The Marginal Welfare Burden of Mongolia's Tax System

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1. Introduction

Taxes influence the behavior of an economy's consumers and producers in important ways, and therefore the economy as a whole. Raising one dollar (or other local unit of currency) of tax could cost society more than one dollar (i.e. the marginal cost of raising a dollar of public funds can be higher than a dollar. Several rounds of tax reforms have been introduced in Mongolia since the country's economic transition from a centrally-planned economy to a market-oriented economy in the early 1990s, and currently, the government of Mongolia is working on another reform of its tax system and a revision of major tax laws.

"The marginal welfare burden of a tax is the change in national welfare due to a very small – a marginal – change in an existing tax. The change in welfare divided by the change in tax revenue describes the marginal welfare burden per dollar of additional tax revenue. This per dollar concept, developed by E. Browning (1976), has practical use as a measure for determining whether a government project is worthwhile if its funding requires raising additional tax revenue" (p. 199). This is a realistic and important analytical problem because policymakers typically consider modest tax hikes or cuts from an already-distorted tax base (Burfisher, M., 2011).

Every additional dollar of tax revenue incurs both direct and indirect tax burdens. The direct burden is a transfer of tax revenue from private expenditure to the government, while the indirect or excess tax burden occurs in the form of a deadweight efficiency cost to the economy. The direct burden of a tax does not incur a loss to the economy, because it transfers the tax payers' spending power to the government, and the government would allocate it elsewhere for the economy's welfare. However, tax distorts consumption and production as producers and consumers change the quantities they produce and consume to avoid paying tax. This change causes inefficiencies given a nation's productive resources and consumer preferences and they are not recouped elsewhere in the economy, and thus these inefficiencies are called a deadweight loss (Burfisher, M., 2011).

Computable general equilibrium models (CGE) are useful tools for tax policy analysis as economy-wide models and capture potential interactions among all taxes in an economy. This feature is important because governments usually impose several types and levels of taxes simultaneously. In fact, in some cases a particular tax or subsidy can improve efficiencies by offsetting inefficiencies caused by other taxes. For example, introducing a subsidy to a manufacturer may offset efficiency losses caused by a sales tax on their purchase of inputs (Burfisher, M., 2011).

In this context, this paper analyses the marginal welfare effects of Mongolia's current tax system using a CGE model and puts forwards some recommendations for the ongoing tax policy reform.

2. The Analysis

2.1 The Model and Aggregation

In analyzing the marginal welfare burden of Mongolia's tax system, the Global Trade Analysis Project (GTAP) Data Base (Version 8) and the standard GTAP Model were employed. The GTAP Model is a multi-region and multi-sector Computable General Equilibrium (CGE) model[1] with perfect competition and constant returns to scale. A CGE model is a system of mathematical equations that describes an economy as a whole and the interactions among its agents. Bilateral trade is handled via the Armington assumption, which provides the possibility to distinguish imports by their origin and explains the intra-industry trade of similar products. The Data Base combines detailed bilateral trade, transport and protection data characterizing economic linkages among regions, together with individual country input–output databases, which account for inter-sectoral linkages.

The GTAP Data Base 8, which was released in 2012, has dual reference years (2004 and 2007) and this analysis used 2007 as the reference year. The data covers 129 regions and 57 commodities, and Mongolia was one of the newly added regions in the Data Base. The GTAP Input–Output Table (IOT) for Mongolia is based on the Mongolian IOT for 2005, which includes 55 sectors (Narayanan, B., et al, eds., 2012; Begg, Burmaa, M., et al, 2012). The standard GTAP Model has five primary factors of production: land, skilled labor, unskilled labor, natural resources, and capital, with land and natural resources being sluggish, and labor and capital being mobile factors.

As Mongolia was the only country of interest in the analysis, the regions were aggregated from the 129 into two groupings, Mongolia and the rest of the world (ROW), and the sectors into five categories (agriculture, mining, manufacturing, infrastructure and services) from the 57 in the database. Also, the skilled and unskilled labor factors of the original GTAP model were combined as labor; thus the newly aggregated model, named "Mon5x4tx" which was used in the analysis has two regions, five sectors and four factors as described in Table 1. The commodity aggregation used in the model is illustrated in Table 2.

Table 1: Size of the "Mon5x4tx" Model

Items	Dimension	Members
Regions (*r*)	2	Mongolia, Rest of the World (ROW)
Sectors (*j*)	5	Agriculture, Mining, Manufacturing, Infrastructure, Services
Factors (*f*)	4	Land, Labor, Natural Resources, Capital

[1] For more details on the GTAP model and database, refer to Hertel, T. (ed.), 1997.

