economy.¹³ Railway service was produced exclusively by the railway sector and represents that part of the service used only for coal export as a transport margin. Thus, we had three margin commodities: trade, railway, and other transport.

The original value of the transport margin associated with coal export was about 135 billion MNT. We assumed that 10% of this value (13.5 billion MNT) could be allocated to the railway, implying that the total demand for the railway together with the total output of the railway sector was 13.5 billion MNT.

4.1.3 Separation of Coke-Oven Products and Refined Petroleum Products (Fuel)

In the SUTs, coke-oven products and refined petroleum products were aggregated into one account. Coke-oven products include peat, coke, semicoke, and lignite which are domestically produced and exported. On the other hand, according to the Mineral Resource and Petroleum Authority of Mongolia, refined petroleum products were exclusively imported (i.e., there was no domestic production). Hence, we distinguished these commodities from one another by dividing the original commodity in the SUTs into two: “fuel” and “coke.” Refined petroleum products (“fuel”) contributed 92.3% of domestic demand for the original commodity while the remaining 7.7% was produced domestically. We used this structure to distribute indirect taxes on the commodity, domestic trade, and transport margins between the new commodities. The structure of sectors producing “coke” were left unchanged and

¹² This refers to that part of the overall railway system that is used only for coal export.

¹³ We knew the structure of the existing railway sector and used this structure to create the new “railway” sector while keeping other transportation sectors aggregated into one account.

the original values of outputs were considered to derive exclusively from the output of “coke.”

4.2 Capital Accounts

To construct a more realistic financing mechanism of public and private investment and include financial flows between institutions in the SAM, we added a capital account for each institution. This resulted in three new accounts: “cap-h”, “cap-gov” and “cap-row.” Here, we once again followed the approach of Cicowiez and Lofgren (2018). The significance of these accounts is that they allowed us to include details on the sources of private investment, government borrowing and foreign direct investment. Such details are useful for policy analyses in CGE models.

Each institution’s savings (calculated as the difference between income and expenditures) went to the corresponding capital account (Table 3):

- Household/firm savings - SH ;
- Government savings - SG ;
- Net foreign savings - $SROW$.

In addition, the following financial flows were included in the SAM (Table 3):

- Net domestic borrowing of the government – $NDFG$;
- Net foreign borrowing of the government – $NFFG$;
- Net foreign borrowing of the private sector (households) – $NFFH$;
- Foreign direct investment – FDI .

Table 3. Capital Accounts

	H	GVT	ROW	cap-h	cap-gov	cap-row
cap-h	SH					$NFFH$
cap-gov		SG		$NDFG$		$NFFG$
cap-row			$SROW$			
$GFCF_PRI$				N_FDI		FDI
$GFCF_PUB$					$GFCF_PUB$	
$VSTK$				$VSTK$		

Note: $GFCF_PRI$, $GFCF_PUB$ and $VSTK$ are the names of both accounts and variables.

The SAM included accounts for private and public investment expenditures (gross fixed capital formation or GFCF) and changes in inventories:

- Private fixed capital investment expenditure – $GFCF_PRI$;
- Public fixed capital investment expenditure – $GFCF_PUB$;
- Changes in inventories – $VSTK$.

The first two were calculated in Equations 1, 2, and 3 below while $VSTK$ was provided in the SUTs. Equation 1 implies that private fixed capital formation ($GFCF_PRI$) was financed by non-FDI (N_FDI) sources and foreign direct investment (FDI). Non-FDI sources were household savings (SH) and net foreign borrowing of households ($NFFH$) in excess of household's net lending to the government ($NDFG$) and inventory changes ($VSTK$) as in Equation 2. Public fixed capital formation ($GFCF_PUB$) was financed by government savings, net domestic and foreign borrowing of the government as in Equation 3.

$$GFCF_PRI = N_FDI + FDI \quad (1)$$

$$N_FDI = SH + NFFH - NDFG - VSTK \quad (2)$$

$$GFCF_PUB = SG + NFFG + NDFG \quad (3)$$

The value of $NFFG$ was taken from IMF Article IV 2017 (1.6 trillion MNT). FDI was taken from the 2014 BoP (419 billion MNT). $NFFH$ and $NDFG$ were calculated as residuals to ensure the balance of Table 3. We took the value of $GFCF_PUB$ from the IMF Article IV 2017 which was 3.3 trillion MNT including the off-budget spending of the Development Bank of Mongolia. $NDFG$ was calculated as a residual and thus adjusted to satisfy Equation 3. Given the values of total GFCF in the SUTs and $GFCF_PUB$, we obtained the value of $GFCF_PRI$. The values of FDI , $VSTK$, $GFCF_PRI$, SH and $NDFG$ in Equation 2 yields the value of $NFFH$.

