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Insights from a 2012 Social Accounting Matrix (SAM) and Multiplier Analysis [*]

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Abstract

This paper describes the construction of the most detailed, openly accessible Social Accounting Matrix (SAM) for Bolivia to date. In addition to allowing for "standard" socio-economic analysis common for SAMs - like assessing the linkages between production, factor income distribution and households' incomes and expenditures – the SAM presented in this paper makes detailed economic assessments at the subnational level, by gender and at detailed agricultural subsector levels, possible. Sections 1-4 present the methodology and data sources used, explain assumptions and criteria adopted for SAM disaggregation, and discuss key findings with a focus on distributional features. Section 5 presents results from a simple SAM multiplier model and section 6 concludes. It is the authors' hope that this SAM database can make a contribution to evidence-based policy making that helps to further reduce poverty and food insecurity in Bolivia.

Keywords: Social Accounting Matrix, Bolivia

JEL classification code: E16

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1. Introduction

The construction of a Social Accounting Matrices (SAMs) entails a significant effort as it requires putting together a large amount of often dispersed and inconsistent data, obtained from different sources and related to different sectors of the economy. The effort, however, is a worthwhile undertaking because a SAM provides an in-depth understanding of the country's economic structure and the interrelations existing between the production sector, income distribution, and saving and investment processes by the different actors of the economy, i.e. households, enterprises, government and the rest of the world. SAMs are thus the basis for critical economy-wide analysis and can help guiding policy decisions. Examples include assessments of the impact of policy changes (e.g. fuel subsidy reform) or the impact of shocks (such as global food price crises) on key socio-economic indicators (such as GDP, household incomes etc.).

This paper describes the process followed in the construction of a Social Accounting Matrix (SAM) for the most detailed, openly accessible SAM for Bolivian economy to date. The SAM was built with a focus on analyzing the structure and importance of the agricultural sector and gender differences in the Bolivian economy, and understanding the linkages between agricultural production, factor income distribution and households' incomes and expenditures. To this end, a considerable disaggregation of accounts has been implemented in the construction of the SAM accounts.

The paper is organized in six sections:

Section 2 presents the structure of the 2012 Bolivian SAM. For this purpose, we follow a standard SAM structure as proposed by Pyatt and Round (1977, 1985), Schuschny (2005), and Breisinger et al. (2010). An aggregated numeric SAM for the Bolivian economy is also presented in this section, which was built based on data from the fully disaggregated SAM.

Section 3 discusses the main features underlying the use of a SAM framework. First, key macroeconomic variables, such as GDP, consumption, savings and investments, fiscal balance and the balance of payments, are identified in the SAM framework. Second, it is highlighted that individual accounts included in the SAM structure can be substantially disaggregated, depending on the areas of particular concern to policy makers in planning to meet their development objectives, and on the data availability.

Section 4 presents the full process of constructing the fully disaggregated 2012 Bolivia SAM. The section discusses the criteria adopted to further disaggregate each of the accounts of the Bolivian SAM, the assumptions made, and the methodology and data sources used.

Section 5 discusses the potential effects of demand and supply shocks affecting the agriculture sector on the rest of the economy, using a fixed-price multiplier analysis based on the 2012 Bolivian SAM. The multiplier matrix (inverse matrix) calculated from the Bolivian SAM reflects the linkages existing between any particular sector with the rest of the sectors of the economy.

Section 6 presents the main conclusions derived from the process of constructing the 2012 Bolivian SAM.

2. 2012 Bolivian SAM structure[1]

For the construction of the Bolivian 2012 SAM, a standard SAM structure was used as proposed by Pyatt and Round (1977, 1985), Breisinger et al. (2010), Jemio et al. (2015). It comprised a standard set of accounts, including:

i. Commodities
ii. Activities
iii. Factor of production, including labor and capital
iv. Institutions, including enterprises, households, and government
v. Saving-investment balance
vi. Rest of the world.

Table 1 presents the SAM structure, comprising nine account categories: activities, commodities, factors of production, households, enterprises, taxes, government, saving-investment and rest of the world. Annex A presents a detailed list of all the categories for each of the accounts included in the 2012 Bolivian SAM.

Rows and columns 1 of Table 1 relate to separate accounts for production activities and the commodities they produce. Column 1 presents the cost structure for the production of output. It comprises intermediate consumption (row 2) and income distribution to factors, i.e. labor, capital and land (row 3). Thus, the total of column 1 comprises the total value of domestic production valued at factor cost.

Column 2 shows the structure of total supply of commodities. It comprises the domestically produced output (row 1), which is supplied by domestic activities, plus imports (row 9), supplied by the external sector, plus net tariffs and net taxes on commodities paid (row 4). Commodity demand is shown along the commodity row (row 2). This includes intermediate demand by activities for further production of commodities (column 1), households' consumption demand (column 4), government current consumption (column 7), gross investment demand (column 8) and exports (column 9).

Column 3 outlines how factor income is distributed to institutions, i.e. households and enterprises, based on the institutions' factor endowments. Row 4 of column 3 comprises the part of income which is received by households, i.e. incomes that compensate labor (wages and salaries) plus the mixed income. The latter includes those incomes which cannot be clearly separated into the part which remunerates capital from that which remunerates labor. Row 5 of column 3 includes factor income, which remunerates capital and is received by enterprises.

Row 4 contains all current incomes received by households, namely: factor incomes (column 3), transfers from enterprises, e.g. distributed profits (column 5), transfers from government, e.g. pension payments (column 7), and transfers from the rest of the world, e.g. remittances (column 9). Column 4 on the other hand shows the way households allocate their total incomes, including consumption of goods and services (row 2), income tax payments (row 6), and transfers to the rest of the world (row 9). The difference between households' total incomes and total current expenditures represents households' savings, which are compiled in row 8 of column 4.

[1] This section and the next draw on Jemio et al. (2015).

Likewise, row 5 contains enterprises' current incomes, including profits (column 3), transfers from government (column 7), and transfers from the rest of the world (column 9). Column 5 records the way enterprises allocate their incomes, comprising transfers to households, e.g. distributed profits (row 4), tax payments on corporate profits (row 6), and transfers to the rest of the world, e.g. remittances of corporate profits (row 9). The difference between enterprises' total incomes and total current expenditures represents enterprises' savings, which are compiled in row 8 of column 5.

Row 6 compiles all tax payments, including import tariffs and indirect taxes on commodities (column 2), income taxes paid by households (column 4) and by enterprises (column 5). Column 6 transfers all these tax payments to the government (row 7).

Row 7 outlines all government's current revenues. They comprise all tax payments (column 6) and transfers from the rest of the world, e.g. official grants (column 9). Column 7 outlines how government allocates its total incomes, including government's current consumption of goods and services (row 2), transfers made to households (row 4), to enterprises (row 5) and to the rest of the world, e.g. interest payments due to the government's external debt (row 9). The difference between government's total incomes and total current expenditures represents its total savings, which are compiled in row 8 of column 7.

Row and column 8 portray the economy's saving-investment balance. Savings are compiled along row 8, including households' savings (column 4), firms' savings (column 5), government's savings (column 7), and external savings (column 9). Total savings are allocated to total investment in column 8, which is a component of total demand for commodities (row 2).

Finally, row 9 and column 9 outline the external balance. Payments to the rest of the world are recorded along the row, comprising import payments (column 2), transfers by households (column 4), transfers by enterprises (column 5), and transfers by the government (column 7). Payments from the rest of the world are recorded along column 9, comprising export payments, which is also part of the aggregate demand for commodities (row 2), transfers from abroad to households (row 4), transfers to enterprises (row 5), and to the government (row 7). The difference between total payments to and total receipts from the rest of the world represents external savings and is recorded in row 8 of column 9.

Table 1 – Structure of the Bolivian SAM

		1	2	3	4	5	6	7	8	9	10
		Activities	**Commodities**	**Factors of production**	**Households**	**Enterprises**	**Taxes**	**Government**	**Saving-investment**	**Rest of the world**	**Total**
1	**Activities**		Domestic supply								Total revenue
2	**Commodities**	Intermediate demand			Household consumption			Government consumption	Investment	Exports	Total demand
3	**Factors of production**	Value added									Factor income
4	**Households**			Wages		Transfers		Transfers		Transfers	Household income
5	**Enterprises**			Profits				Transfers		Transfers	Firms' incomes
6	**Taxes**		Import tariffs & indirect taxes		Direct taxes	Direct taxes					Tax payments
7	**Government**						Tax receipts			Transfers	Government revenues
8	**Saving-investment**				Household savings	Firms' savings		Government savings		Foreign savings	Total savings
9	**Rest of the world**		Imports		Transfers	Transfers		Transfers			Payments to RoW
10	**Total**	Total cost	Total supply	Factor income	Households' outlays	Firms' outlays	Total taxes	Government's outlays	Total investment	Payments from RoW	

3. Main features of the Bolivian SAM

There are two key features present in a SAM framework. First, it preserves the key macroeconomic identities in its structure, and thus key macroeconomic aggregates can be readily calculated from the SAM framework, ensuring the required macroeconomic consistency to the data presented in the SAM.

For instance, the income identity is embedded in columns and rows 1 and 2. The identity underlying row and column 1 is the following:

$$Q = V + Y^f \quad (1)$$

where: Q = Total output gross value
V = intermediate consumption
Y^f = factor income or GDP at factor cost

On the other hand, the identity underlying row and column 2 is

$$Q + M + T^{ind} = V + C + G + I + E \quad (2)$$

where: M = imports

T^{ind} = net indirect taxes
C = private consumption
G = government consumption
I = fixed capital formation
E = exports

Substituting (1) into (2) and rearranging we obtain the economy's income identity:

$$Y^m = C + G + I + E - M \quad (3)$$

Where: Y^m = GDP at market prices

Likewise, column and row 8 presents the economy's saving-investment balance

$$S_h + S_e + S_g + S_f = I \quad (4)$$

where: S_h = households' savings
S_e = enterprises' savings
S_g = government savings
S_f = foreign savings (-– current account balance of the balance of payments)
I = investments

On the other hand

$$S_d = S_h + S_e + S_g \quad (5)$$

$$S_d + S_f = I \quad (6)$$

where: S_d = domestic savings

Table 2 – Aggregate numerical SAM for Bolivia (Millions of Bolivianos)

	Activities	Commodities	Factors of production	Households	Enterprises	Taxes	Government	Saving-investment	Rest of the world	Total
Activities		323,447.9								323,447.9
Commodities	181,510.4			111,206.9			25,152.8	32,993.0	88,272.6	439,135.6
Factors of production	141,937.5									141,937.5
Households			106,241.0		5,014.5		7,519.6		7,222.3	125,997.4
Enterprises			35,696.4				1,275.8		0.0	36,972.2
Taxes		44,975.8		0.0	9,561.9					54,537.6
Government						54,537.6			2,401.6	56,939.2
Saving-investment				14,790.5	10,783.9		22,392.2		-14,973.6	32,993.0
Rest of the world		70,712.0		0.0	11,612.1		598.8			82,922.9
Total	323,447.9	439,135.6	141,937.5	125,997.4	36,972.2	54,537.6	56,939.2	32,993.0	82,922.9	

Source: Own elaboration based on INE's National Accounts data.

Table 2 presents a numerical aggregated SAM for Bolivia, using data from the 2012 Bolivian SAM which construction is described in this paper. Based on the numerical SAM data, and substituting those values in equation (3), we can calculate the income identity for the Bolivian economy:

$$Y = C + G + I + E - M$$

$$187.2 \text{ (in billions of Bolivianos)} = 111.3 + 25.2 + 33.0 + 88.3 - 70.7$$

Likewise, the saving-investment identity can be calculated by substituting the figures from Table 2 in equation (4):

$$S_h + S_f + S_g + S_e = I$$

$$17.8 + 7.8 + 22.4 - 15.0 = 33.0 \text{ (in billions of Bolivianos)}$$

The second key feature of the SAM framework is that it allows researchers to include considerable disaggregation in any of the accounts included in the SAM, depending on the areas of particular concern to policy makers in planning to meet their development objectives. In the case of the Bolivian SAM, the accounts presented in Table 1 have been disaggregated in categories relevant to the objective of analyzing the importance and structure of the agricultural sector and gender in the Bolivian economy, with a focus on poverty incidence and income distribution across different labor and households categories.