Table 2: Commodity Aggregation used in the Model

Mon5x4tx Model (5 Sectors)	GTAP Database 8 (57 Sectors[2])
Agriculture	Paddy rice, Wheat, Cereal grains nec., Vegetables, fruit, nuts, Oil seeds, Sugar cane, sugar beet, Plant-based fibers, Crops nec., Cattle, sheep and goats, horses, Animal products nec., Raw milk, Wool, silk-worm cocoons, Forestry, Fishing
Mining	Coal, Oil, Gas, Minerals nec., Petroleum, coal products
Manufacturing	Bovine meat products, Meat products nec., Vegetable oils and fats, Dairy products, Processed rice, Sugar, Food products nec., Beverages and tobacco products, Textiles, Apparel, Leather products, Wood products, Paper products, publishing, Petroleum, coal products, Chemical, rubber, plastic products, Mineral products nec., Ferrous metals, Metals nec., Metal products, Motor vehicles and parts, Transport equipment nec., Electronic equipment, Machinery and equipment nec., Manufactured goods nec.
Infrastructure	Electricity, Gas manufacturing, distribution, Water, Construction,
Services	Trade, Transport nec, Water transport, Air transport, Communication, Financial services nec, Insurance, Business services nec, Recreation and other services, Public administration, defense, education, health, Dwellings.

Note: The original sectors in the GTAP Data Base 8 start with capital letters.
nec. = not elsewhere cited

A simplified illustration of all economic agents in the model and their interactions is provided in Figure 1, which was taken from Brockmeier (1996). This is a graphical expression of a multi-region open economy with government interventions or taxes. In the GTAP data and the model all sectors produce a single output; thus there is a one-to-one relationship between producing sectors and commodities.

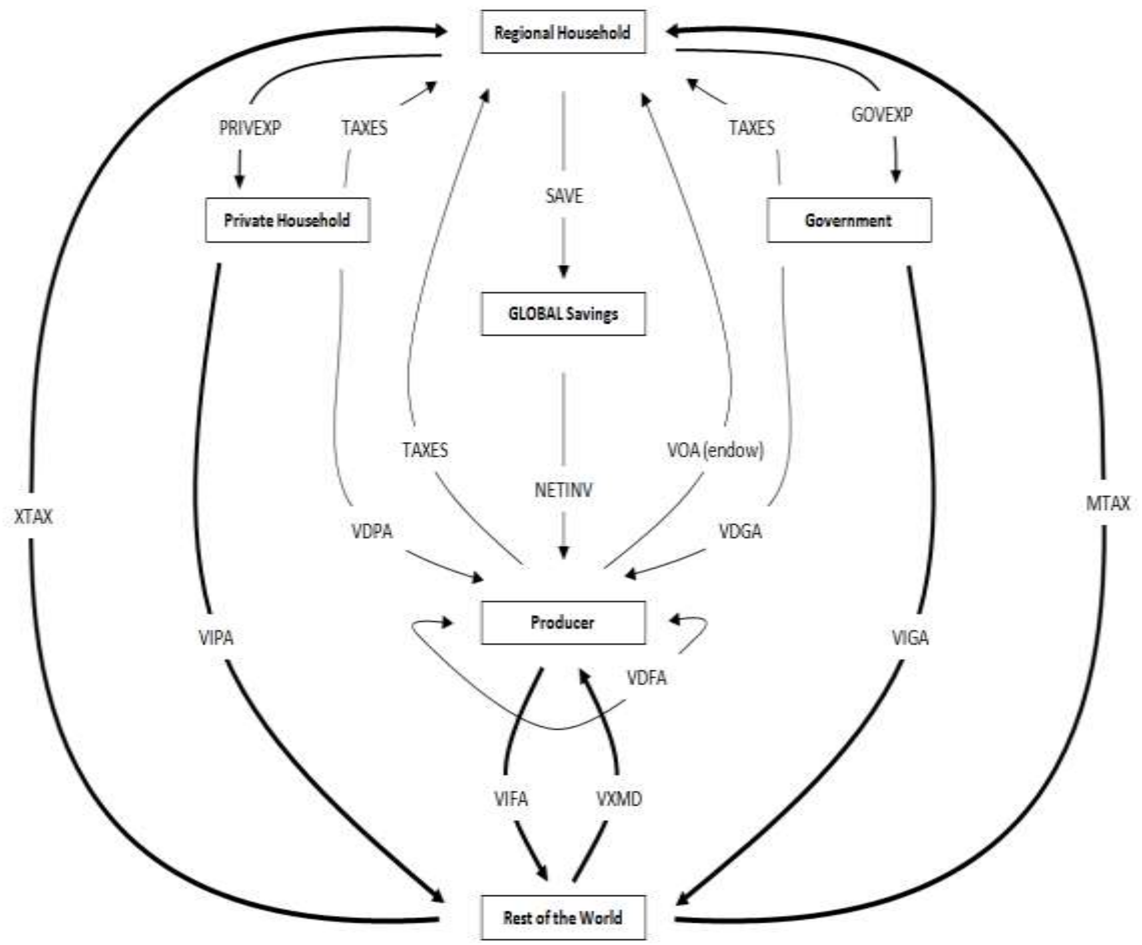
The GTAP model incorporates a regional household (termed an "aggregated household" in the CGE modeling framework), associated with each country (e.g. Mongolia) or composite region (e.g. ROW). The regional household collects all the income that is generated in an economy. Expenditures by this household are allocated across three broad categories: private (*PRIVEXP*), government (*GOVEXP*), and savings (*SAVE*) expenditures. These represent final demand in an economy and each component roughly maintains a constant share of the total regional income. Modelling the components of final demand via this regional household has the advantage that it enables the control of the condition that no agent can spend more income than it receives. Besides, this concept of a regional household is best suited to compute equivalent variation as a measure of regional welfare resulting from different policy scenarios (Brockmeier, 1996).