V. Aggregation of the SAM

After the adjustments and augmentations, the SAM was referred to as "revised." The revised SAM was then aggregated in terms of sectors and commodities for the purposes of facilitating interpretation. Specifically, seventy commodities and fifty-six sectors were aggregated into twenty-four commodities and twenty-four sectors. The mapping between original and aggregated sets of sectors/commodities used in this paper was similar to that of

the NSO. Sectors/commodities more important for the economy, such as agricultural and mining sectors/commodities were largely left disaggregated while relatively small sectors/commodities, especially manufacturing, were aggregated. For instance, forestry and fishery were aggregated into “agriculture” while wood, paper, metal industries, machinery, equipment, and vehicles were aggregated as “other manufacturing sectors/commodities.” The new sectors/commodities (exported coal, fuel and railway) were not aggregated.¹⁴

The aggregated SAM is a square matrix with eighty-six columns and rows. Accounts in the aggregated SAM are shown in Table 4.

Table 4. Accounts in the SAM

Sectors (24)	S	Institutions (3)
1. Agriculture	Agriculture	Households (H)
2. Livestock	Livestock	Government (GVT)
3. Domestic coal	Domestic coal	Rest of the world (ROW)
4. Exported coal	Exported coal	
5. Crude oil	Crude oil	Taxes (3)
6. Metal ores	Metal ores	Income taxes (TD)
7. Other mining	Other mining	Import duties (TM)
8. Food	Food	Taxes on commodities (TI)
9. Textiles	Textiles	
10. Coke and chemicals	Coke and	Factors (2)
11. Manufacturing	Manufacturing	Labor (Lab)
12. Electricity	Electricity	Capital (Cap)
13. Water	Fuel	
14. Construction	Construction	Savings-Investment (3)
15. Trade	Trade	Public investment (INV_PUB)
16. Transportation	Transportation	Private investment (INV_PRI)
17. Railway	Railway	Changes in inventories (VSTK)
18. Accommodation	Accommodation	
19. Information	Information	Capital accounts (3)
20. Financial activities	Financial	Households/firms (Cap-H)
21. Public administration	Public	Government (Cap-GOV)
22. Education	Education	Rest of the world (Cap-ROW)
23. Health	Health	
24. Other activities	Other services	

Table 5 shows the revised macro SAM as the share of nominal GDP in 2014. The shares of public and private investment expenditures in the GDP were similar—15% and 14% respectively. In comparison with the “proto” SAM, export and import shares were slightly decreased as the result of the adjustment of re-exports. Capital intensity decreased due to the “mixed income” adjustment. As a result, the economy was equally capital-intensive and in labor-intensive in the revised SAM.

¹⁴ For the mapping of sectors/commodities in the aggregated and the detailed SAM, see Appendices 5 and 6.

Table 5. Macro SAM 2014 (Percent of the GDP)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 Labor								0.4	44.8									45.3
2 Capital								0.0	45.3									45.3
3 Households	43.9	39.0		10.4				2.4										95.7
4 Government			4.7		13.4	1.6	7.7	0.3	0.5		0.0							28.2
5 ID			13.4															13.4
6 TM										1.6								1.6
7 TI										7.7								7.7
8 ROW	1.4	6.3	1.5	0.8						56.4								66.4
9 Sectors										137.7	48.							185.8
10 Domestic			56.6	13.0					95.1	16.7	3.5				13.6	15.0	6.6	220.1
11 Export Com-s								51.6										51.6
12 Cap-H			19.6											2.3				21.8
13 Cap-GOV				4.1								3.5	7.4					15.0
14 Cap-ROW								11.6										11.6
15 Private												11.7	1.9					13.6
16 Public													15.0					15.0
17 VSTK													6.6					6.6
18 TOTAL	45.3	45.3	95.7	28.2	13.4	1.6	7.7	66.4	185.	220.1	51.	21.8	15.0	11.6	13.6	15.0	6.6	

VI. Structure of the Mongolian Economy (2014)

6.1 Production Structure

Livestock and trade sectors contributed most to labor income while metal ores sector contributed most to capital income. The crude oil, food, metal ores, and coke and chemicals sectors were highly capital-intensive while the public-administration, education, health, railway and livestock sectors were most labor-intensive (Table 6).