The criteria adopted to further disaggregate each of the accounts of the Bolivian SAM, assumptions adopted, methodology and data sources used are discussed in detail in the following sections of this paper.

4. Data sources, methodology and main assumptions

The main data sources used for the construction of the 2012 Bolivian SAM are:

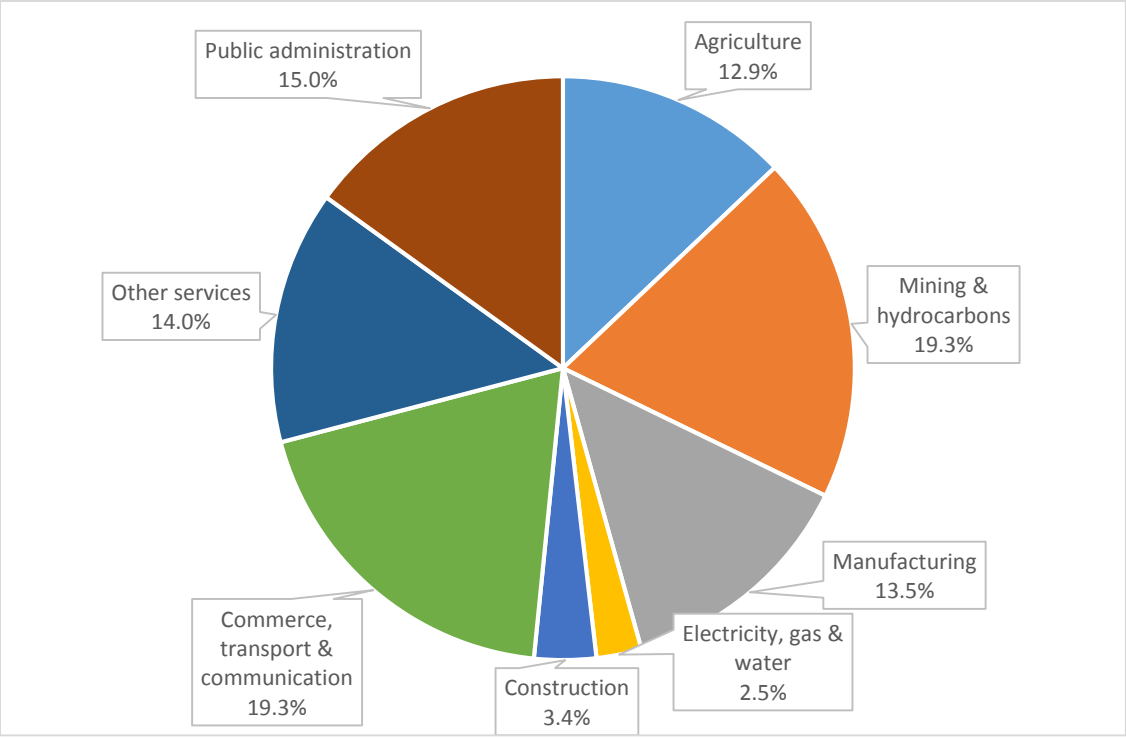
- The 2012 Input-Output Matrix published in the National Institute of Statistics' (INE) website http://www.ine.gob.bo/indice/visualizador.aspx?ah=PC01070154.HTM
- Balance of Payments, published in the Central Bank of Bolivia's (BCB) website http://www.bcb.gob.bo/?q=estadisticas/sector_externo
- General Government Balance published in the BCB's website http://www.bcb.gob.bo/?q=estadisticas/sector_fiscal
- The 2012 National Census of Population and Housing data base.
- The 2012 Household Survey data base.

4.1 Activity and commodity accounts

The 2012 Input-Output (I-O) Table was the main data source used in building the disaggregated activity sector and commodity accounts of the 2012 Bolivia SAM. INE's I-O Table is an activity-commodity matrix, comprising 35 activity sectors and 35 commodities. The I-O Table presents the structure of the Bolivian economy in 2012, where the agriculture sector's share in total GDP is 12.9% (see Figure 1). It also shows that the economy is relatively dependent on its mining and hydrocarbons sectors, which together contribute 19.3% of total GDP. Manufacturing accounts for 13.5% of GDP and there is a large variety of service activities, including commerce, transport,

communication, financial services, services to enterprises, personal, communal and social services, restaurants and hotels, domestic services, and public administration, which together represent almost 50% of GDP.

Figure 1:
Composition GDP at factor costs



Source: Own estimates based on INE's National Accounts data.

Since the main objective of the 2012 SAM is the analysis of the structure of the agricultural sector and its impacts on income distribution and poverty in Bolivia, the activity and commodity accounts for the agricultural sector was disaggregated considerably within the 2012 SAM framework.

The agricultural sector in INE's I-O Table is disaggregated into only five categories:

i. Non-industrial agriculture, covering those non-entrepreneurial agriculture activities that are mainly devoted to produce for self-consumption or for domestic markets.
ii. Industrial agriculture, consisting of those entrepreneurial agriculture activities that are mainly devoted to supply export markets.
iii. Coca, comprising activities related to the harvesting of coca leaves used for local consumption or for cocaine export.
iv. Livestock, covering all activities related to animal breeding, including cattle, porcine, ovine, goat, poultry and sub-products.
v. Forestry, fishing and hunting.

These agricultural sector categories were further disaggregated in the 2012 Bolivian SAM using a two step approach: first, separate accounts were singled-out for each of the crop groups produced.

Non-industrial agricultural activities were disaggregated into six sub-groups:

- Cereals: including rice, maize, quinoa, wheat, barley, grain oat, rye, canahua, sorghum, amaranth
- Vegetables: including broad bean, green pea, onion, tomato, bean, chickpea, carrot, lettuce, cabbage, chili, garlic, beetroot, pumpkin, cauliflower, cucumber, radish, green maize.
- Roots and tubers: potato, cassava, racacha
- Fruits: orange, tangerine, pineapple, lemon, apple, pear, peach, plum, papaya, cherimoya, avocado, cherry, grapefruit, lime, banana, watermelon, grape.
- Other non-industrial agriculture: peanuts, sesame, coffee, cocoa, alfalfa, green barely, green oat, green sorghum, flowers, tea, pepper, fibers, spice, and agriculture services.

Industrial agricultural activities were disaggregated into two sub-groups:

- Oilseeds: soybean and sunflower
- Sugarcane

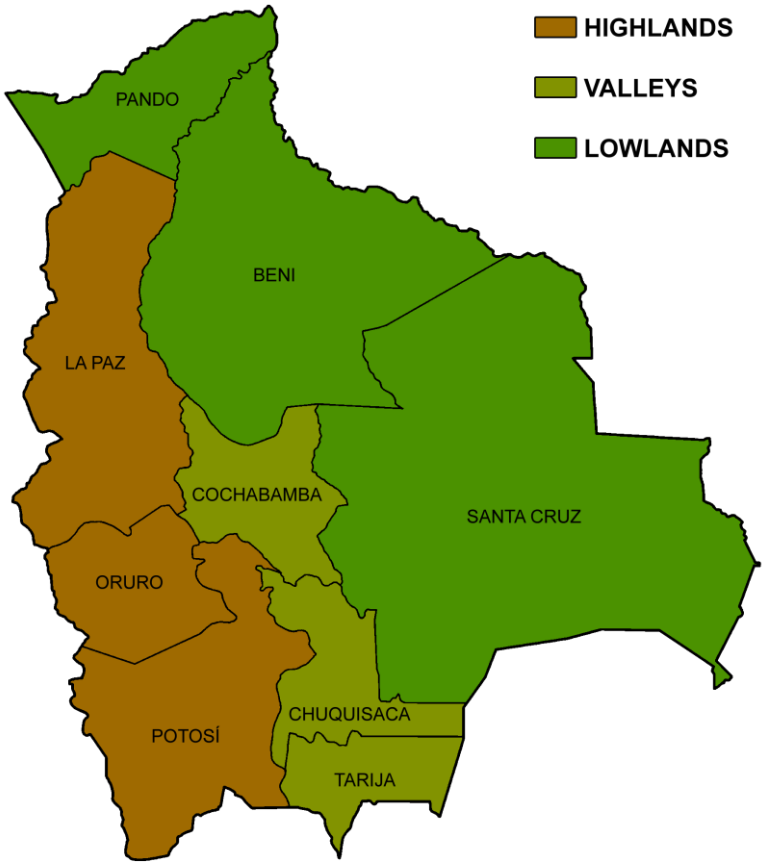
The second criteria to disaggregate the agricultural activity accounts is by sub-national region to reflect different agro-ecological conditions. For this purpose, Bolivia's nine departamentos (states) were grouped into three agro-ecological regions:

- Highlands: La Paz, Oruro and Potosí
- Valleys: Cochabamba, Chuquisaca and Tarija
- Lowlands: Santa Cruz, Beni and Pando

Figure 2 illustrates the regional disaggregation adopted in the construction of the Bolivian SAM.

Non-industrial agriculture, industrial agriculture, coca and livestock accounts were disaggregated according to the regional criteria. Forestry, fishing and hunting and all other non-agricultural activities were not modified and stayed the same as in the I-O Table. The additional break downs included in the agricultural sector activities increased the number of activity sectors from 35 in the I-O Table to 56 in the 2012 Bolivian SAM. Table 3 presents the equivalence existing between the I-O Table's vis-à-vis the 2012 Bolivian SAM's activity categories.

Figure 2: The regional disaggregation adopted for the Bolivian SAM



Source: Own elaboration.

In order to disaggregate agricultural activities and commodities of the I-O table into the agricultural categories of the 2012 Bolivian SAM, a detailed output share matrix was calculated, which showed the shares of individual crop groups in agricultural Gross Output Value (GOV). Shares were calculated based on very detailed GOV data prepared by INE at the crop level for 2006. Volume and price indexes for each of the most relevant crops were used to update this individual GOVs data up to 2012.

Table 4 presents the output shares used to disaggregate all agricultural variables, including gross output value, value added, intermediate consumption, intermediate and final demand. Agricultural goods exports and imports were estimated based on trade statistics published in INE's website http://www.ine.gob.bo:8082/comex/Main. Table 4 shows that the share of the three agro-ecological regions in non-industrial agricultural output value is very similar, i.e. one third each. Industrial agricultural output, by contrast, is overwhelmingly produced in the lowlands region. Coca output value is produced only in the highlands and valleys, while livestock output value is produced mainly in the lowlands (50 percent of total), and to a lesser extent in the highlands and valleys.

Table 3 – Activity sectors in the I-O Table and in the 2012 Bolivian SAM

	I-O Table categories		SAM categories			I-O Table categories		SAM categories
	Sectors		**Sectors**	**Regions**		**Sectors**		**Sectors**
1	Non-industrial agriculture	1	Cereals	Highlands	8	Processed meat	29	Processed meat
		2		Valleys	9	Dairy products	30	Dairy products
		3		Lowlands	10	Bakery	31	Bakery
		4	Vegetables	Highlands	11	Sugar and confectionary	32	Sugar and confectionary
		5		Valleys	12	Other food	33	Other food
		6		Lowlands	13	Beverages	34	Beverages
		7	Roots	Highlands	14	Tobacco	35	Tobacco
		8		Valleys	15	Textiles	36	Textiles
		9		Lowlands	16	Processed wood	37	Processed wood
		10	Fruits	Highlands	17	Paper	38	Paper
		11		Valleys	18	Chemical products	39	Chemical products
		12		Lowlands	19	Refined oil products	40	Refined oil products
		13	Other Non-Industrial Agriculture	Highlands	20	Non metal mineral products	41	Non metal mineral products
		14		Valleys	21	Basic metal products	42	Basic metal products
		15		Lowlands	22	Machinery	43	Machinery
2	Industrial agriculture	16	Soya beans	Valleys	23	Other Manufacturing products	44	Other Manufacturing products
		17		Lowlands	24	Electricity, gas and water	45	Electricity, gas and water
		18	Sugarcane	Highlands	25	Construction	46	Construction
		19		Valleys	26	Commerce	47	Commerce
		20		Lowlands	27	Transportation	48	Transportation
3	Coca	21	Coca	Highlands	28	Communication	49	Communication
		22		Valleys	29	Financial services	50	Financial services
4	Livestock	23	Livestock	Highlands	30	Services for enterprises	51	Services for enterprises
		24		Valleys	31	Real estate	52	Real estate
		25		Lowlands	32	Social services	53	Social services
5	Forestry, fishing	26	Forestry, Fishing		33	Restaurants and hotels	54	Restaurants and hotels
6	Hydrocarbons	27	Hydrocarbons		34	Domestic services	55	Domestic services
7	Mining	28	Mining		35	Public administration	56	Public administration
					36	Direct purchases of other goods and services		

Source: 2012 Bolivian SAM.