The regional income consists of the "Value of Output at Agent's prices (*VOA*)" paid by

[2] Mappings between these sectors and standard classification codes such as ISIC and CPC are available online: https://www.gtap.agecon.purdue.edu/databases/contribute/concordinfo.asp (Terrie L. Walmsley et.al., 2012)

producers for the use of "endowment commodities" to the regional household and flows of taxes (*TAXES*) from the private household, firms and government. As an open economy, it trades with the ROW and collects import taxes (*MTAX*) and exports (*XTAX*). The value of *VOA* flow also represents the values of the opposite flow that correspond to the values of endowment commodities going back to the producers from the regional household, but for the sake of simplicity, this flow and other goods and service flows are not included in Figure 1.

Figure 1: Multi-Region Open Economy with Government Intervention



In an open economy, the private and government households spend their income on both domestically produced and imported commodities. These flows are denoted as "Values of Private and Government" consumption expenditures on domestic goods and services evaluated at "Agent's" prices (*VDPA, VDGA)* and those on "Imported" goods and services (*VIPA, VIGA*). Also, the producers or firms receive payments for selling goods and services to private (*VDPA)* and government (*VDGA*) households, investment goods to the savings sector (*NETINV*) and get additional revenues from exporting goods and services valued at "Market" prices to the ROW (*VXMD*). At the same time, in order to produce goods and services, the firms spend their income on domestically produced intermediate inputs ("Value of Domestic Firm purchases evaluated at Agent's prices", *VDFA*), imported intermediate inputs ("Value of Imported Firm purchases evaluated at Agent's prices", *VIFA*) and primary factors of production (*VOA*). The GTAP model makes a zero-profit assumption for producers, so that all the revenues are completely used on expenditure. As savings and investment are computed on a global basis in the multi-region version of the GTAP model, the savings in the model are denoted by "GLOBAL Savings" (Figure 1).

The composition of Mongolia's and the ROW's GDP, as reported in the GTAP Data Base 8 is shown in Table 3. According to the table, Mongolia's exports to the ROW equaled 60.9% of GDP (Gross Domestic Product), while imports stood at 62.1%. At the same time, the figures for the ROW were 27.4%. This indicates that trade plays an important role for Mongolia's economy compared to the global average. Therefore, an open economy model better describes Mongolia's economy than a closed, single economy model. From the source side, net factor income accounted for 62% of Mongolia's GDP, while net taxes and depreciation equaled 26.1% and 12%, respectively (Table 3).

Table 3: Composition of GDP, %

		Mongolia	Rest of the World
From the expenditure side: GDPEXP=C+G+I+X−M			
	Private consumption (C)	50.5	59.8
	Government consumption (G)	13.2	17.2
	Investment (I)	37.5	23.0
	Exports (X)	60.9	27.4
	Imports (M)	−62.1	−27.4
	Total	100.0	100.0
From the source side: NETFACTINC+NETAXES+VDEP			
	Net factor income	62.0	60.2
	Net taxes (NETAXES)	26.1	29.1
	Depreciation (VDEP)	12.0	10.6
	Total	100.0	100.0

Source: GTAP 8 Data Base.