Table 6. Production Structure (%)

Sector	Labor	Capital	Value added	Value added/Total output	Factor intensity	
					Labor	Capital
Agriculture	1.3	1.7	1.5	41.6	43.1	56.9
Livestock	23.7	3.2	13.4	77.6	87.9	12.1
Domestic coal	0.3	0.5	0.4	27.9	37.5	62.5
Exported coal	0.8	1.4	1.1	27.9	37.5	62.5
Crude oil	0.1	4.3	2.2	39.3	2.6	97.4
Metal ores	6.6	19.6	13.1	40.7	25.2	74.8
Other mining	0.9	1.1	1.0	33.1	46.1	53.9
Food	1.2	7.1	4.2	31.0	14.6	85.4
Textiles	1.4	1.3	1.4	42.6	51.8	48.2

Coke and chemicals	1.1	4.3	2.7	43.5	20.3	79.7
Manufacturing	1.1	1.8	1.5	39.0	38.1	61.9
Electricity	1.8	1.3	1.6	37.1	59.0	41.0
Water	0.5	0.3	0.4	35.0	61.8	38.2
Construction	4.2	5.7	4.9	22.0	42.1	57.9
Trade	17.5	8.0	12.7	64.7	68.5	31.5
Transportation	6.2	4.7	5.4	40.0	56.3	43.7
Railway	0.0	0.0	0.0	44.3	77.3	22.7
Accommodation	1.2	0.7	1.0	38.6	63.7	36.3
Information	1.7	3.3	2.5	54.0	34.3	65.7
Financial activities	3.0	7.3	5.2	78.3	29.0	71.0
Public administration	7.3	1.8	4.5	59.9	80.4	19.6
Education	8.0	1.9	5.0	76.5	80.6	19.4
Health	3.5	0.6	2.1	60.6	85.0	15.0
Other activities	6.2	18.4	12.3	61.1	25.2	74.8
Total	100.0	100.0	100.0		49.7	50.3

6.2 Trade Structure

Table 7 shows trade structure. Metal ores represented more than half of total exports. Fuel, coke-oven products, chemicals, and other manufacturing products contributed most of the imports. Crude oil and metal ores were almost exclusively exported. Most manufacturing commodities were imported. In particular, fuel was not produced domestically and was exclusively imported. On the other hand, some commodities, including trade, railway, and public administration were not traded internationally.

Table 7. Trade Structure (%)

Commodities	Export	Import	Export Intensity (except tax and margin)	Import Intensity
Agriculture	0.3	0.7	4.5	11.5
Livestock	3.6	0.2	11.4	0.8
Domestic coal	-	0.0	-	0.2
Exported coal	7.4	-	100.0	
Crude oil	10.5	-	99.4	-
Metal ores	53.2	0.0	99.4	0.5
Other mining	1.0	0.2	54.9	17.4
Electricity	0.0	1.9	0.1	20.0
Food	0.2	6.8	0.7	24.3
Textiles	2.0	3.3	32.9	49.5
Manufacturing	6.8	35.1	51.3	86.4

Fuel	-	17.8	-	100.0
Coke and chemicals	4.6	10.9	39.8	64.6
Construction	0.3	1.3	0.8	3.6
Trade	-	-	-	-
Accommodation	2.9	5.2	62.4	77.7
Transportation	3.4	2.1	13.2	10.1
Railway	-	-	-	-
Financial activities	0.3	2.1	2.1	16.8
Information	0.2	1.3	2.9	17.5
Public administration	-	-	-	-
Education	0.1	1.4	0.9	11.7
Health	0.0	0.8	0.5	13.5
Other services	3.1	9.0	6.8	19.6
Total	100.0	100.0		

6.3 Demand Structure

Table 8 shows the demand structure for each commodity. Most of food, textiles, and accommodation and information services were consumed by households whereas public administration, education, and health were mostly consumed by the government. Electricity and mining commodities were mainly used as intermediate inputs for production. Trade and railway were a 100% margin commodity while 19% of other transport services were used as a margin. Construction services were mainly used for investment.