Table 4 – Output shares for agriculture activities – 2012 SAM (percent)

	Highlands	Valleys	Lowlands	Bolivia
Non-industrial agriculture	32.2	33.6	34.2	100.0
Cereals	6.7	5.7	19.4	31.8
Vegetables	2.3	5.6	3.8	11.6
Roots	14.3	12.6	5.4	32.2
Fruits	3.7	6.1	2.4	12.3
Other non-industrial agriculture	5.2	3.6	3.2	12.0
Industrial agriculture	0.0	2.6	97.4	100.0
Oilseeds	0.0	1.3	85.3	86.6
Sugarcane	0.0	1.2	12.1	13.4
Coca	49.7	50.3	0.0	100.0
Livestock	13.8	37.2	48.9	100.0

Source: Own estimates based on INE's National Accounts data.

The disaggregation included in the agricultural activities within the SAM framework, resulted in a more detailed supply-demand balance for the Bolivian economy. Table 5 shows the share of the disaggregated agricultural activity categories to value added, output, aggregate demand, exports and imports.

Table 5 – Bolivia supply-demand balances – 2012 SAM

	Value Added (%)	Total Output (%)	Total Demand (%)	Exports (%)	Export/ Output ratio	Imports (%)	Import/ Demand ratio
Cereals	1.7	1.2	1.0	0.7	15.3	0.6	10.2
Vegetables	0.6	0.4	0.3	0.3	17.3	0.0	1.2
Roots and tubers	1.8	1.2	0.9				
Fruits	0.7	0.5	0.4	0.2	10.7	0.1	6.0
Other non-industrial agriculture	0.6	0.4	0.3	0.3	17.4		
Oilseeds	1.1	2.0	1.5	1.3	16.7		
Sugarcane	0.2	0.3	0.2	0.0	0.0		
Coca	0.6	0.3	0.2	0.1	4.4		
Livestock	2.6	2.2	1.7	0.0	0.2	0.1	1.3
Forestry, fishing & hunting	1.2	1.0	0.8	0.1	2.5	0.0	0.5
Total agriculture	11.1	9.4	7.4	2.9	8.0	1.0	2.1
Mining-hydrocarbons	19.5	20.9	21.0	63.1	78.8	0.5	0.4
Manufacturing	12.7	26.7	36.0	28.1	27.4	84.3	37.7
Electricity, gas & water	2.5	1.7	1.4				
Construction	3.2	4.4	3.4				
Commerce, transport & communication	19.0	14.9	12.7	3.2	5.6	7.2	9.2
Other services	17.5	13.2	11.4	2.8	5.5	7.0	9.9
Public administration	14.5	8.8	6.8				
Total	100.0	100.0	100.0	100.0	26.1	100.0	16.1

Source: Own estimates based on National Accounts data.

Some important features about the Bolivian economic structure can be observed from this table:

First, agricultural activities comprise 11.1% of total GDP and 9.4% of total output. On the other hand, agricultural commodities constitute only a small share of total exports (2.9%) and of total imports (1.0%). The most important agricultural activities in terms of their shares in total GDP are: roots and tubers (1.8%) share in total GDP), oilseeds (1.1%), and forestry, fishing and hunting (1.2%).

Second, the agricultural sector in Bolivia is not particularly export oriented. Only 8% of total domestic agricultural production is exported. However, it is important to note that particularly oilseed and sugarcane are further processed and partly exported as manufacturing goods, representing the bulk of manufacturing goods exports.

Third, the Bolivian economy is not dependent on agricultural goods imports. Imports of agricultural goods make up just 1% of total import expenditures. The most import dependent agricultural markets are the markets for cereals and fruits with import penetration ratios of 10.2% and 6%, respectively.

4.2 Functional income distribution accounts

The construction of the functional income distribution matrix for the 2012 SAM faced serious data challenges. INE's national accounts statistics do not comprise data on the functional income composition of GDP at the activity level. Thus, the whole functional income distribution matrix had to be estimated using primary data obtained from the National Census of Population and Housing (CNPV 2012) and from the 2012 National Household Survey (EH 2012). The process followed comprised the following three steps.

Step 1: Classify population by sector of work

All occupied people in both the household survey and the census were classified according to the sector of primary work and main product produced. This yielded the distribution of workers across sectors listed in Table 6 for the census and the household survey, respectively. Both are approximations, as people, especially in the agricultural sector, tend to produce a variety of products, rather than just one. In addition, in the census there were many workers who just said "agriculture" without specifying in more detail the kind of products they produced. These have been distributed to more specific agricultural sectors in order to make the number of persons in each sector and region similar to what was found in the household survey. The household survey is considered more reliable for assessing the distribution of people across sectors, since people were asked specifically what they produce, so it was possible to classify all occupied people. However, in the case of very small sectors, the survey may not be representative.

About 10% of all occupied people in the census had provided insufficient information to determine the sector of work. These were distributed to the "undermanned" sectors in which they were most likely to work given their characteristics. Thus, for example, all unclassified people in rural areas were assigned to the livestock sector, which had plenty of room to include more people (when compared to the numbers signaled by the household survey), and all unclassified, unskilled, urban, males were assigned to the transport sector, while all unclassified, semi-skilled workers in the Valley region were assigned to the restaurant sector.

Step 2: Estimate a Mincer earnings equation using household survey data

In order to establish a model for labor incomes, a Mincer earnings equation was estimated for all the occupied people in the 2012 household survey using OLS. This yielded the results shown in Table 7. This equation indicates the natural logarithm of the average monthly labor income (in Bs.) compared to the reference group (unskilled, indigenous, male potato growers in the Bolivian highlands). As reflected by the dominance of significantly positive coefficients in the regression, practically everybody, except some women, earn more than this very poor group of people.

All estimated coefficients are highly significant. The results indicate that the sectors that provide the highest labor incomes are the mining and hydrocarbon sectors, followed by the financial services sector and the manufacturing of chemical products.

Step 3: Impute labor incomes in the census using the estimated Mincer equation

Third, we use this earnings equation to estimate the monthly income for every individual in the 2012 census. For example, for unskilled, indigenous, male potato growers in the Bolivian highlands, the monthly income would be: exp(5.820429) = Bs. 337. For unskilled, indigenous, female potato growers in the Bolivian highlands, the monthly labor income would be: exp(5.820429 - 0.402632) = Bs. 225. And for skilled, non-indigenous, male oilseed growers in the lowlands, the monthly income would be: exp(5.820429 + .4690769 + 0.1525601 + 1.166483 + 0.3674176) = Bs. 2910.

Furthermore, in the fully fledged labor matrix, portraying the distribution of workers across the 56 activity sectors included in the 2012 SAM presented in Table 2, workers were additionally grouped according to three extra criteria:

- Gender (male/female)
- Ethnicity (indigenous/no indigenous)
- Skills (non-skilled/semi-skilled/skilled)

The combination of these three criteria yielded twelve labor categories in which a total of 4.7 million workers were categorized. Table 8 presents the number of workers grouped in each of the labor categories, by sector of activity.

Table 6: Distribution of occupied people in Bolivia across sectors, 2012

Sector		Census 2012	Household survey 2012
1	Cereals	176,635	176,773
2	Vegetables	53,597	46,167
3	Roots	399,647	415,137
4	Fruits	58,447	5,655
5	Other traditional	26,010	20,686
6	Oilseeds	15,118	21,960
7	Sugarcane	7,323	17,788
8	Coca	130,791	142,653
9	Livestock	496,291	524,989
10	Forestry, fishing	12,179	22,754
11	Hydrocarbons	11,628	13,971
12	Mining	71,351	85,901
13	Processed meat	11,451	114,992
14	Dairy products	3,252	
15	Bakery	44,608	
16	Sugar and confectionary	3,008	
17	Other food	7,263	
18	Beverages	6,204	17,842
19	Tobacco	314	
20	Textiles	149,223	146,248
21	Processed wood	53,337	58,488
22	Paper	12,074	14,734
23	Chemical products	7,807	6,230
24	Refined oil products	294	6,728
25	Nonmetallic mineral products	41,869	42,275
26	Basic metal products	2,181	41,851
27	Machinery	88,817	
28	Other manufacturing products	8,923	23,259
29	Electricity, gas and water	29,158	26,133
30	Construction	378,692	345,500
31	Commerce	791,850	800,770
32	Transportation	304,306	284,479
33	Communication	49,319	56,285
34	Financial services	33,319	39,317
35	Services for enterprises	191,712	177,576
36	Real estate	4,654	
37	Social services	502,757	505,968
38	Restaurants and hotels	261,382	265,797
39	Domestic services	110,782	118,605
40	Public administration	152,052	144,699
	All occupied people	**4,709,625**	**4,732,210**

Source: Authors' calculation based on Bolivian census and household survey data from 2012.

Table 7: Mincer earnings regression

```
      Source |       SS       df       MS              Number of obs =   12408
-------------+------------------------------           F( 39, 12368) =  161.08
       Model |  4963.70503    39  127.274488           Prob > F      =  0.0000
    Residual |  9772.45975 12368  .790140666           R-squared     =  0.3368
-------------+------------------------------           Adj R-squared =  0.3347
       Total |  14736.1648 12407  1.18772989           Root MSE      =   .8889

------------------------------------------------------------------------------
             lnw |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------+------------------------------------------------------------
           mujer |   -.402632   .0189685   -21.23   0.000    -.4398132   -.3654507
      noindigena |   .1525601   .0196448     7.77   0.000     .1140533     .191067
           valle |   .1978533   .0194412    10.18   0.000     .1597456     .235961
           llano |   .3674176   .0213464    17.21   0.000     .3255753    .4092599
     semiskilled |   .0959918   .0207537     4.63   0.000     .0553113    .1366722
         skilled |   .4690769   .0247804    18.93   0.000     .4205035    .5176504
           urban |   .2098385   .0252004     8.33   0.000     .1604417    .2592353
         cereals |   .3422375   .0562529     6.08   0.000     .2319731    .4525019
      vegetables |   .5165375   .1000023     5.17   0.000     .3205174    .7125576
          fruits |   1.136002   .1747778     6.50   0.000     .7934106    1.478594
othertraditional |   1.282987   .2124454     6.04   0.000     .8665607    1.699413
        oilseeds |   1.166483   .1284416     9.08   0.000     .9147179    1.418249
       sugarcane |   1.212318   .1573461     7.70   0.000      .903895    1.520741
            coca |   .8793004   .0747121    11.77   0.000     .7328531    1.025748
          ganado |   .3094664   .0463465     6.68   0.000     .2186201    .4003128
           silvi |   1.290377   .1216978    10.60   0.000      1.05183    1.528924
        petroleo |   1.756186   .1560898    11.25   0.000     1.450226    2.062146
         mineria |    1.98391   .0687079    28.87   0.000     1.849232    2.118588
       manu_food |   1.023711   .0649243    15.77   0.000     .8964495    1.150973
      manu_drink |   1.277917   .1279296     9.99   0.000     1.027155    1.528679
    manu_textile |    .877831   .0574099    15.29   0.000     .7652986    .9903634
       manu_wood |   1.108085   .0774202    14.31   0.000     .9563296    1.259841
      manu_paper |   1.029823   .1434067     7.18   0.000     .7487232    1.310922
      manu_chemi |   1.501912   .1862421     8.06   0.000     1.136849    1.866976
      manu_petro |   1.349254   .1982057     6.81   0.000     .9607403    1.737768
    manu_mineral |   1.470404   .1018311    14.44   0.000     1.270799    1.670009
      manu_metal |   1.292342   .0895861    14.43   0.000      1.11674    1.467945
    manu_diverso |   1.146673   .1085821    10.56   0.000      .933835    1.359511
       elgasagua |   1.362422   .1106047    12.32   0.000      1.14562    1.579225
         construc |   1.387332   .0462358    30.01   0.000     1.296702    1.477961
         comercio |   1.024515   .0439147    23.33   0.000     .9384356    1.110595
           transp |   1.281493   .0493547    25.96   0.000      1.18475    1.378236
           comuni |   1.038213   .0808673    12.84   0.000        .8797    1.196725
          finance |   1.561979   .0857019    18.23   0.000      1.39399    1.729968
         serv_ent |   1.030964   .0559846    18.42   0.000     .9212258    1.140703
        serv_pers |   1.197214   .0465559    25.72   0.000     1.105957     1.28847
           restau |   1.104087   .0529415    20.85   0.000     1.000313    1.207861
         serv_dom |    .959105    .064326    14.91   0.000     .8330159    1.085194
           admpub |   1.430773   .0561455    25.48   0.000     1.320719    1.540827
            _cons |   5.820429   .0353903   164.46   0.000     5.751059      5.8898
------------------------------------------------------------------------------
```

Source: Author's estimation based on Bolivia's 2012 household survey.