2.2 Elements of the GTAP Model

The GTAP database contains several sets that define parameters, variables and equations. As the aggregated model "Mon5x4tx" has five sectors, the set of traded commodities consists of agriculture, mining, manufacturing, infrastructure and services and they can be traded between regions. The set of produced commodities contains capital goods (*CGDS*) in addition to the traded commodities. Capital goods refers to the investment column of the national input–output tables and represents purchases of goods and equipment designated for investment. Thus, capital goods are produced like any other commodity, but it can be considered as a "fictitious" sector that is intermediate between the supply of goods to investment and the demand for savings. Land, labor, capital and natural resources are endowment commodities, whereas labor and capital are mobile, and land and natural resources are sluggish. The mobile endowment commodities are perfectly mobile across industries within each region, while the sluggish endowment commodities are imperfectly mobile or immobile. A detailed list of the sets defined in the model is illustrated in Table 4.

Table 4: Description of the Model Sets

Set Name	GTAP Notation	Members
Traded commodities	TRAD_COMM	Agriculture, Mining, Manufacturing, Infrastructure, Services
Produced commodities	PROD_COMM	Agriculture, Mining, Manufacturing, Infrastructure, Services, Capital Goods (CGDS)
Demanded commodities	DEMD_COMM	Land, Labor, Capital, Natural Resources, Agriculture, Mining, Manufacturing, Infrastructure, Services
Capital goods commodities	CGDS_COMM	Capital
Non-savings commodities	NSAV_COMM	Land, Labor, Capital, Natural Resources, Agriculture, Mining, Manufacturing, Infrastructure, Services, Capital goods
Non-margin commodities	NMRG_COMM	Agriculture, Mining, Manufacturing, Infrastructure
Margin commodities	MARG_COMM	Services
Endowment commodities	ENDW_COMM	Land, Labor, Capital, Natural Resources
Sluggish endowment commodities	ENDWS_COMM	Land, Natural Resources
Mobile endowment commodities	ENDWM_COMM	Labor, Capital
Capital endowment commodity	ENDWC_COMM	Capital

The model has more than 240 types of variables and a decision on which variables are endogenous (values are determined as solutions to the equations in the model) and which are exogenous (they have fixed values and do not change when the model is solved) is called the “model closure”. Tax and tariff rates, supply and demand elasticities, and the shift and share coefficients used in supply and demand equations are considered as exogenous parameters in the CGE models, whereas tax and tariff rates are typically calculated from the model’s base data. The base data represent an economy at an initial equilibrium (Burfisher, M., 2011).

In GTAP, the difference in the value of a transaction evaluated at agents’ and market prices equals a tax or subsidy. The base tax rates calculated from the GTAP Data Base 8 are provided in Tables 5–10. For example, in terms of output tax, Mongolia’s labor force pays more taxes on their income (26.7%) compared to the ROW’s 18.09%, while it pays slightly less tax on capital (4.78%) and natural resources (4.78%) as compared to the ROW (7.05%, and 6.58% respectively).

However, in terms of taxes on primary factors, a uniform rate of 2.26% was allocated for all the primary factors used by all the produced commodities in Mongolia, while those in the ROW vary by factor and commodity. In particular, the tax rate on labor in the ROW was relatively higher than in Mongolia, especially for the manufacturing, infrastructure and service sectors. However, land and capital used in agriculture were subsidized in the ROW (Table 6).

Table 5: Output (or Income) Subsidies (Base Rates)

(% ad valorem rate)

Factors and Commodities	Mongolia	Rest of the World
1 Land	−4.78	−5.38
2 Labor	−26.70	−18.09
3 Capital	−4.78	−7.05
4 Natural resources	−4.78	−6.58
5 Agriculture	−0.18	0.30
6 Mining	−3.66	−3.10
7 Manufacturing	−1.77	−2.42
8 Infrastructure	−1.63	−1.42
9 Services	−1.04	−1.68
Total	−49.30	−45.42

Note: Negative figures indicate tax and positive figures indicate subsidies.
Source: GTAP 8 Data Base.