Table 8. Demand Structure (%)

Commodities	Household consumption	Government consumption	Intermediate consumption	Margin	GFCF	VSTK	Total demand
Agriculture	42.7	-	57.2	-	0.0	0.1	100.0
Livestock	19.0	-	34.4	-	23.6	23.0	100.0
Domestic coal	11.2	-	96.8	-	-	-8.0	100.0
Crude oil	-	-	-	-	-	100.0	100.0
Metal ores	-	-	63.9	-	-	36.1	100.0
Other mining	1.0	-	101.3	-	-	-2.3	100.0
Electricity	8.6	-	91.4	-	-	-	100.0
Food	84.0	-	13.1	-	-	2.9	100.0
Textiles	65.2	-	30.0	-	1.6	3.2	100.0
Manufacturing	14.7	-	54.0	-	26.3	4.9	100.0
Fuel	17.8	-	78.4	-	-	3.8	100.0
Coke and chem.	13.6	-	84.4	-	-	2.0	100.0
Construction	0.3	-	26.0	-	73.6	-	100.0
Trade	-	-	-	100.0	-	-	100.0
Accommodation	66.9	0.2	32.9	-	-	-	100.0
Transportation	21.5	0.1	59.8	18.6	-	-	100.0

Railway	-	-	-	100.0	-	-	100.0
Financial act.	14.6	-	85.4	-	-	-	100.0
Information	58.2	1.2	40.6	-	-	-	100.0
Public admin.	3.3	88.9	7.7	-	-	-	100.0
Education	43.2	53.8	3.0	-	-	-	100.0
Health	34.2	59.2	6.5	-	-	-	100.0
Other services	32.6	4.8	58.1	-	4.5	-0.0	100.0

Food was the most important commodity for households, and they spent 31% of their consumption budget on it. The major commodities for government consumption were public administration, education, and health which contributed 47%, 27%, and 16% of total government consumption, respectively. Manufacturing, fuel, and coke and chemicals were the main intermediate goods and jointly received 40% of total intermediate consumption spending. The main margin commodity was trade and 89% of total margin went to trade services. Construction services were the main investment commodity, absorbing more than half of total investment spending.

6.4 Household Income, Consumption, and Savings

Table 9 shows the household/firm income and expenditure balance. The main sources of income for households were capital ownership and labor (jointly about 87% of household income). Households spent most of their income (59.2%) on purchasing commodities, 14% went to the government in direct taxes, and 5% represented non-tax payments. Transfers to the ROW were relatively small (1.5%) while savings were equal to about 20% of total income. Labor and capital income of households included factor payments from abroad net of factor payments to foreigners. Transfers from/to ROW were taken from the BoP while consumption spending of households was taken from the SUTs. Household savings was calculated as the difference between income and expenditure.

Table 9. Household/Firm Income and Expenditures (%)

Household income		Household expenditures	
Wages	45.9	Consumption	59.2
Capital income	40.8	Direct taxes	13.9
Transfers from government	10.8	Transfers to the government	4.9
Transfers from ROW	2.5	Transfers to ROW	1.5
		Savings	20.4
Total	100.0	Total	100.0

6.5 Government Activities

The government received the majority of its revenue from households (firms) as direct taxes (47.3%) and transfers (16.7%). Commodity taxes made up 27.4% of its revenue. Other sources of income were relatively small. Almost half the government budget was spent on purchasing goods and services while 36.7% went to households as government transfers. Government savings, used to finance capital expenditures, were 14.4% of the total budget. Import duties, export taxes, net taxes on products, net taxes on production, and public consumption were taken from the SUTs and transfers from/to ROW were taken from the BoP. Government savings reflected actual budget data from the NSO, calculated as government revenue minus current expenditures. Direct tax revenue was calculated as a residual by subtracting other types of taxes from total tax revenue in the actual budget data. Similarly, transfers from households was calculated as a residual to replicate total government revenue in the actual budget data. Transfers to households was also calculated as a residual to balance the government account.