Table 8 – Distribution of workers across activity sectors and labor categories used in the 2012 SAM (thousands of workers)

			Agriculture	Mining-hydrocarbons	Manufacturing	Electricity, gas & water	Construction	Commerce, transport & communication	other services	Public administration	Total
Male workers	Non-indigenous	Non-skilled	142.3	6.4	27.8	0.6	56.4	86.5	19.3	2.5	341.8
		Semi-skilled	107.2	17.5	117.0	2.5	116.0	232.1	85.5	47.8	725.6
		Skilled	14.0	8.1	25.1	2.4	24.6	79.5	176.3	30.2	360.2
	Indigenous	Non-skilled	349.6	14.5	26.0	0.5	62.1	67.7	13.6	2.1	536.1
		Semi-skilled	222.5	24.6	79.3	1.4	91.9	136.9	38.6	19.3	614.5
		Skilled	14.4	3.2	9.8	0.8	10.3	26.8	76.9	15.4	157.7
Female workers	Non-indigenous	Non-skilled	82.0	1.0	22.4	0.3	2.6	85.1	90.5	2.0	285.9
		Semi-skilled	40.8	1.8	51.5	12.7	3.9	162.0	178.7	7.6	459.0
		Skilled	4.7	1.7	12.7	0.6	3.3	60.5	196.5	15.5	295.5
	Indigenous	Non-skilled	287.0	2.0	30.1	0.3	3.9	100.5	76.2	1.5	501.4
		Semi-skilled	106.0	1.7	34.6	7.1	3.0	89.3	78.1	3.1	322.9
		Skilled	5.6	0.4	4.3	0.1	0.7	18.7	74.3	4.8	109.0
Total			1,376.0	83.0	440.6	29.2	378.7	1,145.5	1,104.6	152.1	4,709.6

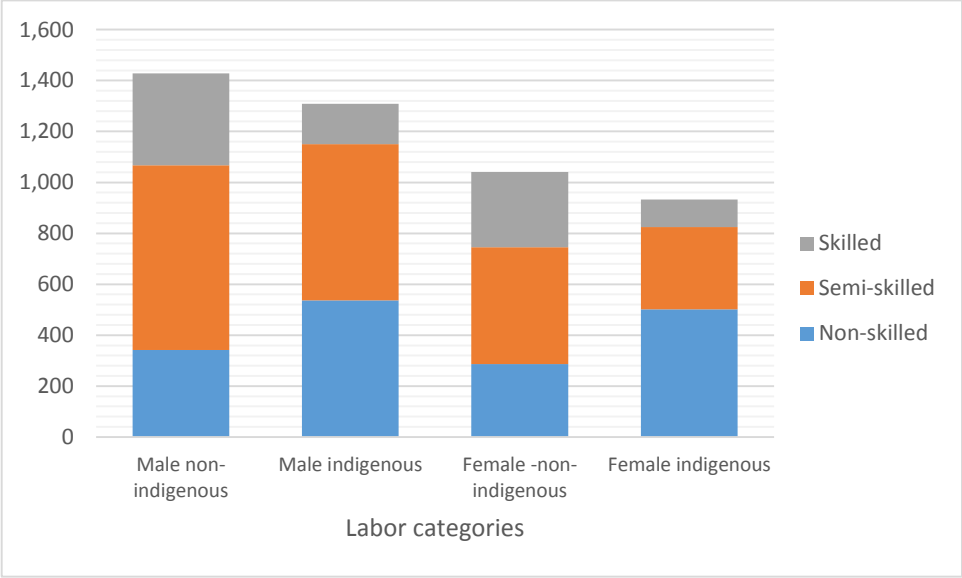
Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

There are interesting features about the labor force and labor income distributions in Bolivia, mapped in the 2012 Bolivian SAM, which are worthwhile highlighting.

Figure 3 shows the employment structure by worker categories and skill level. The main features presented are:

- There are 2.7 million male workers, representing 58.1% of total employment; while there are 2.0 million female workers, representing 41.9% of total employed people.
- The largest number of non-skilled workers belongs to the indigenous labor groups, both male and female. Non-skilled workers also represent a large share in the total indigenous labor groups, i.e. 41% of total male-indigenous workers and 53.7% of their female indigenous counterparts.
- Conversely, the largest number of skilled workers belongs to the non-indigenous labor groups, both male and female. Skilled workers represent 25.2% of total male workers, and 28.4% of their female counterparts.
- The largest number of workers in the Bolivian employed population is that of semi-skilled workers. They represent 50.8% of male-non-indigenous, 47.0% of male-indigenous, 44.1% of female-non-indigenous, and 34.6% of female-indigenous workers.

Figure 3
Employment structure by worker categories and skill level
(thousands of workers)



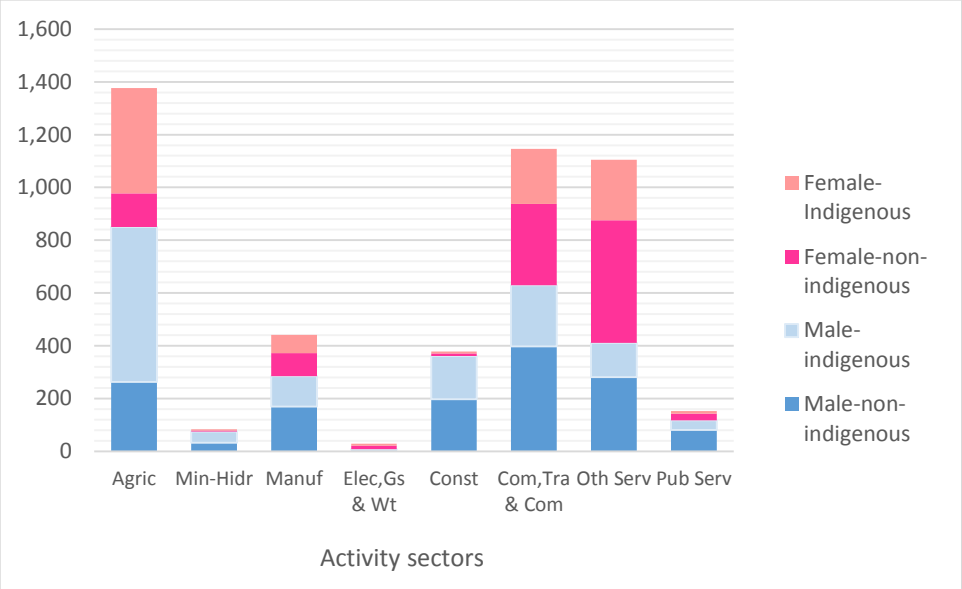
Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Figure 4 shows the employment structure by worker categories and sector of activity. The main features presented are:

- The agricultural sector is the sector employing most of the Bolivian labor force, i.e. 1.4 million workers, representing 29.2% of total employment.
- The bulk of indigenous workers are employed in the agricultural sector, i.e. about 1 million people representing 43.9% of total indigenous workers.
- 95% of the labor force employed in the construction sector are male workers.

- 48 percent of the total employed population (2.3 million workers) is employed in service activities, including commerce, transport, communication and other services.

Figure 4
Employment structure by worker categories and sector of activity
(thousands of workers)

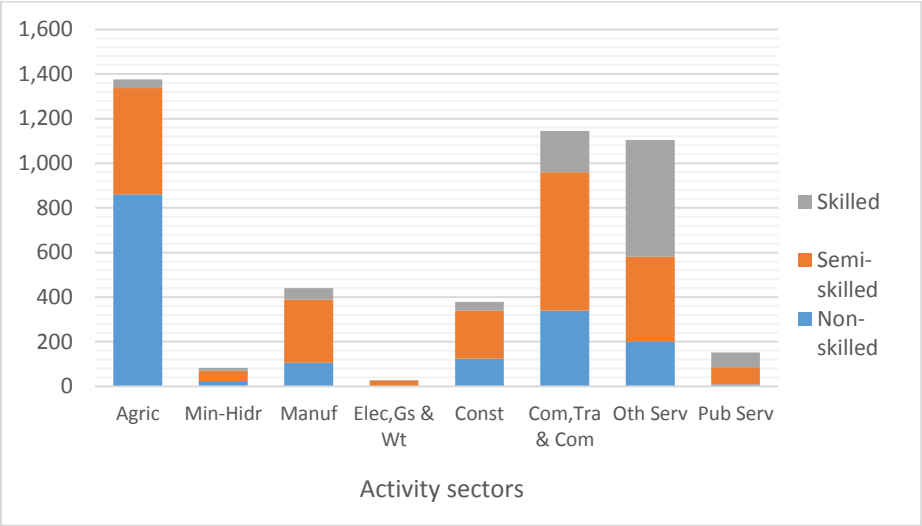


Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Figure 5 shows the employment structure by worker's skill level and sector of activity. The main features presented are:

- The bulk of un-skilled workers, 861 thousand people, work in the agriculture sector, representing 62.6 percent of total workers employed in this sector.
- The largest number of skilled workers (524 thousand people) is employed in other services, comprising, financial services, services to firms, social, communal & personal services.
- The largest number of semiskilled workers are employed in commerce, transport and communication activities (29.2% of total semi-skilled workers), followed by the agricultural sector (22.5%), other services (18.0%), manufacturing (13.3%), and construction (10.1%).

Figure 5
Employment structure by worker's skill level and sector of activity
(thousands of workers)

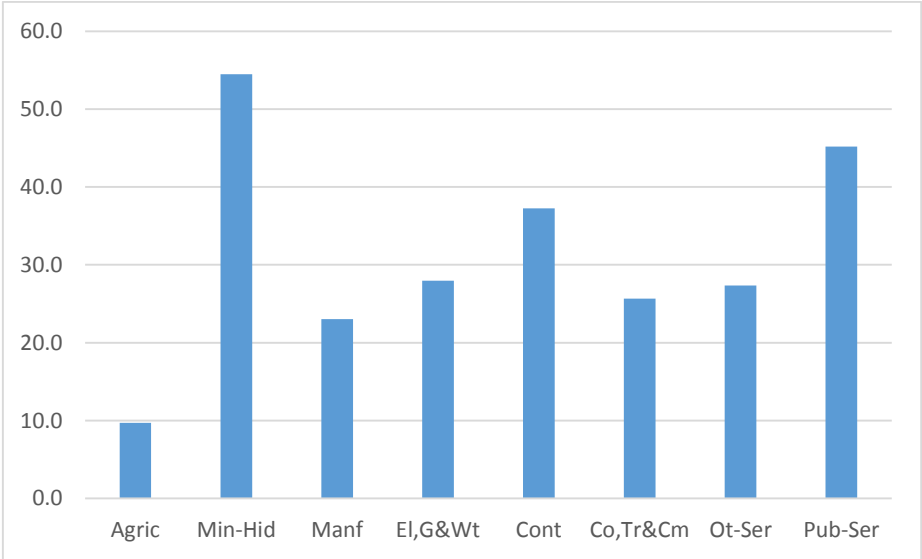


Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Table 9, on the other hand, presents the estimated average annual incomes, for each of the labor categories included in the 2012 SAM, by sector of activity, estimated using the methodology described above.

