INTER-SECTORAL LINKAGES IN THE ETHIOPIAN ECONOMY: A SOCIAL ACCOUNTING MATRIX (SAM) APPROACH

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Abstract[*]

The objective of this paper is to provide empirical evidence regarding the magnitude of economic linkages in Ethiopia. To this end, the Social Accounting Matrix (SAM)-based multiplier analysis in the context of the Ethiopian economy is used.

This paper indicates that the indirect effects enhance the interdependence of the Ethiopian economy. When general equilibrium effects are taken into consideration, agriculture is found to be superior, through income and consumption linkages, in terms of stimulating economic growth in the country. Of the industrial sub-sectors, food processing, metals, beverages, and textiles have strong linkages with the rest of the economy. With regard to the direct or transfer effect, rural households have greater transfer effect than urban households. It is also indicated that rural households spend a larger proportion of their additional income on the products of teff, followed by beverages and metals while urban households spend a significant amount of their additional income on the products of metals, followed by teff.

Moreover, it appears that the own-indirect effects of the rural households are not only significantly large but also by far greater than urban indirect effects. Hence, rural households benefit more from the own- indirect effects. More specifically, the own-indirect effects of teff, metals, and beverages are found to be substantial as compared to other sectors.

The implication of the findings of this paper is that policies directed towards the expansion of the rural sector and of selected manufacturing activities would generate substantial income for the rural society as well as the urban households alike.

1. INTRODUCTION

Conventionally, the effects of macroeconomic adjustment and subsequent policy design have been measured in terms of the behaviour of key macroeconomic variables as current account deficit, inflation, GDP, employment, etc. These variables, however, hide a multitude of changes since the various sectors of the economy react in quite different ways to policy-induced or any exogenous changes so that the macroeconomic average can hide large shifts. In order to improve the living standard of the population and attain development through well-designed strategies, the inclusion of distributional variables during the process of policy design, together with other macroeconomic variables, is crucial. Thus, an in-depth treatment of the real interaction among production activities, factors of production and decision-making units is of a paramount importance for the short-term analysis of demand management and policy design. This is so because it is only through the understanding of the microeconomic behaviours of the different social institutions that a proper picture of the functioning of the economy as a whole could be obtained. As such, the analysis of these types of interconnections among sectors and institutions, such as the effects of exogenous changes on the economy, requires the specification of an economic model. However, the country has no such comprehensive analytical model, which takes into account the interdependence of the various sectors of the economy. In other words, the interactions of the different sectors of the economy have not been measured in the country to date. The real interactions among macroeconomic policies, sectoral outputs, and institutional incomes can be captured by a Social Accounting Matrix (SAM)-based multiplier analysis. This is obviously essential for informed decision-making in the country. In line with this, a number of studies have been undertaken to measure the magnitude of intersectoral linkages in different countries (Keuning and Thorbecke 1992; Dorosh and Haggblade 1993; Kone and Thorbecke 1996; Pradhan and Sahoo 1996; Hassan 1994). In the Ethiopian case, Taye (1991) applied SAM-based multiplier analysis to three Ethiopian villages with the objective of measuring the extent of economic linkages and the impact of government policies on the study areas. Indeed, this is the only type of its kind in Ethiopia to date though it is limited to village level. The author failed to decompose the village level SAM-multiplier into separate effects, that is, direct and indirect effects. The decomposition is important to see the relative strength of direct and indirect multiplier effects in the three villages.

The main objective of the study is, therefore, to measure the size and the magnitude of inter sectoral linkages and to decompose these linkages into separate effects in the Ethiopian economy.

This study is structured in the following way: Section two deals with description of the theoretical SAM; chapter three discusses empirical results, and Section four presents conclusions and policy implications.