Table 6: Taxes on Primary Factors (Base Rates)

(% ad valorem rate)

Factors	Agriculture	Mining	Manufacturing	Infrastructure	Services	Capital Goods	Total
Mongolia:							
Land	2.26	0	0	0	0	0	2.26
Labor	2.26	2.26	2.26	2.26	2.26	0	11.28
Capital	2.26	2.26	2.26	2.26	2.26	0	11.28
Natural Resources	2.26	2.26	0	0	0	0	4.51
Total	9.02	6.77	4.51	4.51	4.51	0	29.33
Rest of the World (ROW):							
Land	−8.03	0	0	0	0	0	−8.03
Labor	5.41	7.48	18.98	16.97	18.41	0	67.25
Capital	−6.70	1.54	1.63	1.89	2.1	0	0.46
Natural Resources	1.16	1.63	0	0	0	0	2.78
Total	−8.15	10.65	20.61	18.85	20.51	0	62.47

Note: Positive figures indicate tax and negative figures indicate subsidies.
Source: GTAP 8 Data Base.

In the case of consumption tax rates, they are substantially higher in Mongolia compared to those in the ROW, especially on imports. For example, the ad valorem rates on private consumption for imported agriculture commodities equaled 33.55% in Mongolia, while it equaled 1.73% in the ROW. Also, the rates for private consumption and government purchases for both the domestic and imported manufacturing commodities were higher in Mongolia than those in the ROW. In addition, firms in Mongolia pay much more tax as shares from their income, especially on their imported inputs. For example, the combined ad valorem rates of taxes on firms' import purchases for infrastructure equaled 152.93% in Mongolia, while it was 25.3% in the ROW. Overall, the above discussion may imply that Mongolia's tax policy is relatively unfavorable for businesses compared to the rest of the world (Tables 7–10).

Table 7: Taxes on Private Consumption (Base Rates)

(% ad valorem rate)

Sectors/Commodities	Mongolia		Rest of the World	
	Domestic	Imports	Domestic	Imports
Agriculture	1.69	33.55	1.13	1.73
Mining	3.50	10.44	17.73	43.41
Manufacturing	17.14	25.03	15.41	16.23
Infrastructure	−0.70	173.54	12.55	33.72
Services	5.36	0.99	3.16	5.60
Total	26.99	243.56	49.99	100.7

Source: GTAP 8 Data Base.

Table 8: Taxes on Government Purchases (Base Rates)

(% ad valorem rate)

Sectors/Commodities	Mongolia		Rest of the World	
	Domestic	Imports	Domestic	Imports
Agriculture	0	0	−0.82	0.89
Mining	2.53	31.21	0.42	0.18
Manufacturing	43.21	12.11	1.20	1.79
Infrastructure	0.73	2.67	0.31	5.45
Services	1.33	0.26	0.17	2.70
Total	47.8	46.24	1.28	11.02

Source: GTAP 8 Data Base.

Table 9: Taxes on Firms' Domestic Purchases (Base Rates)

(% ad valorem rate)

Commodities	Agriculture	Mining	Manufacturing	Infrastructure	Services	Capital Goods	Total
Mongolia:							
Agriculture	0	0	0	0	0	1.47	1.47
Mining	0.21	0	0.36	1.56	1.37	2.47	5.96
Manufacturing	6.22	1.84	0.67	0.12	2.91	34.96	46.72
Infrastructure	−0.44	−0.25	−0.74	0.09	−0.54	0.33	−1.54
Services	0	0	0	0	0	4.29	4.29
Total	5.99	1.59	0.3	1.76	3.74	43.51	56.89
Rest of the World (ROW):							
Agriculture	−2.02	0	0	0	0	1.44	−0.58
Mining	2.52	0.33	0.46	5.54	6.59	0.03	15.47
Manufacturing	1.68	1.01	0.92	0.79	6.52	3.12	14.04
Infrastructure	−0.25	2.57	4.17	0.7	1.73	1.28	10.2
Services	−2.33	0	0	0	0	1.51	−0.82
Total	−0.42	3.91	5.55	7.04	14.85	7.39	38.31

Source: GTAP 8 Data Base.