Figure 6 shows the average annual labor incomes for different activity sectors. The activity sector where workers earn the lowest average income is agriculture, while the sector where workers earn the highest income is mining & hydrocarbons. Average income per worker in the mining-hydrocarbons sector is 5.6 times greater than that in the agricultural sector. Average income per worker in the public sector is also high (4.7 greater than in agriculture).

Figure 6
Average yearly incomes by sector of activity
(thousands of Bolivianos)



Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Table 9 – Average annual labor income estimated for each of the labor categories, by sector (thousands of Bolivianos)

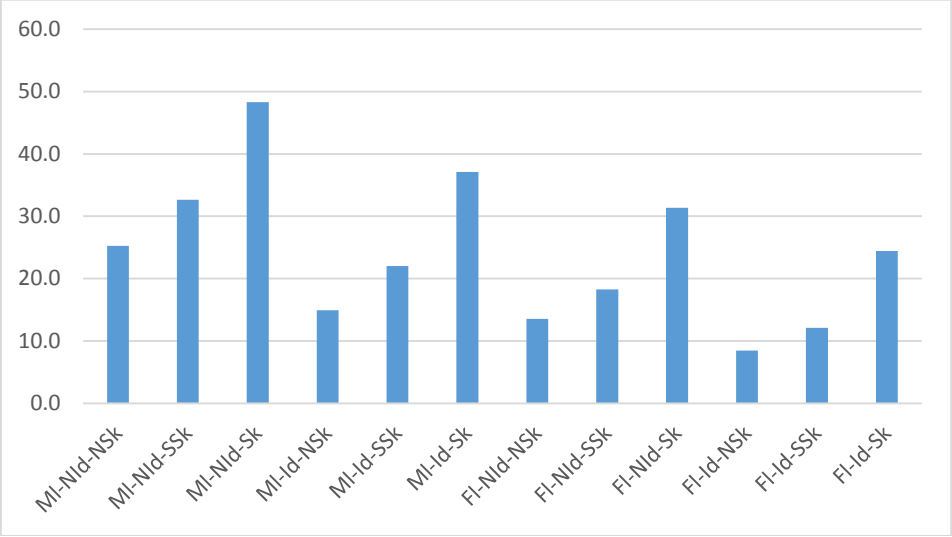
			Agriculture	Mining-hydrocarbons	Manufacturing	Electricity, gas & water	Construction	Commerce, transport & communication	other services	Public administration	Total
Male workers	Non-indigenous	Non-skilled	14.2	54.4	26.6	37.8	37.8	31.6	27.5	39.5	25.3
		Semi-skilled	15.8	60.0	29.2	41.6	42.2	32.8	30.5	48.2	32.6
		Skilled	30.5	91.6	38.6	58.4	59.0	44.3	47.4	59.1	48.3
	Indigenous	Non-skilled	8.6	43.1	20.8	28.4	28.7	24.6	21.6	30.3	14.9
		Semi-skilled	10.7	47.4	22.9	32.2	31.8	25.7	24.2	38.2	22.0
		Skilled	17.3	72.0	30.0	46.3	46.6	35.9	37.0	48.1	37.1
Female workers	Non-indigenous	Non-skilled	8.9	37.1	15.1	25.4	23.0	17.1	13.2	25.4	13.5
		Semi-skilled	9.3	44.0	16.8	22.1	26.8	19.2	18.7	28.4	18.3
		Skilled	17.4	62.8	25.0	39.0	39.3	28.0	32.0	39.5	31.4
	Indigenous	Non-skilled	5.6	29.0	10.8	20.0	17.8	13.3	10.4	19.8	8.4
		Semi-skilled	6.6	32.9	12.5	18.9	20.4	15.0	14.2	22.4	12.1
		Skilled	11.2	49.8	19.3	31.7	31.7	22.4	25.4	32.2	24.4
Total			9.7	54.5	23.0	27.9	37.2	25.6	27.4	45.2	23.2

Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Figure 7 presents average incomes per worker for the different worker categories included in the 2012 SAM. Independently of their skill level, female-indigenous (Fl-Id) workers are the lowest paid, followed by female non-indigenous (Fl-NId) and male-indigenous workers (Ml-Id). The highest paid are male-non indigenous workers (Ml-NId).

The lowest average labor income are received by indigenous-non-skilled female workers (Fl-Id-Nsk), while the highest average income is earned by non-indigenous-skilled male workers (Ml-NId-Sk), the latter being 5.7 times greater than the former.

Figure 7
Average annual incomes by labor category
(thousands of Bolivianos)



Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Based both on the distribution of workers across activity sectors and labor categories and on the imputed incomes per worker explained above, labor factor income shares were calculated and utilized in the construction of the labor income distribution matrix of the 2012 Bolivian SAM (Table 10).

Households' income and expenditure accounts

Households within the 2012 Bolivian SAM were grouped according to four criteria:

- Region (highlands, valleys and lowlands)
- Location (urban and rural)
- Gender of household's head (male and female)
- Ethnicity of household's head (indigenous and non-indigenous)
- Quintile of income (5 quintiles)

The combination of all these criteria renders a total of 120 household categories, for which total incomes, expenditures and savings had to be estimated. This section describes in some detail the process of constructing households' accounts, including labor incomes, non-labor incomes, expenditure structures, and savings for each of the 120 household categories included in the SAM.

Table 10 – Factor income shares per activity sector and labor category (percent)

			Agriculture	Mining-hydrocarbons	Manufacturing	Electricity, gas & water	Construction	Commerce, transport & communication	other services	Public administration	Total
Male workers	Non-indigenous	Non-skilled	15.2	7.7	7.3	2.8	15.1	9.3	1.8	1.4	7.9
		Semi-skilled	12.7	23.2	33.7	12.9	34.7	25.9	8.6	33.5	21.6
		Skilled	3.2	16.3	9.5	17.2	10.3	12.0	27.7	26.0	15.9
	Indigenous	Non-skilled	22.6	13.8	5.3	1.6	12.6	5.7	1.0	0.9	7.3
		Semi-skilled	17.8	25.8	17.9	5.3	20.7	12.0	3.1	10.7	12.4
		Skilled	1.9	5.1	2.9	4.5	3.4	3.3	9.4	10.8	5.3
Female workers	Non-indigenous	Non-skilled	5.5	0.8	3.3	0.9	0.4	4.9	4.0	0.7	3.5
		Semi-skilled	2.8	1.7	8.5	34.4	0.7	10.6	11.1	3.1	7.7
		Skilled	0.6	2.4	3.1	2.7	0.9	5.8	20.8	8.9	8.5
	Indigenous	Non-skilled	12.1	1.3	3.2	0.7	0.5	4.6	2.6	0.4	3.9
		Semi-skilled	5.3	1.2	4.3	16.5	0.4	4.6	3.7	1.0	3.6
		Skilled	0.5	0.5	0.8	0.5	0.2	1.4	6.3	2.3	2.4
Total			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

4.2.1 Households' labor income accounts

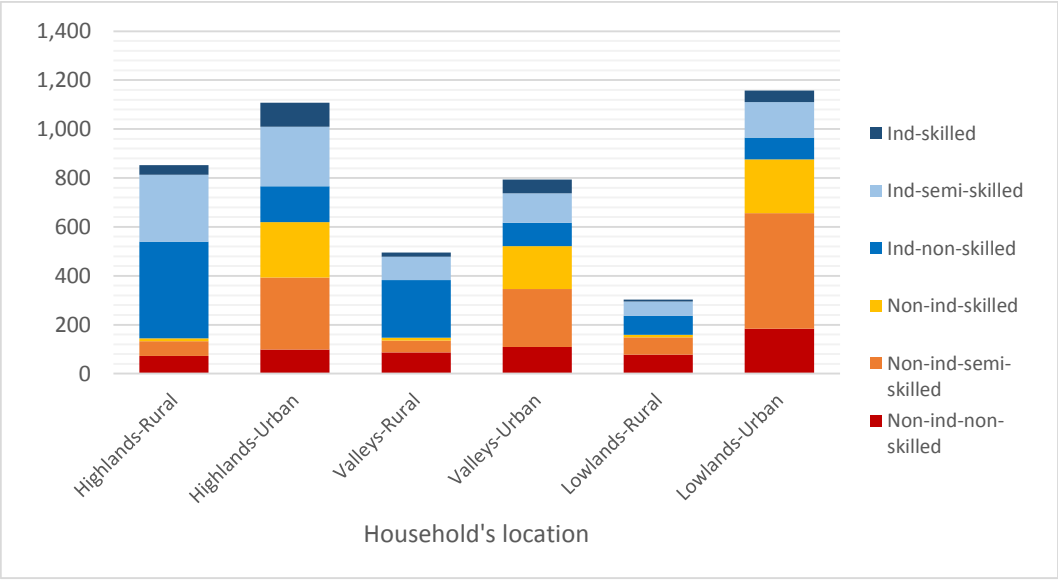
Building the households' labor income matrix entailed the allocation of individual workers' incomes, calculated in the previous section, to each of the households' categories included in the SAM. For this purpose, the following steps were taken:

First, a matrix allocating individual workers to each of the household categories was built using the data base of the National Census. The matrix comprised 12 columns, one for each of the labor categories identified in section 4.3, and 120 rows, one for each of the household categories. Table 11 shows the distribution of workers, by worker category, across household categories grouped based on location of the household and determined characteristics of the household head.

Figure 8 shows the distribution of workers across households grouped by two location criteria: first, by the region they are situated, i.e. highlands, valleys or lowlands, and second, by the area of location, i.e. urban or rural.

- Most workers belong to households located in the urban areas in the highlands, valleys and lowlands, evidencing the increasing urbanization of the Bolivian population and Bolivian labor force.
- There are much more workers belonging to rural households in the highlands compared to workers belonging to rural households in the lowlands, because the agriculture technologies prevalent in the highlands are more labor intensive, while those predominant in the lowlands are more capital intensive.
- There is a large concentration of workers of indigenous origin in households located in the highlands, both urban and rural, and rural households in the valleys. The share of indigenous workers in households located in the lowlands tends to be much smaller.

Figure 8
Distribution of workers across household categories, grouped by location of households (thousands of workers)



Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Table 11 – Distribution of workers across household categories used in the 2012 SAM

