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A 2004 Social Accounting Matrix (SAM) Analysis for Italy

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Abstract: This study discusses the proper use of Social Accounting Matrix (SAM) analysis. Using a 2004 Social Accounting Matrix (SAM) for Italy, this study examines the key features of the Italy in different sectors. It attempts to analyze this by deriving quantitative measures of input output and SAM multipliers such as type I and II in two regional economic impacts that are most concerned like output and income. The 57 activities accounts are aggregated into five activities. Among the 5 major sectors, the manufacturing industry yields the largest output multiplier in both open and closed model. The utility and construction sector as well as agriculture sector constitute the second and third most important output generating industries with all multipliers. Also, the value of Rasmussen backward and forward linkages report that manufacturing sector is the key sector in Italy's industries thus investment in this sector would initiate economic development due to the inter-linkage with other industries. The outcome of the study may be used for the development strategy of Italian economy.

Key words: Social accounting matrix, input output, multiplier, forward linkage, backward linkage

INTRODUCTION

Historically, the roots of Social Accounting Matrix (SAM) and Input Output (I/O) table framework can be traced back to French physician Francois Quesney with his famous tableau economique (economic table) in 1758. According to Schumpeter he was greatly influenced by Richard Cantillon Irish-French economist. After 200 years Wassily Leontief walked on Quesney and Walras footsteps (Yanovsky, 2006) and received Nobel Prize for inventing input output table.

The term of social accounting matrix was coined by Sir John Hicks in 1942 and developed by Sir Richard Stone who won Nobel Prize for having made fundamental contributions to the development of systems of national accounts on 1984.

A Social Accounting Matrix (SAM) is a presentation of the core national accounts and provides a coherent detailed data in economy. SAM enable policy maker to understand the structure of the economy as well as various economic indicators to make decision rationally. The purpose of this article is fourfold: to review conceptual framework and general structure of social accounting matrix to calculate Italy's key macroeconomic indicators in SAM database to explain how input output and SAM multipliers are calculated and analyzed to describe how Rasmussen backward and forward linkages are calculated in order to identify the most important sector in Italy's economy.

THE CONCEPT OF SOCIAL ACCOUNTING MATRIX

A social accounting matrix gives a comprehensive economy-wide picture of the value of transactions in the circular flow of national income and spending in economy usually for 1 year (Fig. 1). The household supply primary inputs like labor and capital to producer who are organizer of production activities. Producer or firms combine intermediate factors (purchases from other firms) and primary factors (wages, payments to owners of capital) of production.

Households also paid back for their labor and capital factors as wages and rents. Household spend their incomes on goods which are delivered by the producer, pay tax and save some part on income.

The government uses its tax to buy goods and services and investors uses household saving. Moreover, there are economic relations between country and the rest of the world in order to meet some other domestic demand as import and additional source of demand for domestic goods as export also capital inflow and outflow (Burfisher, 2011). "In fact SAM in nothing more or less than the transformation of the circular flows (Cohen, 1989)".

STRUCTURE OF THE SAM

A SAM is the integration of input-output table and national income accounts. A Social Accounting Matrix (SAM) really is nothing more than double-entry book

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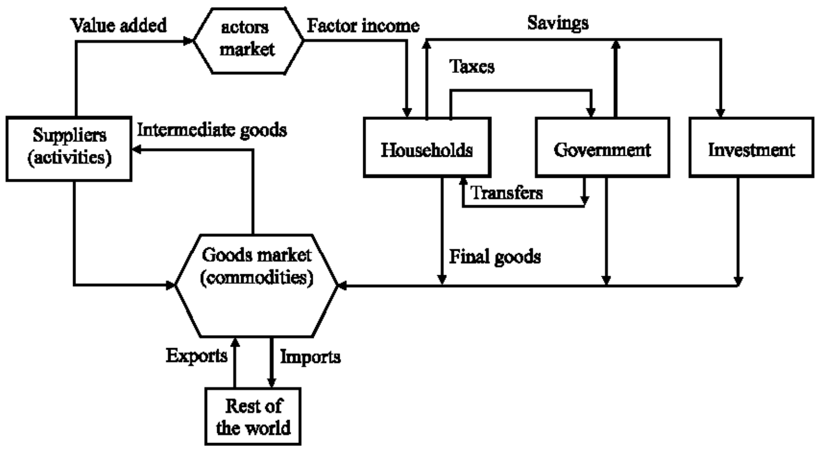