Table 10. Government Budget (%)

Government revenue		Government expenditures	
Transfers from households	16.7	Transfers to households	36.7
Direct taxes/TD	47.3	Transfers to ROW	2.8
Import duties/TM	5.7	Public consumption	46.1
Export taxes	0.0	Savings	14.4
Net taxes on products/TI	27.4		
Transfers from ROW	1.1		
Net taxes on production	1.8		
Total	100.0	Total	100.0

6.6 Rest of the World (ROW)

Table 11 shows the transactions of the ROW. The ROW received most of its income from imports. Capital income contributed about 10% of total ROW income while other sources of income were relatively small. The ROW spent 78% of its income on purchasing Mongolian goods and services while saving 17.5% of its income and transferring 3.6% to Mongolian households (private sector). Other items on the expenditure side were almost insignificant. Exports and imports took their values from the SUTs while factor payments, factor income,

and transfers from/to Mongolian domestic institutions were taken from the BoP. Finally, savings of the ROW was computed as the difference between total income and total expenditures.

Table 11. Rest of the World Account

ROW income		ROW expenditure	
Wages	2.1	Compensation of employees	0.7
Capital income	9.5	Capital payments	0.0
Transfers from	1.2	Savings	17.5
Transfers from	2.2	Transfers to households	3.6
Imports	85.1	Transfers to government	0.5
		Exports	77.7
Total	100.0	Total	100.0

6.7 Investment/Savings Structure

More than half of total investment was financed by private savings. Rest of the world and the government contributed nearly 33% and 12% of total investment budget (source) respectively. The majority of the investment budget was dedicated to financing gross fixed capital formation (that is, private and public investment at 38.5% and 42.6% respectively). A relatively small fraction (18.9%) was spent on inventory changes.

Table 12. Investment/Savings Structure (%)

Source		Allocation	
Household/firm	55.5	Private investment	38.5
Government	11.5	Public investment	42.6
Rest of the world	32.9	Change in inventories	18.9
Total	100.0	Total	100.0

VII. Conclusions

This paper has presented the building of the Mongolian SAM for 2014 and some analysis done on the basis of the SAM. The SAM was constructed based on the Mongolian National Accounting System database and integrated all transactions in the economy for 2014 to exhibit a general and complete picture of the economy at one glance. This SAM has become the main database for Mongolian CGE models.

References

Cicowiez, M. and Lofgren, H. (2018). Technical Note on the Construction of a Social Accounting Matrix for Mongolia 2015. Unpublished manuscript.

Appendix 1. Balance of the SAM

Generally, we made sure that each account in our SAM was balanced at every step of the construction. Technically, we checked the balance of the SAM using either GAMS software or Microsoft Excel after any change had been made.

We took some values in the SAM from the primary data sources mentioned earlier. On the other hand, we calculated other values in the SAM on the basis of several assumptions. To balance the labor account, for example, household labor income was calculated as compensation of employees in the SUTs plus net labor income from abroad. The same applied to the capital account. For household and ROW accounts, the savings of each institution was calculated to balance the corresponding account while government transfers to households balanced the government account. Industry and commodity accounts were already balanced in the “proto” SAM because their values were taken from the balanced SUTs. The same was true for tax accounts.

Because the “proto” SAM was balanced, all adjustments and augmentations were made to maintain that balance. Household income from each factor absorbed the difference in factor accounts caused by the adjustment of mixed income, for example, which changed the factor-payment structure from industries. Total factor payment from individual industries were unchanged by the adjustment, however. In addition, reducing export and import by the same amount in the adjustment of re-exports ensured that the balance of the ROW account was not disturbed. When splitting total output into domestic supply and export and total margin into domestic and export margin, the transaction-cost model ensured that the disaggregated values equaled the original total values. It also ensured that exports at basic price, along with export margin and tax, equaled exports at purchaser price. When we split an existing sector or commodity, we kept the original aggregate values so that other parts of the SAM were unaffected. Moreover, we imposed assumptions on some components of the SAM to maintain the overall balance. When splitting the coal and transportation sectors, for example, we based our split on the income side of the sectors and then applied the resulting structure to the expenditure side.