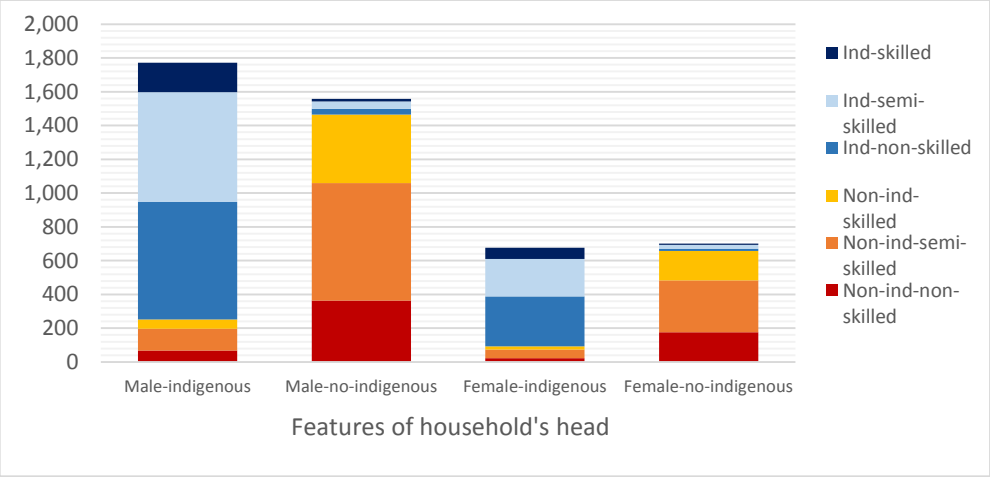
					Total (thousands of workers)	Male workers (%)						Female workers (%)						Total (%)
						Non-indigenous			Indigenous			Non-indigenous			Indigenous			
	Location		Household head			Non-skilled	Semi-skilled	Skilled	Non-skilled	Semi-skilled	Skilled	Non-skilled	Semi-skilled	Skilled	Non-skilled	Semi-skilled	Skilled	
Households	Highlands	Rural	Male	Indigenous	**536.1**	1.14	0.94	0.50	32.23	25.08	14.65	3.04	1.22	0.37	20.20	15.70	5.60	11.38
				Non-Indigenous	**90.5**	8.07	3.60	1.36	0.35	0.49	0.19	3.60	1.39	0.37	1.10	0.93	0.37	1.92
			Female	Indigenous	**188.2**	0.61	0.39	0.11	3.26	3.76	1.71	0.63	0.37	0.10	18.71	11.27	5.32	4.00
				Non-Indigenous	**37.1**	0.76	0.48	0.14	0.26	0.29	0.13	5.49	1.66	0.61	0.22	0.28	0.09	0.79
		Urban	Male	Indigenous	**367.8**	1.17	2.27	2.30	9.49	20.18	29.68	2.76	3.88	3.28	5.94	11.27	14.40	7.81
				Non-Indigenous	**375.7**	8.89	16.01	25.87	0.22	0.63	1.14	6.05	10.54	15.40	1.12	2.48	3.85	7.98
			Female	Indigenous	**179.6**	0.76	1.52	1.25	1.12	3.24	4.31	0.73	1.68	1.25	10.15	13.78	18.26	3.81
				Non-Indigenous	**184**	1.46	3.35	5.02	0.22	0.67	1.20	10.14	11.50	14.48	0.28	0.68	1.01	3.91
	Valleys	Rural	Male	Indigenous	**269.6**	1.08	0.68	0.50	22.33	8.67	5.33	1.71	0.57	0.34	9.87	5.02	3.21	5.72
				Non-Indigenous	**98.1**	12.08	2.96	1.28	0.30	0.26	0.13	5.00	1.44	0.64	0.60	0.37	0.28	2.08
			Female	Indigenous	**91.6**	0.56	0.22	0.08	2.72	1.72	0.82	0.31	0.15	0.07	8.86	3.78	2.75	1.94
				Non-Indigenous	**36.3**	1.73	0.65	0.22	0.22	0.15	0.13	5.04	1.15	0.68	0.10	0.12	0.09	0.77
		Urban	Male	Indigenous	**214.2**	1.32	1.70	1.80	6.98	9.55	15.54	1.99	2.27	2.44	3.59	5.64	10.09	4.55
				Non-Indigenous	**321**	11.38	13.35	19.16	0.19	0.47	0.89	7.10	8.89	13.23	0.70	1.39	2.57	6.82
			Female	Indigenous	**99.8**	0.73	0.96	0.75	1.10	1.95	2.73	0.52	0.85	0.74	5.29	6.29	10.09	2.12
				Non-Indigenous	**159.2**	2.57	3.57	4.30	0.22	0.44	0.82	9.37	8.74	11.44	0.18	0.43	0.73	3.38
	Lowlands	Rural	Male	Indigenous	**136.9**	1.76	1.36	0.42	8.47	6.02	2.92	1.12	0.63	0.24	3.03	2.76	1.47	2.91
				Non-Indigenous	**114.5**	12.35	4.99	1.28	0.34	0.36	0.13	4.34	2.11	0.61	0.36	0.37	0.18	2.43
			Female	Indigenous	**25.2**	0.35	0.21	0.06	0.84	0.73	0.25	0.10	0.11	0.03	1.42	1.21	1.01	0.54
				Non-Indigenous	**26.7**	1.49	0.79	0.17	0.15	0.13	0.06	2.38	1.05	0.51	0.04	0.09	0.09	0.57
		Urban	Male	Indigenous	**248.4**	1.99	3.05	2.28	7.11	11.41	13.63	2.83	3.79	2.64	3.47	6.88	7.98	5.27
				Non-Indigenous	**558.7**	21.36	27.62	24.99	0.35	0.85	0.82	12.42	18.82	17.02	0.96	2.23	2.48	11.86
			Female	Indigenous	**92.7**	0.97	1.30	0.67	1.12	2.18	2.03	0.56	1.09	0.61	3.63	6.35	7.25	1.97
				Non-Indigenous	**257.7**	5.44	8.10	5.55	0.37	0.76	0.76	12.77	16.10	12.96	0.20	0.62	0.64	5.47
Total (thousands of workers)					**4,709.60**	**341.80**	**725.60**	**360.20**	**536.10**	**614.50**	**157.70**	**285.90**	**459.00**	**295.50**	**501.40**	**322.90**	**109.00**	**100.00**

Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Figure 9 presents the distribution of workers across household categories grouped by some characteristics of the household head.

- There are far more households with male head than with female head.
- Workers with indigenous origin tend to belong to households with indigenous head, while workers with non-indigenous origin belong to households with non-indigenous head.
- There is a much larger concentration of skilled workers in households with non-indigenous head, either male or female, while there is a much larger concentration of non-skilled workers in households with indigenous head.

Figure 9
Distribution of workers across household categories, grouped by determined features of the household head (thousands of workers)



Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Finally, Figure 10 presents the distribution of workers to households grouped based on the income quintile they belong to.

- The number of workers tends to increase when we move from households in the lower quintiles to households in the upper quintiles. This pattern shows that there are more members participating in the labor market in the wealthier households compared to the poorer households.
- There is a much larger concentration of indigenous workers in households belonging to the lowest quintiles, while non-indigenous workers mostly belong to households in the upper quintiles.
- The largest share of indigenous skilled workers belongs to the upmost quintile, evidencing that education can indeed produce social mobility in Bolivia. In fact, the bulk of skilled workers, both of indigenous and non-indigenous origin, belong to households in the upmost income quintiles.

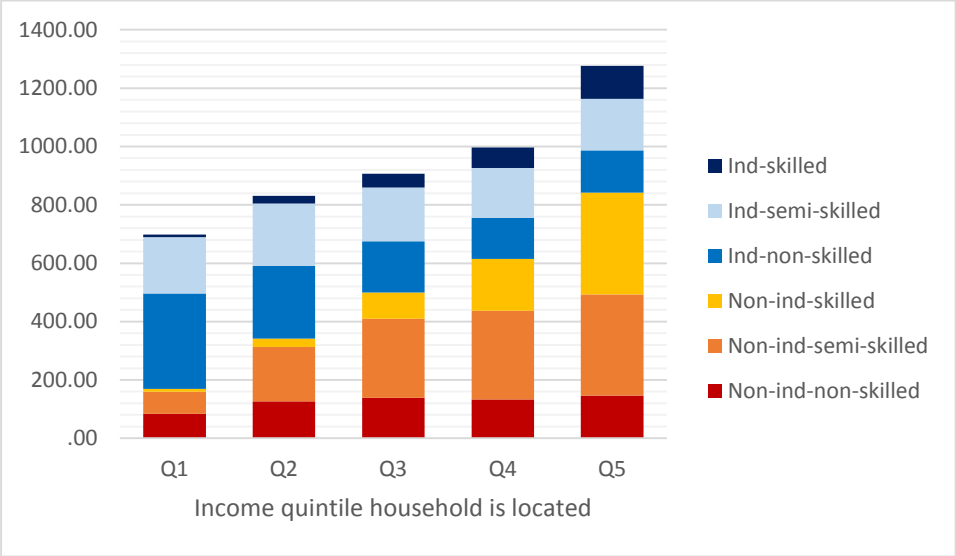
Once individual workers were allocated to each of the 120 household categories, average labor incomes by household category were easily calculated. Table 12 present the average income matrix for all worker and household categories included in the 2012 Bolivian SAM.

Table 12 – Yearly average labor income by workers and by household categories (thousands of Bolivianos)

					Male workers						Female workers						Total
					Non-indigenous			Indigenous			Non-indigenous			Indigenous			
	Location		Household head		Non-skilled	Semi-skilled	Skilled	Non-skilled	Semi-skilled	Skilled	Non-skilled	Semi-skilled	Skilled	Non-skilled	Semi-skilled	Skilled	
Households	Highlands	Rural	Male	Indigenous	15.0	19.7	39.0	9.8	14.4	25.4	8.6	9.9	21.2	5.7	6.9	16.4	11.1
				No-Indigenous	15.0	19.8	32.7	10.6	14.7	25.5	8.8	9.8	19.4	5.9	7.4	16.1	15.4
			Female	Indigenous	14.2	17.7	31.7	9.8	13.5	24.2	8.6	9.7	18.9	5.9	7.3	16.4	8.5
				No-Indigenous	14.6	18.0	32.0	10.3	14.3	25.1	9.2	10.4	19.8	6.1	7.1	16.5	11.7
		Urban	Male	Indigenous	24.5	28.0	41.7	22.5	25.0	35.3	12.5	16.0	26.1	10.5	13.1	22.3	23.3
				No-Indigenous	26.7	29.0	41.1	21.0	24.2	34.8	12.7	16.1	26.3	10.2	13.0	22.2	28.3
			Female	Indigenous	25.0	28.1	40.3	21.2	24.2	34.8	12.1	16.2	25.9	10.8	13.2	22.1	17.9
				No-Indigenous	25.6	28.3	40.6	21.9	24.8	34.7	13.1	16.2	26.3	9.3	12.7	22.3	22.7
	Valleys	Rural	Male	Indigenous	17.4	23.0	42.1	10.7	15.8	31.8	9.6	11.3	25.0	6.6	8.6	20.8	12.2
				No-Indigenous	16.5	21.0	35.7	11.4	15.6	29.3	9.8	11.0	23.8	7.1	9.1	20.7	16.8
			Female	Indigenous	16.2	20.8	36.1	10.8	15.3	30.6	9.5	10.9	22.5	7.0	9.2	20.5	10.2
				No-Indigenous	16.7	21.0	34.4	11.1	16.1	30.3	10.3	11.6	24.1	7.0	9.0	19.8	14.4
		Urban	Male	Indigenous	28.5	31.7	49.7	24.9	27.9	41.8	14.9	18.3	31.6	12.4	15.4	26.9	26.7
				No-Indigenous	30.5	32.6	48.5	24.4	27.1	41.6	15.1	18.4	31.6	12.3	14.9	26.8	32.2
			Female	Indigenous	29.8	32.1	48.1	24.8	27.5	41.2	14.5	18.4	31.1	12.7	15.4	26.6	21.9
				No-Indigenous	30.4	32.4	48.2	25.0	28.0	41.5	15.4	18.5	31.5	11.5	14.4	26.6	26.9
	Lowlands	Rural	Male	Indigenous	18.6	23.8	46.1	14.5	18.0	36.0	10.8	13.3	29.1	9.3	12.2	24.8	16.7
				No-Indigenous	16.7	20.7	40.7	14.6	17.7	32.9	10.4	12.8	28.3	9.4	12.3	24.4	17.9
			Female	Indigenous	17.7	22.8	38.7	14.8	18.5	35.3	11.2	13.6	26.9	9.7	12.6	24.9	15.2
				No-Indigenous	17.3	21.9	40.7	14.3	18.1	36.0	10.9	13.5	28.7	9.9	12.5	24.0	17.0
		Urban	Male	Indigenous	33.5	39.3	59.6	29.1	34.0	49.6	17.2	21.7	37.4	14.9	18.4	32.3	31.8
				No-Indigenous	34.8	40.1	57.4	28.7	33.7	48.5	17.1	21.6	37.5	14.3	17.6	31.8	37.0
			Female	Indigenous	34.4	39.6	56.8	29.1	34.0	48.9	16.7	21.9	36.8	15.2	18.5	32.0	27.2
				No-Indigenous	35.2	40.2	57.1	29.5	34.2	48.8	17.5	21.8	37.5	13.3	17.4	31.3	31.8
Total					25.3	32.6	48.3	14.9	22.0	37.1	13.5	18.3	31.4	8.4	12.1	24.4	23.2

Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Figure 10
Distribution of workers across household categories, grouped by household income quintile (thousands of workers)

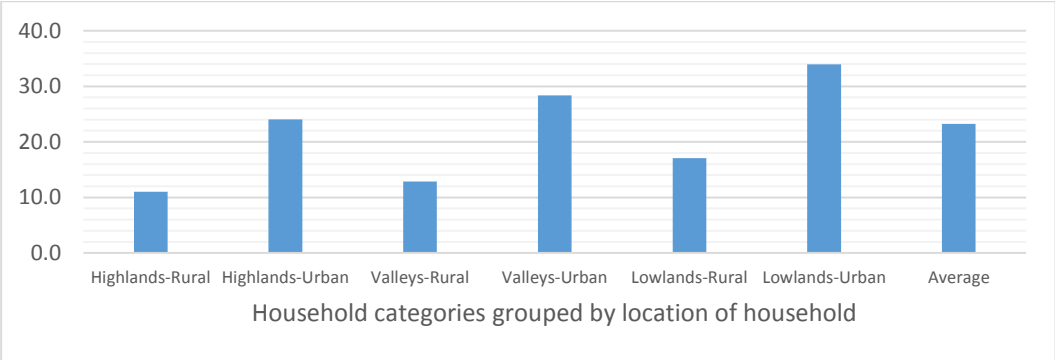


Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

There are significant differences in average annual labor incomes for different household categories. Figure 11 shows the following patterns:

- Average labor incomes for workers in rural households are lower than those of urban households.
- Average labor incomes for households located in the lowlands are higher than those for households in the highlands.