Fig. 1: Circular flow of income and spending in national economy

Table 1: Standard macro SAM structure used in CGE Model

Parameters	Activities	Commodities	Factors	Enterprises	Households	Government	Capital	ROW	Total
Activities		Sales			Home consumption				Total domestic production
Commodities	Intermediate inputs	Marketing margins			Private consumption	Government consumption	Investment expenditures	Exports	Total marketed supply
Factors	Value added								Total factor income
Enterprises			Capital income			Transfers			Total enterprise income
Households			Lobar income	Retained earnings	Inter household transfers	Transfers		Remittances	Total household income
Government	Indirect taxes	Import tariffs		Corporate taxes	Income taxes			Foreign grants	Total government income
Capital				Corporate saving	Household saving	Government saving		Foreign saving	Total saving
Rest of the World (ROW)		Imports	Factor income paid to ROW	Enterprise income paid to ROW		Government income paid to ROW			Total foreign exchange outlays
Total	Total cost of production	Total absorption	Total value added	Total enterprise expenditure	Total household expenditure	Total government expenditure	Total investment	Total foreign exchange earnings	

keeping like Input-Output (I/O) table. A SAM is the integration of input-output table and national income accounts. A SAM describes transactions between agents. Each agent in the economy has both a row account across the board and one column account down it both identically numbered. Therefore, each cell in SAM matrix describes the expenditure by agents' column account to the account of its row where what is incoming into one account must be outgoing from another account. As a result the incomes of an account become visible along its row and its expenditure along its column. Column sum record each agents 'spending and row sum record its total income. A SAM is balanced when total spending is equal to the total income for every agent. A SAM is square matrix and balanced database. Table 1 shows a standard macro SAM structure.

For better understanding of SAM and its elements, we will start to consider traditional SAM layout Table 2 which shows us the fundamental building blocks and flows across macroeconomic key players.

Table 2: Traditional SAM layout

Receipts	Industry	Factors	Institutions	Exports	Total
Industry	S_{11}	0	S_{13}	S_{14}	X_1^d
Factor	S_{21}	0	0	S_{24}	X_2^d
Institutions	S_{31}	S_{32}	S_{33}	S_{34}	X_3^d
Imports	S_{41}	S_{42}	S_{43}	S_{44}	X_4^d
Total	x_1^{sT}	x_2^{sT}	x_3^{sT}	x_4^{sT}	

Anguita and Wagner in 2010

Matrices:

- S_{11}: intermidiate transaction matrix
- S_{21}: value added matrix
- S_{31}: sales taxes matrix
- S_{41}: imports
- S_{32}: distribution matrix
- S_{42}: factor imports
- S_{13}: final demand matrix
- S_{33}: transfer matrix
- S_{43}: institutional import matrix
- S_{14}: industry export matrix
- S_{24}: factor export matrix
- S_{34}: institutional export matrix
- S_{44}: transshipment matrix

Column totals:

- x_1^{sT} : total outlay or agents expenditures
- x_2^{sT} : total factor expenditures
- x_3^{sT} : total institution expenditures
- x_4^{sT} : total export

Row totals:

- x_1^d : total industry output
- x_2^d : total factor income
- x_3^d : total insitutional income
- x_4^d : total imports

Basic SAM accounts: Each SAM consists of four main accounts and can be described briefly as follows:

Industry accounts: The industry accounts describe the production processes that purchase intermediate inputs from the commodities account and also the services of primary factors and payments to the labor and capital that it employed. An activity account can be separated to subdivide by modeler. For example manufacturing activity can be disaggregated into pollutant and green sectors. The ith element of this vector is:

$$\left(x_1^d\right)_i = \sum_{g=1}^{4}\sum_{j}\left(s_{1g}\right)_{ij} \tag{1}$$

The row vector (total industry outlay) denotes the column sum of industry expenditure. The jth elements of this vector can be written as follow:

$$\left(x_1^{sT}\right)_i = \sum_{k=1}^{4}\sum_{i}\left(s_{k1}\right)_{ij} \tag{2}$$