Table 10: Taxes on Firms' Import Purchases (Base Rates)

(% ad valorem rate)

Commodities	Agriculture	Mining	Manufacturing	Infrastructure	Services	Capital Goods	Total
Mongolia:							
Agriculture	0	0	0	0	0	23.84	23.84
Mining	0	0	0	0	0	0	0
Manufacturing	6.41	3.28	2.78	1.46	5.79	5.06	24.76
Infrastructure	40.4	5.54	44.53	36.85	24.59	1.02	152.93
Services	0	0	0	0	0	1.23	1.23
Total	46.8	8.81	47.31	38.3	30.38	31.15	202.77
Rest of the World (ROW):							
Agriculture	−2.47	0	0	0	0	0.23	−2.24
Mining	2.05	0.15	0.29	3.36	8.33	3.2	17.38
Manufacturing	0.74	0.33	0.62	0.49	5.51	5.41	13.09
Infrastructure	4.52	1.70	8.59	2.96	2.61	4.92	25.3
Services	−1.45	0	0	0	0	2.98	1.52
Total	3.38	2.19	9.5	6.8	16.44	16.73	55.05

Source: GTAP 8 Data Base.

2.3 The Simulation

The marginal welfare burden of Mongolia's tax system was evaluated by observing changes in national welfare when a very small—a marginal—change in the existing tax system is introduced. This is done by shocking the model with a 1% increase in every tax rate in the Mongolian economy simultaneously. Because taxes change the relative prices of goods and services, consumers and producers change the quantities they consume or produce. These changes also affect household savings and the accumulation of capital and investment, labor supply decisions and incomes, the relative returns from economic activity, and so on.

The list of shocks introduced in the "Mon5x4tx" Model and description of the tax variables are shown in Box 1 and Table 11, respectively. The default behavioral parameters of the standard GTAP model were not changed in the experiment; however a built-in systematic analysis of the sensitivity of welfare results to alternative elasticity parameter values for factor substitution was carried out.

Box 1: List of Shocks in "Mon5x4tx" Model

```
Shock tf(ENDW_COMM,PROD_COMM,"Mongolia") = rate% 1 from file tf.shk;
Shock tfd(TRAD_COMM,PROD_COMM,"Mongolia") = rate% 1 from file tfd.shk;
Shock tfm(TRAD_COMM,PROD_COMM,"Mongolia") = rate% 1 from file tfm.shk;
Shock tgd(TRAD_COMM,"Mongolia") = rate% 1 from file tgd.shk;
Shock tgm(TRAD_COMM,"Mongolia") = rate% 1 from file tgm.shk;
Shock to(NSAV_COMM,"Mongolia") = rate% 1 from file to.shk;
Shock tm(TRAD_COMM,"Mongolia") = uniform 1;
Shock tp("Mongolia") = 1;
Shock tx(TRAD_COMM,"Mongolia") = uniform 1
```

Table 11: Description of Policy Variables

Variables	Dimensions	Description
tf	ENDW_COMM*PROD_COMM*REG	tax on primary factor *i* used by *j* in region *r*
tfd	TRAD_COMM*PROD_COMM*REG	tax on domestic *i* purchased by *j* in *r*
tfm	TRAD_COMM*PROD_COMM*REG	tax on imported *i* purchased by *j* in *r*
tgd	TRAD_COMM*REG	tax on domestic *i* purchased by government household in *r*
tgm	TRAD_COMM*REG	tax on imported *i* purchased by government household in *r*
tm	TRAD_COMM*REG	source-generated change in tax on imports of *i* into *s*
tms	TRAD_COMM*REG*REG	source-specific change in tax on imports of *i* from *r* into *s*
to	NSAV_COMM*REG	output (or income) tax in region *r*
tp	REG	Commodity's source-generated shift in tax on private consumption
tx	TRAD_COMM*REG	Destination generated change in subsidy on exports of *i* from *r*

2.4 The Results

The simulation results demonstrated that a 1% increase in Mongolia's taxes would result in a direct burden of US$37.05 million of tax revenue and an efficiency loss of US$0.95 million.

As reported in Table 12, Mongolia’s initial amount of net tax revenue equaled US$1,024.1 million, and it increased to US$1,061.2 million after increasing all taxes by 1% simultaneously; thus, the additional net tax revenue or the direct burden equaled US$37.05 million. However, this amount is not a loss to the economy or the total welfare of Mongolia because it just shifts the spending power of the consumers and producers to the government. This means that although the consumers’ and producers’ disposable incomes would be reduced by US$37.05 million due to the additional taxes incurred, the government would have the same amount of extra tax revenues which can be spent for the nation’s welfare. Overall, Mongolia’s GDP would increase by US$57.02 million mostly due to increased revenue of net taxes (Table 12).