Figure 11
Yearly average labor incomes per household categories grouped by location of household (thousands of Bolivianos)

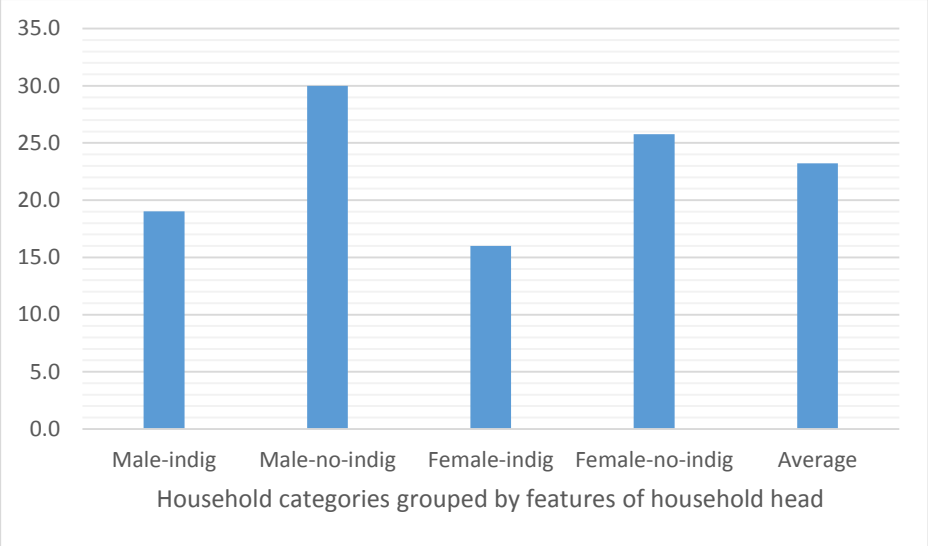


Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Figure 12 shows that:

- Average labor income for male headed households is higher than average labor income of female headed households.
- Average labor income of indigenous headed households is lower than that of non-indigenous headed households.

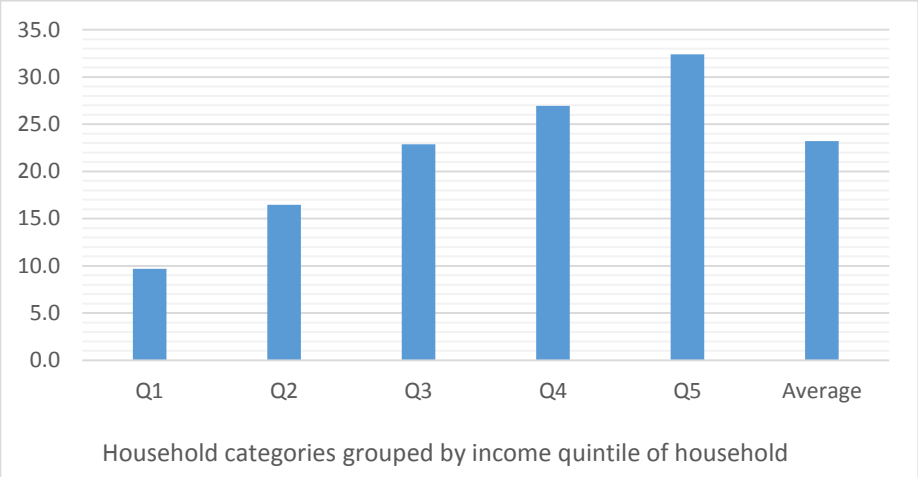
Figure 12
Yearly average labor incomes per household categories grouped by determined features of the household head (thousands of Bolivianos)



Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

Finally, Figure 13 shows that average labor income of households in the fifth income quintile is 3 times higher than that of households in the first income quintile.

Figure 13
Yearly average labor incomes per household categories grouped by income quintile of household (thousands of Bolivianos)



Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

4.2.2 **Households' labor and non-labor incomes**

Based on a worker's per household matrix and on the individual labor incomes imputed to workers using the estimated Mincer function, a labor income matrix for all household categories was built. However, households in Bolivia not only receive labor incomes, but also other non-labor incomes, such as government cash transfers made by the government to different sectors of the population, e.g. elder people, pregnant women, and school boys. Besides, the government also pays pensions to retirees affiliated to the pension system. Finally, households also receive remittances from abroad, sent by relatives living and working overseas.

Table 13 presents all income types received by the different household categories, both labor and non-labor incomes. It also presents the number of households in each household category and the average total income per household type.

Table 13 – Total and average yearly incomes received by household categories

	Location		Household head		Labor income	Non-labor income			Total income	Number of households (thousands)	Average household income (thousands of Bolivianos)
						Government cash transfers	Pension payments	Remittances			
					(Millions of Bolivianos)						
Households	Highlands	Rural	Male	Indigenous	5,943.3	287.5	0.0	178.3	6,409.0	288.5	22.2
				No-Indigenous	1,397.5	49.0	0.0	31.5	1,477.9	54.0	27.4
			Female	Indigenous	1,593.8	165.1	0.0	147.2	1,906.2	142.1	13.4
				No-Indigenous	436.2	30.4	0.0	28.5	495.1	29.1	17.0
		Urban	Male	Indigenous	8,583.5	120.7	522.0	201.1	9,427.2	209.3	45.1
				No-Indigenous	10,642.2	163.3	706.3	196.8	11,708.7	229.6	51.0
			Female	Indigenous	3,224.5	92.9	401.9	231.0	3,950.4	142.5	27.7
				No-Indigenous	4,178.0	115.3	498.9	230.7	5,022.9	142.9	35.1
	Valleys	Rural	Male	Indigenous	3,282.5	121.8	0.0	373.0	3,777.2	147.0	25.7
				No-Indigenous	1,644.6	46.5	0.0	142.7	1,833.9	55.7	32.9
			Female	Indigenous	936.6	70.8	0.0	309.4	1,316.8	72.7	18.1
				No-Indigenous	520.8	27.8	0.0	126.0	674.6	27.7	24.3
		Urban	Male	Indigenous	5,728.6	69.6	301.1	596.1	6,695.5	108.8	61.5
				No-Indigenous	10,325.8	139.4	603.0	936.9	12,005.2	186.6	64.3
			Female	Indigenous	2,186.8	54.4	235.1	687.1	3,163.5	72.2	43.8
				No-Indigenous	4,283.4	98.9	427.7	1,036.3	5,846.3	115.6	50.6
	Lowlands	Rural	Male	Indigenous	2,286.6	39.6	0.0	40.5	2,366.8	59.7	39.6
				No-Indigenous	2,055.1	38.9	0.0	41.8	2,135.8	58.6	36.5
			Female	Indigenous	383.3	12.7	0.0	21.6	417.5	16.7	25.0
				No-Indigenous	455.1	14.2	0.0	24.1	493.4	17.3	28.6
		Urban	Male	Indigenous	7,903.5	63.1	273.1	207.6	8,447.3	106.9	79.0
				No-Indigenous	20,681.7	176.5	763.2	637.6	22,258.9	292.3	76.2
			Female	Indigenous	2,517.2	36.1	156.0	184.8	2,894.0	53.1	54.5
				No-Indigenous	8,191.4	112.4	486.0	615.1	9,404.9	155.1	60.6
Total					109,382.0	2,146.9	5,374.4	7,225.8	124,128.9	2,784.0	44.6

Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

4.2.3 Households' expenditures and savings

Households' expenditure structure was estimated based on data processed from the 2012 household survey. It contains fairly disaggregated data on consumption for each household. The structures of households' consumption included in the SAM were estimated based on the following process:

- Using the household survey data base, households were grouped according to the categories defined in the 2012 Bolivian SAM.
- An average expenditure structure was calculated for each of the household categories included in the SAM.
- Those structures were expanded based on the number of households per household category, calculated from the National Census.
- The resulting values were adjusted to the levels of private consumption provided by the I-O Table and National Accounts.

Table 14 presents the main results obtained by applying this methodology. There are disparities in the average consumption per household for the different household categories included in the SAM. The largest disparities appear when households are grouped according to their location.

Table 14 – Total and average yearly consumption by household categories

Household categories	Consumption (millions of Bs.)	Number of households (thousands)	Average consumption per household (thousands Bs.)
Location of household			
Highlands rural	9,697.80	513.7	18.9
Highlands urban	27,313.80	724.4	37.7
Valleys rural	7,409.40	303.2	24.4
Valleys urban	26,015.00	483.2	53.8
Lowlands rural	5,152.40	152.3	33.8
Lowlands urban	38,705.20	607.3	63.7
Total	114,293.60	2,784.00	41.1
Characteristics of household's head			
Male indigenous	35,119.60	920.2	38.2
Male non-indigenous	46,796.40	876.8	53.4
Female indigenous	12,553.50	499.4	25.1
Female non-indigenous	19,824.10	487.7	40.6
Total	114,293.60	2,784.00	41.1
Income quintile			
Q 1	7,036.00	368	19.1
Q 2	14,423.60	450.8	32
Q 3	21,050.00	487	43.2
Q 4	26,486.10	576.5	45.9
Q 5	45,297.90	901.7	50.2
Total	114,293.60	2,784.00	41.1

Source: Own estimates based on data from the 2012 CNPV and 2012 EH.

4.3 Other institutional accounts

For the construction of other institutional accounts included in the 2012 Bolivian SAM, different additional data sources were used.

The government accounts were built based on data provided by the Central Bank and by UDAPE on the general government balance. The figures corresponding to government expenditures and taxes, i.e. value added taxes, sales taxes and import tariffs, were taken from the I-O table. Other government transactions, including transfers to households, interest payments due to the domestic and external public debt, transfers to government from the rest of the world, direct tax payments by enterprises, were taken from the general government balance.

In the case of the rest of the world accounts, the main data source used was the balance of payments published on the Central Bank website. The balance of payment figures, in a first place, had to be converted from American dollars to Bolivianos, using the average exchange rate for 2012. The values corresponding to exports and imports were taken from the I-O table. Other transactions with the rest of the world appearing in the 2012 Bolivian SAM were obtained from the balance of payments, including: transfers from the rest of the world to households (remittances) and to the government (grants), transfers to the rest of the world from government (interest payments), from companies (profit remittances), and finally external savings, which is equal to the current account balance of the balance of payments.

Finally, the accounts for companies were basically estimated as a residual of the other institutional accounts.

5. SAM fixed-price multiplier analysis

The structure of the 2012 Bolivian SAM captures the main features of the Bolivian economy, including its production structure, its income distribution configuration, households' income and expenditure particularities. Thus, the multiplier matrix calculated based on the 2012 Bolivian SAM portrays quite well the expected impacts of a demand or supply shocks on the economy as a whole and on each of the sectors, labor groups and household categories included in the SAM. Annex B discusses the methodology used to calculate the multiplier matrix.

In this section we use the multiplier matrix calculated based on the 2012 Bolivian SAM to analyze the expected effects on sectoral output, and on labor and household incomes, resulting from a shock in the demand for agriculture commodities, i.e. change in exports due to changes in external demand.

Table 15 presents the multipliers of shocks in the demand for agricultural commodities on output produced by different sectors. Each multiplier in Table 15 measures the expected changes in units of output produced by a sector, resulting from one unit change in the export demand for an agricultural commodity. The multiplier measures both the direct and indirect effects.

Non-industrial commodities, i.e. roots, other agriculture products, vegetables, fruits, coca and livestock, have the largest multiplier effects on total output. The largest impact takes place within the non-industrial agricultural sector. Cereals, oilseeds, sugarcane and livestock have smaller multiplier effects.