2. DESCRIPTION OF THE THEORETICAL SAM

To begin with, social accounting matrix is a data system that is consistent and complete on transactions among sectors and institutions. It is consistent because for every receipt there is a corresponding outlay and complete since both the receiver and the sender of each and every transaction are clearly identified (Sadoulet & Janvry 1995). Hence, SAM is a socio-economic information system, which describes all transactions that occur in an economy at a point in time. As summarized in Vandemoortele (1987), SAM consists of three words. The word social refers to different socio-economic groups and treated separately in the database. The word accounting means that all transactions are expressed in monetary values and accounts. Finally, matrix refers to these socio-economic groups and the monetary values of transactions that are represented and arranged in rows and columns. The rows of the SAM record incomings, while the columns of the same record the outgoings or expenditures. Hence, the intersection of the rows and columns has a dual meaning, that is, receipts for one account and expenditure for another. It is an accounting necessity that receipts and expenditures must balance and this ensures the consistency of the system.

SAM depicts the interconnections that exist among production activities, production factors, and institutions. Such interrelationships can be presented diagrammatically in figure 2.1.

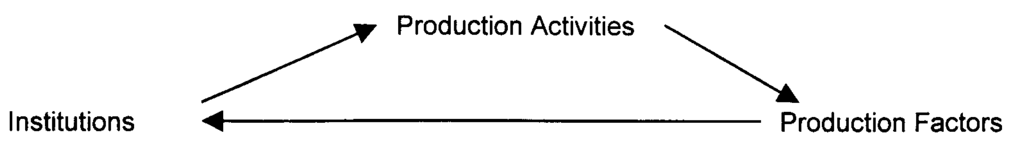

Figure. 2.1. Interrelationship among Activities, Institutions and Factors of Production

The arrow shows the direction of influence. As indicated in the diagram, production activities require factors of production, such as labour, capital, and land in order to produce goods and services. Production factors obtain income from the service they rendered and the income so obtained is channelled to institutions according to their factor endowments. Institutions allocate their income to final consumption of goods and services, transfers, and savings. Production activities sell their outputs to other sectors (intermediate consumption) and institutions, or export to the external sector and obtain income. On the other hand, these sectors pay for the factors of production for their factor services and circular flow is closed.

In order to use SAM for analytical framework, it is necessary to partition the SAM into endogenous and exogenous accounts. This will enable us to identify the impact of a change in the latter on the former. The basic assumptions of the linear equilibrium model include: constant relative prices, average and marginal propensities are equal and they are linear and fixed, expenditure and income elasticities are equal to unity[1] Furthermore, this model assumes that the economy is typified by under capacity utilization of resources.

Endogenous accounts consist of production factors, institutions (households) and production activities for they form part of stated objectives. In other words, the objective(s) of any economic policy is to bring growth, alleviate poverty, and the like. Hence, it is necessary to endogenise households, factors of production, and production activities in order to see how they respond to policy measures. On the other hand, exogenous accounts include government, combined capital account, and the rest of the world. Government is viewed as an interventionist institution which formulates policies and uses instruments, such as taxes, subsidies, and the like to achieve its objectives. Capital account is also assumed to be exogenous because it does not affect other accounts in the short-run. This model assumes that there is under capacity utilization of resources in the Ethiopian economy implying any increase in exogenous demand is met by output increase. Due to the existence of idle capacity in the economy, in the short-term, no additional investment is required to bring output (income) increase in the economy resulting from an exogenous demand increase. Finally, the rest of the world account is set exogenous since Ethiopia is considered to be a small open economy and hence its macroeconomic policies cannot influence world aggregates. It takes, for instance, export price of coffee as given.

Thus, by partitioning the SAM, the effects of changes in the exogenous accounts on the endogenous accounts of the economy can be captured. Multiplier analysis corresponding to the SAM-based linear fixed coefficient model can do this.

Following Pyatt and Round (1979) formulation,

$$Y = T + X \qquad [1]$$

Where

Y refers to the column vector whose elements are the row sums of the endogenous accounts (y_1, y_2, y_3), T refers to the matrix of transactions between endogenous accounts and, X refers to the matrix of injections into endogenous accounts. The injection is a transaction from exogenous accounts into endogenous accounts and can take the form of current transfers from the government or from the rest of the world to households.