Factor accounts: Factor consists of resource endowments of labor and capital which are used to combine with intermediate inputs for activity. Labor maybe divided into skilled and unskilled workers. Production activities pay wages and rent to labor and capital respectively, therefore, the row sum represents total factor income. The ith element of this vector is:

$$\left(x_2^d\right)_i = \sum_{g=1}^{4}\sum_{j}\left(s_{2g}\right)_{ij} \tag{3}$$

The row of this account denotes the column sum of factor expenditure and can be expressed as:

$$\left(x_2^{sT}\right)_i = \sum_{k=1}^{4}\sum_{i}\left(s_{k2}\right)_{ij} \tag{4}$$

Institutions accounts: The institutional account comprises households, government, enterprises and capital investment. The row of this account denotes sum of institutional income. Mathematically:

$$\left(x_3^d\right)_i = \sum_{g=1}^{4}\sum_{j}\left(s_{3g}\right)_{ij} \tag{5}$$

The sum of institution account records total institutional expenditures that can be defined mathematically:

$$\left(x_3^{sT}\right)_i = \sum_{k=i}^{4}\sum_{i}(S_{k3})_{ij} \tag{6}$$

Rest of the world accounts: This account is comprised export and import that describes trade and investment flows between country and Rest of the World (ROW). The column account reports total export or total trade receipts from the rest of the world, mathematically:

$$\left(x_4^d\right)_i = \sum_{g=1}^{4}\sum_{j}(S_{4g})_{ij} \tag{7}$$

And row account reports total import which is gross payments to the rest of the world. The ith element of this vector is:

$$\left(x_4^{sT}\right)_i = \sum_{k=1}^{4}\sum_{i}(S_{k4})_{ij} \tag{8}$$

As we discussed earlier in each account, total income equals total expenditure that is:

$$x_k^d = x_k^{sT} \;;\forall k \tag{9}$$

And finally, it should be noted that the accounts included in SAMs can differ in dimension across CGE Models.

SAM DEVELOPMENT

Table 3 illustrates the industry-by-industry SAM given in Table 2 based on an aggregation depicted by Thorbecke and Jung (1996). First we should distinguish between endogenous and exogenous expenditures, receipts accounts. It is possible to move household sector

Table 3: Endogenous accounts of aggregated industry

Receipts	Industry	Expenditures factor	HH, Ent
Industry	S_{31}	0	S_{13}
Factor	S_{21}	0	0
HH, Ent	S_{31}	S_{32}	S_{33}

Anguita and Wagner in 2010

from final demand column and labor input row and make them exogenous in the table. This is known as closing model respect to households (Miller *et al*., 2011), thus, the endogenous account, S is usually composed of the production, S_{11}, factors S_{21} as well as household and institution accounts capturing the circular flow of production. The exogenous accounts usually is consists of the government, capital investment plus rest of the world. On the demand side we know that:

$$X_d = \left(I - S\hat{X}^{-1}\right)^{-1} f \tag{10}$$

where, $\hat{x}$ is defined as a diagonal matrix whose diagonal elements are total outlays or total outputs. Assuming a small exogenous change (denotes by Δ) in the final use vector, Δf the corresponding change in the output vector Δx_d can be obtained as follows:

$$\Delta x_d = \left(I - S\hat{X}^{-1}\right)^{-1} \Delta f \tag{11}$$

Using Eq. 10 to predict the change in output Δx_d given in change in final demand Δf. Endogenous account of aggregated industry-by-industry SAM can be shown as a subset of Table 2.

Then technical coefficient matrix, SX^{-1} in Eq. 9 and 10 is given by Eq. 11. We can re-write as matrix form:

$$A = XS^{-1} = \begin{pmatrix} A_{11} & 0 & A_{13} \\ A_{21} & 0 & 0 \\ A_{31} & A_{31} & A_{33} \end{pmatrix} \tag{12}$$

Equation 10 can be written using Eq. 11 as:

$$R_a = (I - A)^{-1} f = R_a f \tag{13}$$

where, $R_a = (I-A)^{-1}$ denotes the SAM's total requirement matrix or multiplier matrix. Waugh (1950) proposed the technique of a power series approximation (the algorithm is approximated because we cannot sum the whole power series) to the matrix inversion. The power series is:

$$(I - A)^{-1} = I + A + A^2 + A^3 + \ldots A^k + \ldots \tag{14}$$

A satisfies certain conditions (a is non-negative, productive and (I-A) is singular (all eigenvalues of matrix A<|1|)) that are usually met in input output table. Inserting Eq. 13 into Eq. 10, we obtain:

$$\Delta x_d = \left(I - A + A^2 + A^3 + \ldots A^k\right)\Delta f \tag{15}$$

Removing parentheses, this is :

$$\Delta x_d = \Delta f + A\Delta f + A^2\Delta f + A^3\Delta f + \ldots A^k\Delta f \tag{16}$$

From Eq. 15, we can see that the effect of an exogenous change in final demand vectors, this cause an initial effect of the same amount on output vector (Δf).