Table 15 – Output multiplier effects of shocks in the demand for agriculture commodities on output produced by activity sectors

	Commodities									
Activities	**Cereals**	**Vegetables**	**Roots**	**Fruits**	**Other-agric**	**Oilseeds**	**Sugarcane**	**Coca**	**Livestock**	**Forestry**
Non-Industrial agriculture	1.11	1.23	1.26	1.17	1.24	0.10	0.11	1.17	0.25	0.11
Industrial agriculture	0.03	0.04	0.04	0.04	0.04	1.27	1.31	0.04	0.11	0.03
Livestock	0.06	0.07	0.07	0.07	0.07	0.05	0.05	0.08	1.07	0.06
Forestry, fishing & hunting	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	1.00
Agriculture	1.23	1.36	1.40	1.30	1.38	1.44	1.48	1.32	1.45	1.20
Mining & hydrocarbons	0.04	0.05	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.05
Manufacturing	0.60	0.67	0.69	0.64	0.68	0.52	0.54	0.74	0.77	0.59
Electricity,Gas & Water	0.04	0.05	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.04
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comm., transp. & comm.	0.50	0.57	0.57	0.53	0.58	0.54	0.54	0.47	0.53	0.57
Other services	0.35	0.39	0.40	0.37	0.40	0.44	0.45	0.41	0.39	0.35
Public administration	0.04	0.05	0.05	0.04	0.05	0.04	0.04	0.05	0.04	0.04
Total	**2.81**	**3.13**	**3.20**	**2.98**	**3.18**	**3.04**	**3.13**	**3.09**	**3.28**	**2.84**

Source: 2012 Bolivian SAM.

In the case of cereals, the main explanation is the large share of imports in the total supply of this commodity, which causes a leakage in the system. In the case of oilseeds and sugarcane, the main explanation is that both commodities are produced using capital intensive technologies, and thus, capital income has a lower impact on consumption, because it is saved or sent abroad as profit remittances.

Table 16 shows the multiplier effect matrix of demand shocks on labor incomes. The income multipliers are smaller than the output multipliers. As in the case of output, the largest labor income multiplier effects occur in non-industrial commodities. As discussed previously, these commodities are produced in sectors using labor intensive technologies, and thus, an additional unit of output produced in these sectors, will have a large impact on labor income, and thus on consumption demand, causing a much larger multiplier effect on the economy. Conversely, the lowest multiplier effects on labor income are owed to commodities produced in industrial agriculture activities, which is explained by the capital intensive technology used in these sectors.

Table 16 also shows that demand shocks have larger multiplier effects on income earned by non-skilled and semi-skilled male workers, because of the large share of these labor categories employed in non-industrial agriculture activities. For the same reason, the multiplier effects are stronger on the incomes of indigenous non-skilled and indigenous semi-skilled workers.

6. Conclusions

The construction of the 2012 Bolivian SAM described in this paper represented a considerable effort in terms of data processing, especially for the construction of the factor income, household income and household saving-expenditure matrices.

The Bolivian statistical system provides data which is not always complete and consistent for the construction of a disaggregated SAM. For instance, national accounts statistics are quite updated, and there is even an input-output table available for 2012, which was used in the construction of the 2012 Bolivian SAM. However, the I-O Table does not include the third quadrant, describing the composition of sectorial value added by income categories, i.e. wages and salaries, gross operating surplus and net indirect taxes. Thus, this matrix had to be estimated using micro data from the 2012 National Census and from household surveys. On the other hand, detailed data on sectoral gross output value, which is necessary to include more disaggregation in the SAM framework, was only available until 2006. Thus, this data had to be estimated for 2012 using volume and price indexes.

However, the results obtained from this process are quite illustrative, because they provide a much clearer and insightful picture about how income is generated, distributed and spent in the Bolivian economy. The results obtained show the deep income disparities existing among workers and households, depending on certain attributes they possess, such as gender, ethnicity, skill level, area and region of location of households and workers.

The fixed-price multiplier analysis helped in understanding the potential effects of shocks on the different sectors of the economy. The results are consistent with the structure of the Bolivian SAM discussed in this paper.

Table 16 – Income multiplier effects of shocks in the demand for agricultural commodities

Labor categories	Commodities									
	Cereals	Vegetables	Roots	Fruits	Other-agric	Oilseeds	Sugarcane	Coca	Livestock	Forestry
By gender & skill level										
Male non-skilled	0.34	0.34	0.41	0.31	0.23	0.13	0.18	0.45	0.25	0.23
Male semi-skilled	0.35	0.36	0.31	0.39	0.37	0.23	0.27	0.42	0.39	0.38
Male skilled	0.13	0.15	0.15	0.15	0.19	0.18	0.15	0.16	0.16	0.17
Female non-skilled	0.10	0.17	0.19	0.14	0.23	0.05	0.06	0.19	0.15	0.07
Female semi-skilled	0.11	0.14	0.15	0.14	0.16	0.08	0.08	0.17	0.14	0.11
Female skilled	0.06	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07
Total	**1.10**	**1.23**	**1.28**	**1.18**	**1.26**	**0.73**	**0.82**	**1.46**	**1.17**	**1.03**
By ethnicity & skill level										
Indigenous non-skilled	0.30	0.29	0.44	0.27	0.22	0.09	0.11	0.26	0.21	0.15
Indigenous semi-skilled	0.24	0.21	0.21	0.25	0.22	0.11	0.12	0.25	0.22	0.18
Indigenous skilled	0.04	0.05	0.05	0.05	0.06	0.04	0.05	0.06	0.05	0.05
Non-indigenous non-skilled	0.14	0.22	0.17	0.17	0.25	0.10	0.13	0.38	0.19	0.16
Non-indigenous semi-skilled	0.23	0.29	0.25	0.27	0.30	0.21	0.24	0.34	0.31	0.31
Non-indigenous skilled	0.15	0.17	0.16	0.16	0.22	0.20	0.17	0.18	0.18	0.19
Total	**1.10**	**1.23**	**1.28**	**1.18**	**1.26**	**0.73**	**0.82**	**1.46**	**1.17**	**1.03**

Source: 2012 Bolivian SAM.

Annex A – Bolivian 2012 SAM accounts

No.	*40 activities and commodities, activities 1-9 differentiated by agro-ecological regions*	*3 agro-ecological regions*
1	Cereals	Highlands: La Paz, Oruro, Potosi
2	Vegetables	Valleys: Cochabamba, Chucisaca, Tarija
3	Root crops	Lowlands: Santa Cruz, Beni, Pando
4	Fruits	
5	Other non-industrial agriculture	
6	Soybeans	
7	Sugarcane	
8	Coca	*16 factors of production*
9	Livestock	12 types of labor differentiated by:
10	Forestry & fishing	> male/female (m/f) and
11	Hydrocarbons	> non-indigenous and indigenous (nid/id)
12	Mining	and 3 skill categories
13	Meat processing	> non-skilled (ns)
14	Dairy products	> semi-skilled (ss)
15	Bakery	> skilled (sk)
16	Sugar & confectionary	1 type of capital
17	Other food processing	3 types of land differentiated by agro-ecological
18	Beverages	regions
19	Tobacco	
20	Textiles	
21	Wood processing	
22	Paper	
23	Chemical products	*120 households*
24	Refined oil procducts	differentiated by:
25	Non-metallic mineral products	location
26	Basic metal products	> 1: Highlands
27	Machinery	> 2: Valleys
28	Other manufaturing products	> 3: Lowlands
29	Electricity, gas, & water	region
30	Construction	> Rural (r)
31	Commerce	> Urban (u)
32	Transportation	gender
33	Communication	> Male (m)
34	Financial services	> Female (f)
35	Other services	ethnicity
36	Real estate	> non-indiginous (nid)/
37	Social services	> indiginous (id)
38	Restaurants & hotels	income quintile
39	Domestic services	> 01-05
40	Public administration	

Annex B – Fixed-price multiplier analysis

The table below represents a schematic version of the SAM presented in Table 1.

Schematic SAM

	Act	Comm	Factors	Hholds	Enterp	Taxes	Gover	S-I	RoW	Total
Act		X								X
Comm	A			C			G	I	E	TD
Factors	Y									Y
Hholds			Yl		DP		Tr		Rm	Yh
Enterp			Yk							Yc
Taxes	Ta	Ts			Ty					T
Gover						T			Gr	Yg
S-I				Sh	Sc		Sg		Se	S
Row		M			Rc		Rg			PtA
Total	X	TS	Y	Yh	Yc	T	Yg	I	PfA	

where:

A: intermediate consumption
Y: factor income
Ta: activity taxes
X: total output
Ts: sale and import taxes
M: imports
TS: total supply
Yl: labor income
Yk: profits
C: household consumption
Sh: household savings
Yh: Households' income
DP: distributed profits
Ty: income taxes paid by companies
Sc: savings by companies
Rc: profit remittances abroad
Yc: income by companies
T: total taxes
G: government consumption
Tr: government cash transfers to households
Sg: government savings
Rg: interest payments abroad
Yg: government income
I: investment demand
E: exports
Rm: remittances received by households
Gr: RoW transfers to government
Se: external savings
PfA: total payments from abroad
PtA: total payments to abroad
TD: total demand

Expressing the schematic SAM in matrix equation format:

$$\begin{bmatrix} 0 & x & 0 & 0 & 0 & 0 \\ a & 0 & 0 & c & 0 & 0 \\ y & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & yl & 0 & dp & 0 \\ 0 & 0 & yk & 0 & 0 & 0 \\ ta & ts & 0 & 0 & ty & 0 \end{bmatrix} \mathbf{x} \begin{bmatrix} X \\ TS \\ Y \\ Yh \\ Yc \\ T \end{bmatrix} \mathbf{+} \begin{bmatrix} 0 \\ G + I + E \\ 0 \\ Tr + Rm \\ 0 \\ 0 \end{bmatrix} \mathbf{=} \begin{bmatrix} X \\ TS \\ Y \\ Yh \\ Yc \\ T \end{bmatrix}$$

Where:

a = Ai/X (input-output technical coefficients)

y= Y/X (income to output coefficients)

ta= Ta/X (activity to output coefficients)

x= X/TS (output to total supply coefficients)

ts= Ts/TS (sale-import taxes to total supply coefficients)

yl= Yl/Y (labor income to total income coefficients)

yk= Yk/Y (profit incomes to total income coefficients)

c= C/Yh (consumption to household income coefficients)

dp= DP/Yc (distributed profits to companies' income coefficient)

ty= Ty/Yc (direct taxes to companies' income coefficients)

Solving the system for X, TS, Y, Yh, Yc and TS, we obtain:

$$\begin{bmatrix} X \\ TS \\ Y \\ Yh \\ Yc \\ T \end{bmatrix} = \begin{bmatrix} 1 & -x & 0 & 0 & 0 & 0 \\ -a & 1 & 0 & -c & 0 & 0 \\ -y & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & -yl & 1 & -dp & 0 \\ 0 & 0 & -yk & 0 & 1 & 0 \\ -ta & -ts & 0 & 0 & -ty & 1 \end{bmatrix}^{-1} \mathbf{x} \begin{bmatrix} 0 \\ G + I + E \\ 0 \\ Tr + Rm \\ 0 \\ 0 \end{bmatrix}$$

The resulting inverse matrix represents a multiplier matrix, which measures the impacts of changes in final demand, comprising government consumption (G), investment (I) and exports (E), or in transfers to households, both from government (Tr) or from abroad (RM), on total output (X), total supply (TS), total income (Y), household incomes (Yh), companies incomes (Yc) and tax collection (TS).

By adding-up the multiplier coefficients vertically in the inverse matrix, we obtain the production and consumption linkages of a determined activity sector with the rest of the economy. For instance, we can calculate the impact of an increase in exports of a determined commodity, both, on each sector's output and on total output. The impacts capture both, the direct and indirect impacts. Likewise, we can calculate the impact of the increased export on incomes for each labor category included in the SAM, as well as on total labor income.

According to Breisinger et al. (2010), production linkages are determined by sectors' production technologies, which are contained in the input-output part of SAM. They are differentiated into backward and forward linkages. Consumption linkages on the other hand, depend on various factors, including the share of factor income distributed to households; the composition of the consumption basket; and the share of domestically supplied goods in consumer demand.

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