Appendix 2. Differences between the 2015 SAM in Cicowiez and Lofgren (2018) and the SAM Discussed in this Paper

As a result of the following differences, some values in the two SAMs differ:

- While we took the value of public investment expenditure from the IMF IV review, values in the 2015 SAM were taken from Mongolian Ministry of Finance budget data. These sources differ significantly. Given the volatility observed in recent years in Mongolia and the government's procyclical policy, this difference is quite normal.
- In the 2015 SAM, foreign savings financed a part of public investment expenditure while, in our SAM, it financed a part of private investment expenditure.
- Because the mixed income adjustment in the 2015 SAM differed from the adjustment used in our SAM to classify salaried or non-salaried workers, there were large differences between factor payments in our SAM and those in the 2015 SAM. The builders of the 2015 SAM used the same classifications as ours in their later version of the SAM, however, though that version was not available for us to consult.
- The 2015 SAM did not take margins into account.
- In addition, some values differed by a significant amount (more than 1 trillion MNT) even if they were accounted for identically in both SAMs. These differences represented by the changes in the following variables between 2014 and 2015:
 - Imports decreased by about 2.2 trillion MNT (about 10% of the 2014 GDP)
 - Private consumption increased by 1 trillion MNT (about 5% of the 2014 GDP)
 - Intermediate consumption decreased by 1.3 trillion MNT (more than about 10% of the 2014 GDP)

Appendix 3. Abbreviations of SUTs Sector Names

Abbreviation	Full name
accom	Accommodation and food service activities
adm	Administrative and support service activities
animal	Animal production, hunting
art	Arts, entertainment and recreation
a-trans	Air transport
auxfin	Activities auxiliary to financial service and insurance activities
basmet	Manufacture of basic metals
bev	Manufacture of beverages
chem	Manufacture of chemicals and chemical products
coal	Mining of coal and lignite
coke	Manufacture of coke and refined petroleum products
com	Manufacture of computer, electronic and optical products
cons	Construction
crop	Crop production, related service activities
edu	Education
elec	Electricity, gas, steam and air conditioning supply
fabmet	Manufacture of fabricated metal products, except machinery and equipment
fin	Financial service activities, except insurance and pension funding
fish	Fishing and aquaculture
food	Manufacture of food products
for	Forestry and logging
furn	Manufacture of furniture
health	Human health and social work activities
info	Information and communication
insu	Insurance, reinsurance and pension funding, except compulsory social security
leather	Manufacture of leather and related products
lw-trans	Land and water transport
mach	Manufacture of machinery and equipment n.e.c.
med	Manufacture of medical and dental instruments and supplies
metore	Mining of metal ores
minsup	Mining support service activities
motveh	Manufacture of motor vehicles, trailers and semi-trailers; other machinery and equipment n.e.c.
nonmetmin	Manufacture of other non-metal mineral products
oil	Extraction of crude petroleum and natural gas
othact	Other activities
othman	Other manufacturing
othmin	Other mining and quarrying
othser	Other service activities
paper	Manufacture of paper and paper products
pharma	Manufacture of basic pharmaceutical products and pharmaceutical preparations
post	Postal and courier activities
print	Printing and reproduction of recorded media
pro	Professional, scientific and technical activities
pubad	Public administration and defense; compulsory social security
real	Real estate activities
repins	Repair and installation of machinery and equipment
rubplast	Manufacture of rubber and plastics products
textile	Manufacture of textiles
tob	Manufacture of tobacco products
trade	Wholesale and retail trade; repair of motor vehicles and motorcycles
warehouse	Warehousing and support activities for transportation
waste	Waste management and remediation activities
water	Water supply; sewerage management
wear	Manufacture of clothing
wood	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials

Appendix 4. Transaction Cost Model (TCM)

This model is a system of linear equations with the same number of equations and endogenous variables. It took some information from the SUTs and generated values for all endogenous variables as described below.

The TCM took the values of the following from the SUTs as exogenous:

- Domestic production at basic price;
- Exports at purchaser price;
- Imports at basic price;
- Aggregate transaction costs by commodity.

The TCM generated values for the following endogenous variables:

- Exports at basic price;
- Domestic supply at basic price;
- Share of transaction costs in total raw trade values by commodity. The model assumed that all transaction costs of a commodity were the same constant share of their corresponding raw trade values (that is, there was only one transaction cost share per commodity).
- Eventually, transaction costs related to exports and imports and domestic transaction costs were computed using the shares and raw trade values.

Before running the model, we only had domestic production at basic price. On the other hand, with the TCM, we knew the composition of domestic production for each commodity (meaning that we knew how much was exported and how much was sold domestically). Without the TCM, we knew only how much was paid by foreigners for exports. In contrast, the TCM provided the distribution of these values between producers and transaction costs.