Table 12: Changes in Mongolia’s GDP by Source

(US$ Million)

GDPSRC	Net Factor Income	Net Taxes	Depreciation	Total
Base Data (A)	2,435.5	1,024.1	470.0	3,929.6
Updated Data (B)	2,450.8	1,061.2	474.6	3,986.6
Change (B−A)	15.37	37.05	4.59	57.02

However, the change to the equivalent variation (EV), which is a measure of economic welfare in the GTAP model, was negative. The regional household EV is equal to the difference between the expenditure required to obtain the new (post-simulation) level of utility at initial prices. According to the simulation results, the total welfare cost of an additional 1% increase in all taxes was estimated at US$0.43 million (Table 13).

The EV decomposition summary for Mongolia reported an allocative efficiency of US$−0.95 million. This represents the efficiency loss in the economy—as resources were reallocated away from their most efficient use in response to the updated taxation policy. However, due to the positive terms of trade (ToT) effects of US$0.52 million, the total welfare cost to the economy was reduced to US$0.43 million. There were efficiency gains of US$0.10 million in ToT in goods and services and US$0.42 million in ToT in investment and savings (Table 13).

Accordingly, for every dollar of additional tax rise, the Mongolian economy would incur 1.16 cents of excess tax burden, which is the taxes’ deadweight efficiency cost to the economy. This represents the marginal welfare burden of Mongolia’s current tax system and was estimated as: marginal welfare burden of tax (1.16 cents) = 100*change in welfare, and EV (US$−0.43 million)/change in government tax revenue (US$37.05 million). This means that given the current taxation structure in the Mongolian economy, each additional US$1 of taxation revenue costs the economy 1.16 cents; thus the government will need a return of US$1.0116 when using this tax revenue, or overall welfare in the economy will fall (Table 13).

Table 13: Welfare Effects for Mongolia: EV Decomposition Summary

(US$ Million)

Total welfare change (EV)		−0.43
	Allocative efficiency	−0.95
	Endowment	0
	Technology	0
	Population	0
	Terms of trade in goods and services	0.10
	Terms of trade in investment and savings	0.42
Change in government tax revenue (ΔT)		37.05
Welfare cost: cents per dollar of revenue {100x (EV/ΔT)}		−1.16

The decomposition results of the allocative efficiency effect by tax type indicated that consumption taxes were the most distorting, followed by import and input taxes. A consumption tax rise resulted in a US$0.70 million loss of welfare, while hikes in import and input taxes would incur a US$0.18 million and a US$0.17 million welfare cost to the economy, respectively. Therefore, a 1% increase in consumption tax would result in 1.89 cents of deadweight efficiency cost to the economy, while those for import and input taxes would equal 0.49 cents and 0.46 cents. The marginal welfare burdens estimated by tax types are illustrated in Figure 2.

On the other hand, in terms of allocative efficiency effect by commodity or sector, the excess burden for manufacturing industry was the highest, followed by services. The deadweight efficiency cost for manufacturing equaled US$0.66 million, and it amounted to US$0.15 million for services. At the same time, the infrastructure sector would incur a US$0.11 million efficiency loss due to the 1% increase in tax. Accordingly, the combined efficiency loss of these three sectors equaled 97% of the total deadweight efficiency cost (Table 15).

The results of the systematic sensitivity analysis (SSA) indicate that the negative sign of the equivalent variation (EV) welfare effect was robust with respect to factor (capital/labor/land) substitution elasticity (*ESUBVA*). According to the Chebyshev theorem, the lower and upper values of the EV change ranged between US$−0.54 million and US$−0.34 million with a 75% confidence interval and between US$−0.66 million and US$−0.22 million with a 95% confidence interval. These analyses were performed by changing the *ESUBVA* parameter values of all produced commodities to two times the base parameter values, or by 100% (Table 16).

Table 14: Welfare Decomposition of the Allocative Efficiency Effect by Tax Type

(US$ Million)

Tax Type	Welfare cost
Factor tax	0.00
Output tax	0.03
Input tax	−0.17
Consumption tax	−0.70
Government tax	0.04
Export tax	0.04
Import tax	−0.18
Total	−0.95

Figure 2: Marginal Welfare Burden of Additional Tax Revenue by Tax Type

(Cents per US$1)