Suppose Δf is related to industry j, it means there is demand from industry j to other sectors whose outputs are employed as intermediate goods in sector j (direct effect) but those new inputs also requires intermediate consumption of additional inputs (indirect effects). As direct and indirect industrial effects are initiated firms pay wages to labor service who, in turn, spend some part of the income to buy locally produced goods and services which drive the induced effect (found from a model that is closed with respect to households). The sum direct, indirect and induced effects are often called total effects.

Equation 15 indicates that when exponent increase, the corresponding effect decrease which means that each time the latter indirect effects calculating less that in the previous indirect effects. By applying multiplier we are able to estimate the overall change in the economy due to changes in final demand that will be discussed in the next study.

I/O AND SAM MULTIPLIER

In this study, we are going to present the most important results concerning multipliers in Italy. SAM multiplier analysis provide a strong tool for economic analysis and enables to estimate the macroeconomic policies effects of initial exogenous shocks for example change in final demand like increase in households consumption on the whole of economic system. Similar to macroeconomic (Keynesian) multipliers, I/O multiplier and SAM multiplier provide a technique to describe properly economic policy impacts on different sectors. Multipliers are basically a ratio of total impacts to initial impacts. In fact, multiplier coefficients are able to determine which sectors have the greatest effects on economic activity and which the smallest. Miller *et al*. (2011) contend that one of the main applications of I/O and SAM is to answer the question on how a given economic sector will respond to impulse changes in elements that are exogenous to the model.

Input output multiplier focuses on inter industry transactions so it is "open model" whereas "closed model" like SAM based model are able to include consumption linkage as well. The accounts in SAM are categorized into two accounts; endogenous accounts like: primary factors, households, production activities and exogenous account. The endogenous accounts are consumption transactions which involve households, enterprise and government institutions and they give us some useful information about household income, consumption as well as income distribution.

Computable General Equilibrium (CGE) Models also help policy maker to assess the policy effects on the economy among different agents within an economic system. The core of CGE Models database is SAM, thus, the question that may arise here is; what is difference between SAM based analysis and computable general equilibrium analysis? The short answer is whilst multiplier models are fixed price models; CGE Models are flexible price models.

There are two general types of multipliers in I/O Models. Types of multipliers that depend on how other variables in the model are treated. Type I or simple multiplier is defined as direct and indirect effects that are derived from open I/O table whereas type II or total multipliers are derived from closed I/O table by considering direct and indirect effects plus induced effects. The total effects can be defined in open I/O Model as the direct plus indirect, and in closed I/O Model as the direct plus indirect plus induced effects.

By reffering to Eq. 12, the jth sector's SAM accounting multiplier $SAM^{(AM)}$ is calculated summing the columns of the accounting multiplier matrix, R_{aij}:

$$SAM_j^{(AM)} = \sum_j (R_a)_{ij} \tag{17}$$

where, R_a demotes an element of SAM's accounting multiplier matrix. Thus, a SAM accounting multiplier is calculated for each industrial activity, primary factor of production, household and enterprises.

DATA

As noted already, the critical data that determine the structure of a CGE Model are contained in Social Accounting Matrices (SAMs). The data for the modeling were derived from the worldwide Input-Output (IO) tables and trade database prepared by the Global Trade Analysis Project (GTAP). Also at this part, a brief description is presented to illustrate how to transform the data from the GTAP database (73×73) into a SAM (16×16) (Table 4). In the Italy SAM, in order to facilitate the analysis and interpretations of simulation results, 57 activities accounts are aggregated into five activity accounts including agriculture and mining; manufacturing; utility and construction; transportation and communication and services.

Similar aggregation follows in the commodity accounts, also five production factors are aggregated into two factors-labor and capital and one household type. Table 5 shows the summary of this aggregation and presents Italy's macro SAM in reference year 2004.