Appendix 5. Mapping between Industries in the Aggregated and Detailed SAMS

Agriculture	Crop production, related service activities, forestry, logging, fishing and aquaculture
Livestock	Animal production and hunting
Domestic coal	Mining of domestic coal and lignite
Exported coal	Mining of exported coal
Crude oil	Extraction of crude petroleum and natural gas
Metal ores	Mining of metal ores
Other mining	Other mining and quarrying, mining support service activities
Food	Manufacture of food products, beverages and tobacco products
Textiles	Manufacture of textiles, clothing, leather and related products
Coke and chemicals	Manufacture of coke, chemicals, chemical products, rubber and plastics products, basic pharmaceutical products, pharmaceutical preparations and other non-metal mineral products
Manufacturing	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; Manufacture of paper and paper products; Printing and reproduction of recorded media; Manufacture of basic metals; Manufacture of fabricated metal products; Manufacture of computer, electronic and optical products; Manufacture of machinery and equipment; Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of furniture; Manufacture of medical and dental instruments and supplies; Repair and installation of machinery and equipment; Other manufacturing
Electricity	Electricity, gas, steam and air conditioning supply
Water	Water supply, sewerage management, waste management and remediation activities
Construction	Construction
Trade	Wholesale and retail trade; repair of motor vehicles and motorcycles
Transportation	Land, water and air transport, warehousing and support activities for transportation
Railway	Railway transport
Accommodation	Accommodation and food service activities
Information	Information, communication, postal and courier activities
Financial activities	Financial service, insurance, reinsurance and pension funding (except compulsory social security) and activities auxiliary to these activities
Public administration	Public administration and defense; compulsory social security
Education	Education
Health	Human health and social work activities
Other activities	Real estate activities, professional, scientific and technical activities, administrative and support service activities, arts, entertainment, recreation and other activities

Appendix 6. Mapping between Commodities in the Aggregated and Detailed SAMS

Agriculture	Products of agriculture, horticulture and market gardening, forestry and logging products, and fish and other fishing products
Livestock	Live animals and animal products (excluding meat)
Domestic coal	Domestic coal and lignite; peat
Exported coal	Exported coal
Crude oil	Crude petroleum and natural gas
Metal ores	Metal ores
Other mining	Stone, sand, clay and other minerals; natural water
Electricity	Electricity, town gas, steam, hot water and water distribution
Food	Meat, fish, fruit, vegetables, oils, fats, dairy products, egg products, grain mill products, starches and starch products, other food products, beverages, and tobacco products
Textiles	Yarn, thread, woven and tufted textiles, textile articles other than apparel, knitted or crocheted fabrics, clothing, leather, leather products and footwear
Manufacturing	Products of wood, cork, straw and plaiting materials; Pulp, paper and paper products; printed matter and related articles; Furniture, other transportable goods; Basic metals; Fabricated metal products, except machinery and equipment; General-purpose machinery; Special-purpose machinery; Office, accounting and computing machinery; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical appliances, precision and optical instruments, watches and clocks; Transport equipment.
Fuel	Refined petroleum products
Coke and chemicals	Coke-oven products, nuclear fuel, basic chemicals, other chemical products, man-made fibers, rubber and plastics products, glass and glass products, and other non-metal products
Construction	Construction services
Trade	Wholesale and retail trade services
Accommodation	Accommodation, food and beverage services
Transportation	Passenger transport services, freight transport services other than railway, rental services of transport vehicles with operators and supporting transport services
Railway	Railway transport services for coal export
Financial activities	Financial and related services
Information	Telecommunications, broadcasting, information supply services, postal and courier services
Public administration	Public administration and other services provided to the community as a whole; compulsory social security services
Education	Education services
Health	Human health and social care services
Other services	Real estate services; Leasing or rental services without operator; Research and development services; Legal and accounting services; Other professional, technical and business services; Support services; Support services to agriculture, hunting, forestry, fishing, mining and utilities; Maintenance, repair and installation services; Manufacturing services on physical inputs owned by others;

Other manufacturing services, publishing, printing and reproduction services,
materials recovery services;
Sewage and waste collection, treatment and disposal and other environmental
protection services;
Services of membership organizations;
Recreational, cultural and sporting services;
Other services;
Domestic services