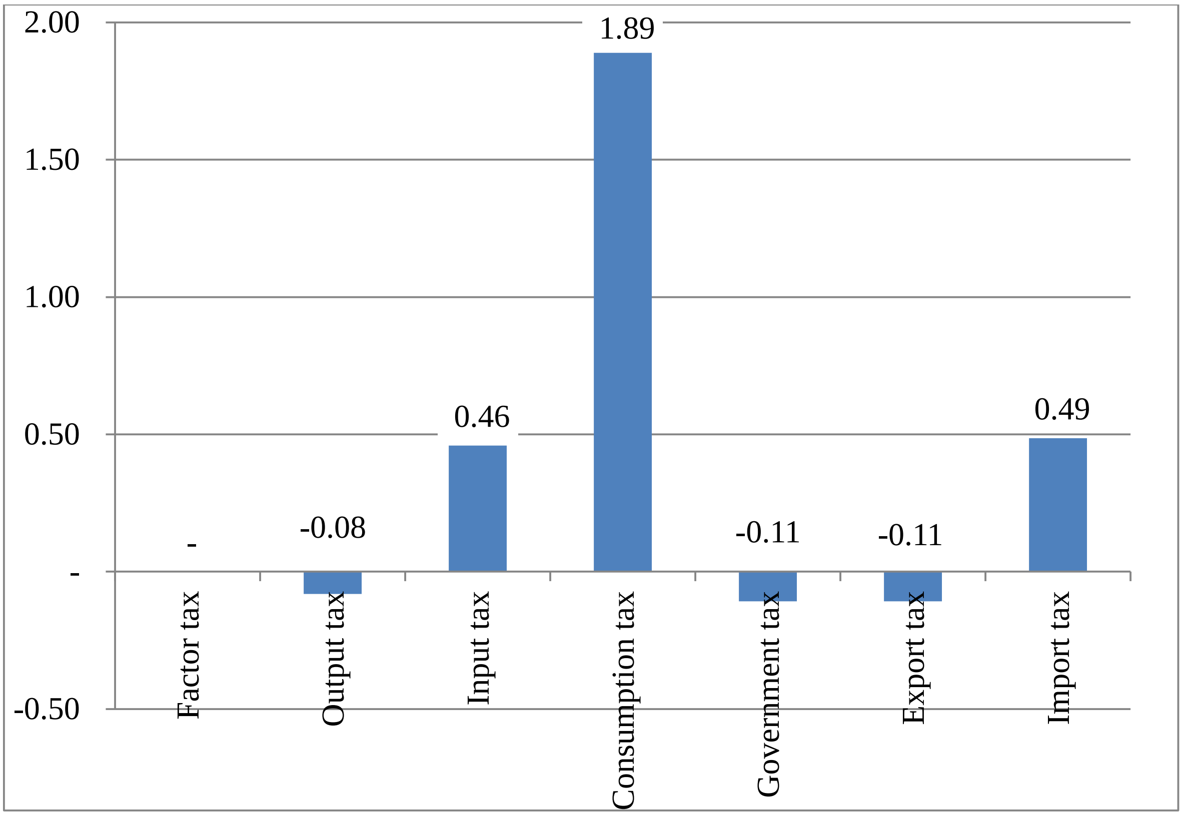


Table 15: Welfare Decomposition of the Allocative Efficiency Effect by Commodity

(US$ Million)

Commodities	Contribution to EV of Allocative Effects
Land	0
Labor	0
Capital	0
Natural Resources	0
Agriculture	−0.08
Mining	0.05
Manufacturing	−0.66
Infrastructure	−0.11
Services	−0.15
Total	−0.95

Table 16: Systemic Sensitivity Analysis (SSA) of the Model Results to Changes in the Elasticity of the Factor Substitution (*ESUBVA*) Parameter (Chebyshev's Theorem)

Mean	Standard Deviation	Confidence Intervals	Standard Deviation Multiplier	Upper Limit	Lower Limit
X	sd		K	X+sd*K	X−sd*K
−0.44	0.05	75%	2	−0.34	−0.54
		95%	4.47	−0.22	−0.66

3. Conclusion

Taxes can have significantly different impacts on welfare. Therefore, policy makers need to understand the welfare cost associated with different taxes in order to be more informed when designing tax policy.

For example, a simultaneous 1% increase in Mongolia’s current tax rates would result in a direct burden of US$37.05 million of tax revenue, while the excess burden or the deadweight efficiency loss to the economy equals US$0.43 million. That is, raising an additional dollar of tax revenue would cost the Mongolian economy 1.16 cents. Therefore, the government will need a return of US$1.0116 per dollar spent on any projects that use tax revenues; otherwise the overall welfare in the economy will fall.

It was revealed that the current consumption tax would have more distorting effects, while the efficiency loss in the manufacturing sector would be the highest in the case of an additional tax hike within the country’s current tax system. In this case, for example, by increasing consumption tax, consumer welfare and production would be more adversely affected than if the revenue was raised through an increase in any other tax.

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