Micro-economic and macroeconomic data in a SAM: SAM's micro-economic data consists of all information about economic agents in detail. For example data on production reports the amount spent by each sector on each type of primary factors as well as each tax. The expenditure of each agent on each type of goods is described by domestic demand.

Table 4: Concordnace between GTAP, WIOD and researcher aggregation code

GTAP classification	WIOD	Researcher aggregation
Paddy rice, wheat, cereal grains, vegetables, fruit, nuts, oil seeds sugar cane, sugar beet, plant-based fibers, crops, cattle, sheep, horses animal products, raw milk, wool, silk-worm cocoons	C1	Agriculture and mining (1)
Forestry, fishing, coal, oil, gas, minerals	C2	-
Meat: cattle, sheep, goats, horse, meat products , vegetable oils and fats, dairy products, processed rice, sugar, food products , beverages and tobacco products, textiles, wearing apparel, leather products, wood products, paper products, publishing, petroleum, coal products, chemical, rubber, plastic prods, mineral products , ferrous metals, metals , metal products, motor vehicles and parts, transport equipment electronic equipment, machinery and equipment , manufactures	C3-C16	Manufacturing (2)
Electricity, gas manufacture, distribution, water, construction	C17+C18	Utility and construction (3)
Trade, transport , sea transport, air transport, communication	C19-C27	Transportation and communication (4)
Financial services , insurance, business services, recreation and other services, public administration/defense/health/educate, dwellings	C28-C35	Services (5)
Skilled labor, unskilled labor	-	Labor
Capital, land, resources	-	Capital

Table 5: Italy's SAM 2004

	Activities				Commodities					
Variables	1	2	3	4	5	6	7	8	9	10
Agriculture	0	0	0	0	0	69009	0	0	0	0
Manufacturing	0	0	0	0	0	0	1098028	0	0	0
Utility and construction	0	0	0	0	0	0	0	239574	0	0
Transportation and communication	0	0	0	0	0	0	0	0	541460	0
Services	0	0	0	0	0	0	0	0	0	973501
Agriculture	4971	68773	5489	910	5164	0	0	0	0	0
Manufacturing	10535	458952	66489	49597	70875	0	0	0	0	0
Utility and construction	1207	24420	10166	11872	29976	0	0	0	0	0
Transportation and communication	3745	126243	14921	67585	40634	0	0	0	0	0
Services	2987	83729	16917	71390	117872	0	0	0	0	0
Labour	20597	115792	38522	84811	259706	0	0	0	0	0
Capital	23827	153622	65047	230000	319062	0	0	0	0	0
Tax	1139	66497	22023	25295	130210	665	2997	0	0	0
Regional household	0	0	0	0	0	0	0	0	0	0
Household	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0
Investment	0	0	0	0	0	0	0	0	0	0
Rest of the world	0	0	0	0	0	44743	283867	6410	32782	36130
Margin import	0	0	0	0	0	2891	8291	0	0	0
Margin export	0	0	0	0	0	0	0	0	0	0
Total	69009	1098028	239574	541460	973501	117308	1393183	245984	574243	1009631

	Factors										
Variables	11	12	13	14	15	16	17	18	19	20	Total
Agriculture	0	0	0	0	0	0	0	0	0	0	69009
Manufacturing	0	0	0	0	0	0	0	0	0	0	1098028
Utility and construction	0	0	0	0	0	0	0	0	0	0	239574
Transportation and communication	0	0	0	0	0	0	0	0	0	0	541460
Services	0	0	0	0	0	0	0	0	0	0	973501
Agriculture	0	0	0	0	25889	310	228	5574	0	0	117308
Manufacturing	0	0	0	0	293450	456	130029	312799	0	0	1393183
Utility and construction	0	0	0	0	15001	105	151134	2103	0	0	245984
Transportation and communication	0	0	0	0	255181	1125	25004	32588	0	7216	574243
Services	0	0	0	0	344127	328179	7361	37068	0	0	1009631
Labour	0	0	0	0	0	0	0	0	0	0	519429
Capital	0	0	0	0	0	0	0	0	0	0	791559
Tax	196889	53881	0	0	97988	0	20017	0	0	0	617602
Regional household	322540	535683	617602	0	0	0	0	0	0	0	1475825
Household	0	0	0	1031638	0	0	0	0	0	0	1031638
Government	0	0	0	330175	0	0	0	0	0	0	330175
Investment	0	201995	0	114012	0	0	0	0	0	0	333773
Rest of the world	0	0	0	-	0	0	0	13801	0	3966	403933
Margin import	0	0	0	-	0	0	0	0	0	0	11181
Margin export	0	0	0	-	0	0	0	0	11181	0	11181
Total	519429	791559	617602	1475825	1031638	330175	333773	403933	11181	11181	11788216

GTAP, constructed by reseacher

A SAM database presents some of the macroeconomic indicators in the row sum and column sum place. For example the column sum of rest of the world report total export of goods and services.