Furthermore, defining the matrix of average endogenous transaction propensities as A_n , we have

$$A_n = \frac{T}{Y} \Leftrightarrow T = A_n Y \qquad [2]$$

Alternatively, equation [2] can be expressed as

$$\begin{bmatrix} I & A & A_{13} \\ (I - A_{22})^{-1} A_{21} & I & B \\ C & (I - A_{33})^{-1} A_{32} & I \end{bmatrix} \qquad [3]$$

The subscripts 1, 2, and 3 refer, respectively, to factors of production, endogenous institutions and production activities. The matrix of average endogenous transaction propensities A_n is composed of five sub-matrices:

(a) payment matrix of factors of production by production activities A_{13}
(b) transaction matrix of factor incomes into institutional incomes A_{21}
(c) transaction matrix between endogenous institutions A_{22}
(d) consumption matrix A_{32}, and
(e) industrial transaction matrix A_{33}

From equations [1] and [2] we get

$$Y = A_n Y + X \qquad [4]$$

Equation [4] shows that total endogenous income is the sum of the value of endogenous transactions and the value of exogenous injections.
Rearranging Equation [4] yields,

$$Y = (I - A_n)^{-1} X \qquad [5]$$

Letting $M = (I - A_n)^{-1}$, we have

$$Y = MX \qquad [6]$$

Matrix M has been termed as the accounting multiplier matrix since it explains the endogenous variables such as factors of production, production activities and endogenous institutions in terms of the exogenous variables such as government, capital account and rest of the world. The basic departure of equation [6] from the conventional input-output model is that the former concerns with the simultaneous determination of the levels of output, incomes of the factors of production and household consumption. By contrast, the input-output model concerns with the determination of output levels only.

The multiplier matrix shows how a change in any element of the exogenous accounts will affect the endogenous accounts. It measures the aggregate effect of injections into the economy on the interwoven parts of the endogenous system such as structure of output, factor demand, income distribution and consumption patterns.

The matrix M, according to Pyatt and Round (1979), can be expressed as a product of three multiplier sub-matrices (M_1, M_2 and M_3)[2]:

$$M = M_3 M_2 M_1 \tag{7}$$

Hence, equation [6] can alternatively be expressed as:

$$Y = M_3 M_2 M_1 X \tag{8}$$

The multiplier matrix M_1 captures transfer effects. It measures the effects of transfer within endogenous accounts of the economy. Formally, this submatrix is given by:

$$M_1 = \begin{bmatrix} I & 0 & 0 \\ 0 & (I - A_{22})^{-1} & 0 \\ 0 & 0 & (I - A_{33})^{-1} \end{bmatrix} \tag{9}$$

Such multipliers show how an injection into a specific set of endogenous accounts will affect this same set of accounts due to the interrelationships that exist between the endogenous variables that make up this set of accounts. To clarify this point, an exogenous change in a production activity, for example, will cause a chain of transfer between all other production activities.

The second multiplier M_2 measures the cross-effects or the " open-loop" effects and shows the interactions among and between the sets of endogenous accounts. Formally, this sub matrix is given by:

$$\begin{bmatrix} I & A & A_{13} \\ (I - A_{22})^{-1} A_{21} & I & B \\ C & (I - A_{33})^{-1} A_{32} & I \end{bmatrix} \qquad [10]$$

where $A = A_{13}(I-A_{33})^{-1}A_{32}$, $B = (I-A_{22})^{-1}A_{21}A_{13}$ and $C = (I-A_{33})^{-1}A_{32}(I-A_{22})^{-1}A_{21}$

This submatrix measures the influence of an injection into one part of the system upon other parts of the system. As it is vividly indicated in equation [3], there is no direct relationship between, for instance, production activities and the incomes of institutions. A unit increase in the demand of production activities will increase factorial incomes by A_{13}. If, on the other hand, the expenditure of production factors increases by a unit, then institutional incomes will increase by A_{21}. The total interaction within the institutional accounts due to the rise in the institutional incomes by A_{21} are $(I-A_{22})^{-1}A_{21}$. As a result, the aggregate increase in institutional incomes because of a unit increase in the exogenous demand for production activities will be $(I-A_{22})^{-1}A_{21} A_{13}$. This multiplier is termed as the "open-loop" multiplier in the literature.

Third submatrix denoted by M_3 measures the full circular effect of an injection into the economy, travelling through the economic system back to its initial point. This submatrix is given by:

$$\begin{bmatrix} D & 0 & 0 \\ 0 & E & 0 \\ 0 & 0 & F \end{bmatrix} \qquad [11]$$

Where $D = \{I-A_{13}(I-A_{33})^{-1}A_{32}(I-A_{22})^{-1}A_{21}(I-A_{22})^{-1}A_{21}\}^{-1}$,
$E = \{I - (I-A_{22})^{-1}A_{21}(I-A_{33})^{-1}A_{32}\}^{-1}$ and
$F = \{I - (I-A_{33})^{-1}A_{32}(I-A_{22})^{-1}A_{21}(I-A_{22})^{-1}A_{21}A_{13}\}^{-1}$

It captures "closed-loop" effects, for example, from production activities to factors of production, to institutions and back to production activities in the form of consumption demand. Note that both M_1 and M_3 are block diagonal matrices and hence they only reflect direct and feedback effects or own-effects.

3. DISCUSSION OF RESULTS

In the previous chapter, attempts have been made to show how SAM could be transformed into a model. In this chapter, the accounting multipliers in the context of the Ethiopian economy are presented.

3.1. Analysis of Economic Linkages

It is known that the various sectors of the economy are interdependent as users of inputs from other sectors and as suppliers of inputs to other sectors. The former is termed as backward linkage and the latter is called forward linkage (Sadoulet and de Janvry 1995). Backward linkage measures the proportion of an activity's output that represents purchases from other activities, while forward linkage measures the proportion of an activity's output that is used as input by other sectors. Before the 1970s, linkages had been measured based on input-output matrix. Linkages based on only inter-activity flows have been the main reason for ignoring agriculture while giving due emphasis to industrialization. Since peasant agriculture, the dominant activity in most developing economies, is the producer of primary commodities, it has weak backward linkages. And since it is the producer of final commodities, it has low forward linkages. However, the inclusion of income and final consumption linkages into input-output matrix brought the key role of agriculture in development from the 1970s onwards (ibid.:273). In developing economies like Ethiopia, the largest segment of the population is dependent on agriculture. As such, agriculture is considered to be the main source of household income and expenditure. Expenditures of agricultural households can induce industrialization under the force of effective demand. Thus, when one considers the linkage effects brought by agricultural incomes, then agriculture will be as strong as the industrial sector and induces a relatively more equitable distribution of growth (ibid.:291).

Accordingly, the i^{th} column sum of the aggregate multiplier matrix gives the total input requirement from all sectors and this is the economy-wide backward linkage of this sector. The i^{th} row sum of the aggregate multiplier matrix indicates the total forward linkage of the *i*th sector. These linkage types can be used for assessing the degree of interdependence of many sectors.

Looking at the aggregate multiplier matrix, teff has got the highest backward linkage (10.764), followed by wheat (10.665). Food processing and textiles have also strong backward linkages indicating their high dependence on domestic sources and less dependence on imported materials. Surprisingly, backward linkages with the magnitude of less than five occur in beverages (4.148), non-metals (4.471), and metals (2.351). This is clearly a sign of their high import dependence. The available evidences indicate that non-metals and metals have high import-intensity with magnitudes of 0.70 and 0.90, respectively. These sub-sectors have weak integration with the rest of the domestic economy.

Table 3.1. Aggregate Multiplier Matrix-INV (I-An)

		1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL BWLK
Labor	1	2.346	1.255	1.417	1.097	1.908	1.951	1.875	1.872	1.214	0.498	1.004	0.506	0.231	25.751
Capital	2	0.941	1.894	0.977	0.814	1.274	1.160	1.239	1.272	0.882	0.436	0.786	0.470	0.170	19.401
Rural HHs	3	2.307	1.933	2.599	1.285	2.132	2.108	2.089	2.103	1.394	0.609	1.180	0.635	0.268	30.910
Urban HHs	4	1.064	1.295	0.884	1.694	1.131	1.082	1.105	1.121	0.758	0.349	0.656	0.372	0.147	17.453
Teff	5	0.231	0.216	0.242	0.191	1.250	0.217	0.217	0.219	0.149	0.065	0.124	0.068	0.028	4.305
Wheat	6	0.091	0.088	0.094	0.082	0.089	1.231	0.087	0.087	0.241	0.048	0.050	0.030	0.012	2.682
Maize	7	0.138	0.133	0.143	0.122	0.134	0.131	1.151	0.132	0.089	0.039	0.075	0.041	0.017	3.007
Coffee	8	0.025	0.024	0.026	0.023	0.024	0.024	0.024	1.024	0.017	0.007	0.014	0.008	0.003	1.362
Food processing	9	0.087	0.078	0.094	0.063	0.083	0.081	0.081	0.081	1.137	0.153	0.047	0.038	0.014	2.534
Beverages	10	0.166	0.152	0.178	0.126	0.158	0.155	0.155	0.156	0.104	1.096	0.089	0.049	0.020	3.382
Textiles	11	0.114	0.100	0.125	0.075	0.107	0.105	0.105	0.106	0.071	0.031	1.629	0.035	0.014	3.157
Non-Metals	12	0.007	0.007	0.008	0.006	0.007	0.007	0.007	0.007	0.005	0.002	0.004	1.003	0.001	1.114
Metals	13	0.181	0.175	0.185	0.165	0.176	0.172	0.172	0.174	0.116	0.052	0.099	0.055	1.023	3.620
Total FWLK		10.071	9.597	9.441	7.776	10.764	10.665	10.547	10.616	7.974	4.148	7.236	4.471	2.351	161.141
Partial FWLK-FP		3.286	3.149	2.393	1.911	3.182	3.111	3.114	3.144	2.096	0.934	1.790	0.976	0.401	29.488
Partial FWLK-HHs		3.371	3.227	3.483	2.978	3.263	3.190	3.193	3.224	2.152	0.958	1.836	1.008	0.415	32.301
Partial FWLK-PA		3.414	3.221	3.564	2.886	4.319	4.364	4.239	4.248	3.727	2.256	3.610	2.487	1.535	43.869

Source: Own computation.
Note: FWLK-Forward linkage; FP-Factors of production; HHs-households; PA-Production Activities.

With regard to forward linkages, it can be gleaned from the same table that teff has got the highest forward linkage (4.305) followed by metals (3.620), beverages (3.382), and textiles (3.157). Among the industrial sub-sectors, metals have got the highest forward linkages followed by beverages.

The total linkage, which is the composite of the multipliers of different accounts, is useful in assessing the aggregate effect expected at the national level. The individual effects can be calculated and they are called partial forward or backward linkages. Looking at the accounts of production activities, wheat has the largest partial backward linkage (4.364) followed by teff (4.319). Among the industrial sub-sectors, food processing has the largest partial backward linkage (3.727) followed by textile (3.610). Between households, rural households have the largest partial backward linkage effects (3.483). And also between factors of production, labour has higher partial backward linkage (3.286) as compared to capital (3.149).

Table 3.2. Transfer Multiplier Matrix -M1=INV(I-A0)

		1	2	3	4	5	6	7	8	9	10	11	12	13
Labor	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Capital	2	0	1	0	0	0	0	0	0	0	0	0	0	0
Rural HHs	3	0	0	1.000496	0.017653	0	0	0	0	0	0	0	0	0
Urban HHs	4	0	0	0.028129	1.000496	0	0	0	0	0	0	0	0	0
Teff	5	0	0	0	0	1.028064	8.59E-08	1.67E-07	3.91E-08	0.00254	0.000302	1.64E-06	3.09E-05	9.01E-06
Wheat	6	0	0	0	0	1.9E-05	1.144163	1.2E-05	2.82E-06	0.182868	0.021735	0.000118	0.002226	0.000648
Maize	7	0	0	0	0	1.87E-08	6.09E-09	1.01993	2.77E-09	0.00018	2.14E-05	1.16E-07	2.19E-06	6.38E-07
Coffee	8	0	0	0	0	9.17E-08	2.99E-08	5.79E-08	1.000395	0.000883	0.000105	5.71E-07	1.07E-05	3.13E-06
Food processing	9	0	0	0	0	0.000113	3.66E-05	7.11E-05	1.67E-05	1.082813	0.128696	0.0007	0.013183	0.003839
Beverages	10	0	0	0	0	2.07E-06	6.94E-07	1.32E-06	3.24E-07	0.000123	1.049578	0.000149	0.000563	0.000107
Textiles	11	0	0	0	0	1.87E-05	6.13E-06	1.18E-05	2.81E-06	0.000528	0.000395	1.569672	0.002901	0.000719
Non-Metals	12	0	0	0	0	8.61E-06	2.82E-06	5.44E-06	1.29E-06	0.000216	0.000154	0.000149	1.001217	0.000318
Metals	13	0	0	0	0	2.13E-06	7.4E-07	1.37E-06	3.55E-07	0.000235	0.000202	0.000329	0.000972	1.000156
sum		1	1	1.028625	1.018149	1.031432	1.145659	1.02223	1.001239	1.560887	1.293342	1.764069	1.475296	1.117014

Source: Own computation.

3.2.2. Open-Loop Multiplier Matrix (M_2)

This submatrix shows how an external income injection brings a change in endogenous demand, which transmits throughout the system without returning to its original injection. This submatrix is also known as cross-effects or extra group effects. In Table 3.3 below, selected rows and columns of this submatrix are presented.

Looking at the intersection of accounts of production factors and household accounts one can see the effects of a change in incomes of factors of production on the allocation of incomes of households. It is vividly shown that rural households stand to benefit more from an increase in labour income than their urban counterparts. On the other hand, urban households gain slightly higher from the rise in capital income than rural households.

The intersection of household accounts and production activities shows the impacts of a change in the incomes of the former on the structure of the latter. It is clear that rural households spend a larger proportion of their additional income on the products of teff, followed by beverages and metals. On the other hand, urban households spend a significant amount of their additional income on the products of metals, followed by teff.

TABLE 3.3. Open-Loop Multiplier Matrix -M2=(I+A*+A*2)

		1	2	3	4	5	6	7	8	9	10	11	12	13
Labor	1	1	0	0.437673	0.315711	0.600381	0.599999	0.6	0.597441	0.120784	0.064993	0.124174	0.047263	0.052915
Capital	2	0	1	0.286028	0.263855	0.355437	0.236674	0.34268	0.374043	0.144321	0.113614	0.136426	0.100057	0.037869
Rural HHs	3	0.781874	0.502028	1	0	0.647862	0.587941	0.641159	0.654903	0.168332	0.107912	0.165892	0.090683	0.062368
Urban HHs	4	0.24442	0.521285	0	1	0.332029	0.270026	0.325286	0.341009	0.106093	0.075166	0.10176	0.066959	0.03452
Teff	5	0.071623	0.066677	0.073853	0.056784	1	0	0	0	0	0	0	0	0
Wheat	6	0.027625	0.028101	0.02644	0.028444	0	1	0	0	0	0	0	0	0
Maize	7	0.042145	0.042049	0.041042	0.041139	0	0	1	0	0	0	0	0	0
Coffee	8	0.007511	0.007815	0.007039	0.008213	0	0	0	1	0	0	0	0	0
Food processing	9	0.028024	0.022731	0.031778	0.013002	0	0	0	0	0	0	0	0	0
Beverages	10	0.052802	0.045109	0.057919	0.030756	0	0	0	0	0	0	0	0	0
Textiles	11	0.037466	0.027776	0.044726	0.010209	0	0	0	0	0	0	0	0	0
Non-Metals	12	0.002231	0.002103	0.002278	0.001841	0	0	0	0	0	0	0	0	0
Metals	13	0.054508	0.056301	0.051437	0.058468	0	0	0	0	0	0	0	0	0

Source: Own computation.

The effects of a change in the structure of activities on the incomes of production factors can be examined by looking at the intersection of the two accounts. It is to be noted that the income of labour is highly influenced by increased production of agricultural activities. In other words, increased agricultural production significantly affects labour income (for more details, see Table 3.3).

3.2.3. Closed-Loop Multiplier Matrix (M_3)

This submatrix measures the effects of an exogenous injection into an endogenous account on itself after a series of interactions in the system. It captures circular effects together. It is also termed as circular or inter-group effects or own-indirect effects. Selected rows and columns are presented in Table 3.4 below.

The indirect impacts of a change in an account can be observed by looking at the intersection of that account with itself. In this way, the factor accounts revealed that the own-indirect effects of labour are substantial. With regard to the redistribution of income over households, it appears that the indirect effects of the rural households are not only significantly large but also by far greater than urban indirect effects. Hence, rural households benefit more from the own- indirect effects. Finally, the third block diagonal depicts the indirect effects of activities on themselves. The indirect effects of teff, metals, and beverages are found to be substantial as compared to other sectors.

TABLE 3.4. Closed-Loop Multiplier Matrix -M3= Inv(I-A*3)

		1	2	3	4	5	6	7	8	9	10	11	12	13
Labor	1	2.344137	1.253161	0	0	0	0	0	0	0	0	0	0	0
Capital	2	0.939562	1.893371	0	0	0	0	0	0	0	0	0	0	0
Rural HHs	3	0	0	2.560751	1.23689	0	0	0	0	0	0	0	0	0
Urban HHs	4	0	0	0.835046	1.676757	0	0	0	0	0	0	0	0	0
Teff	5	0	0	0	0	1.215186	0.189446	0.212343	0.218527	0.059019	0.039524	0.058095	0.032508	0.020379
Wheat	6	0	0	0	0	0.085947	1.075482	0.084792	0.087313	0.023686	0.015903	0.023301	0.013096	0.008149
Maize	7	0	0	0	0	0.130104	0.114323	1.128362	0.132161	0.035817	0.024035	0.03524	0.019787	0.012333
Coffee	8	0	0	0	0	0.023584	0.020699	0.023265	1.023961	0.006507	0.004372	0.006401	0.003601	0.002237
Food processing	9	0	0	0	0	0.080044	0.070728	0.079013	0.081242	1.021794	0.014538	0.021472	0.011935	0.007566
Beverages	10	0	0	0	0	0.153635	0.13557	0.151638	0.155967	0.041945	1.028021	0.041312	0.02302	0.014532
Textiles	11	0	0	0	0	0.103777	0.091912	0.102464	0.105294	0.028126	0.018713	1.027726	0.015344	0.009798
Non-Metals	12	0	0	0	0	0.006736	0.005928	0.006647	0.006841	0.001849	0.001239	0.00182	1.001019	0.000638
Metals	13	0	0	0	0	0.17064	0.149799	0.16834	0.173363	0.047065	0.031614	0.046297	0.02604	1.016184

Source: Own computation.

4. CONCLUSIONS AND POLICY IMPLICATIONS

In this study, an attempt has been made to provide empirical evidence regarding the size and magnitude of economic linkages in Ethiopia. The analysis has been based on the Social Accounting Matrix (SAM) -based multiplier analysis. The advantage of this method is that it captures both the direct and indirect effects of any exogenous change. Based on the SAM-multiplier analysis, the following are the main conclusions and policy implications.

Taking both direct as well as indirect or induced effects, the agricultural sector in general and teff, wheat, and coffee in particular have strong integration with the entire economy. This paper indicated that the indirect effects enhance the interdependence of the Ethiopian economy. In other words, when general equilibrium effects are taken into consideration, agriculture is found to be superior, through income and consumption linkages, in terms of stimulating economic growth in the country. Of the industrial sub-sectors, food processing, metals, beverages, and textiles have strong linkages with the rest of the economy.

In terms of the decomposition of the aggregate multiplier matrix, one can observe that rural households have greater transfer effect than urban households. It is also indicated that rural households spend a larger proportion of their additional income on the products of teff, followed by beverages and metals while urban households spend a significant amount of their additional income on the products of metals, followed by teff.

Moreover, it appears that the indirect effects of the rural households are not only significantly large but also by far greater than urban indirect effects. Hence, rural households benefit more from the own- indirect effects. Finally, the own-indirect effects of teff, metals, and beverages are found to be substantial as compared to other sectors.

The implication of the findings of this study is that policies directed towards the expansion of the rural sector and promotion of some manufacturing activities would generate substantial income for the rural society as well as the urban households alike.

NOTES

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[1] It is possible to make average and marginal propensities different by introducing elasticities for each institution.

[2] These three sub-matrices are explained below.

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