In the following, some of Italy' key macroeconomic indicators will be calculated. All accounts are in million of US dollar.

Italy's Gross Domestic Products for 2004: The study of this research explains some economy key indicators and how they are measured. Let us begin with gross domestic product. We calculated Italy's GDP using data from the Italian SAM which is shown in Table 5. GDP could be calculated both in income and expenditure side.

GDP from the income is shown by the following relation. GDP = Factor income + Tax revenue = 1.060.788+ 617.032 = 1.677.820 million of US dollar or 1.6 77 Trillion of US dollar. Also, GDP from expenditure side is introduced by the following equation. GDP = Total private consumption + Total investment expenditure + Total government expenditure + Total export-Total import. Thus, Italy's GDP from the expenditure side is:

1.031.638+333.773+330.175+
397.348-415.114 = 1.677.820

Some SAM may have accounts for 300 or more sectors in economy and >5 primary factors, thus to fully understand and not to lose the detailed information for such large economy dimension becomes more challenging and complex.

In order to get an overview of an economy without skipping detailed information, a modeler can construct a “structure table” to describe the economy in terms of shares. This approach will enable the modeler to identify most important parts of the economy.

Table 6: Structure table-factor cost shares

		Factor shares in industry factors costs (%)	
Factors	Industry shares in GDP (%)	Labor	Capital
Agriculture and mining	3.0	63	37
Manufacturing	23.0	51	49
Utility and construction	8.5	45	55
Transportation and communication	21.5	34	66
Services	44.0	53	47

GTAP and reseacher calculations

Table 7: Structure table-industry shares in factor employment

	Factor shares in industry factor employment (%)	
Factors	Labor	Capital
Agriculture and mining	4	2
Manufacturing	22	20
Utility and construction	7	8
Transportation and communication	16	29
Services	50	41

GTAP and researcher calculations

Table 6-9 show the structure table for Italy’s economy in 2004. All data are adjusted for rounding. Table 6 a shows that services share in GDP is the most important sector in the economy, thus it would be logical that any change in the services share will have greater effect on the economy as compared to the rest of the sectors. For example any policy shock in agricultural sector would not have significant effects on Italian economy.

Moreover, Table 6 clearly shows that about 44% of GDP and 50% labor and 41% of capital employment are related to service account thus Italy has relatively service economy. Also agriculture sector is labor intensive whereas transportation and communication sector are absolutely capital intensive.

Table 7 shows about 50% of Italy’s labor employed in service sector so, any change in this sector would likely have a larger impact on national employment and wages. Let’s take a look at briefly into tax issue in the SAM. By following, we classified tax into five broad types as follows:

- Trade taxes are levied on imports and exports
- Production taxes are paid by production activities based on their output
- Sales taxes are paid by domestic firms on their intermediate input purchase and by consumer and investors on their purchase of final goods and services
- Factor use taxes are paid by production activities based on their factor inputs
- Income taxes are paid by factors or households based on income earned from wages and rents

Table 8: Structure tabel-commodity shares in domestic demand and trade

	Commidity shares (%)					
	Domestic demand				Trade	
Factors	Intermediate demand	Private household consumer	Government consumption	Investment demand	Export	Import
Agriculture and mining	21	3	0	0	1	11
Manufacturing	49	33	0	41	79	70
Utility and construction	5	2	0	48	0	2
Transportation and communication	15	26	0	8	10	8
Services	10	36	100	3	9	9

GTAP and researcher calculations

Table 9: Tax structural table

	Tax rate (%)				
Factors	Import tariff	Export tax	Production tax	Sales tax	Factor use tax
Agriculture and mining	1.4	-0.02	-2.3	18.0	4.1
Manufacturing	1.0	0.00	0.4	14.8	18.2
Utility and construction	0.0	0.00	2.2	47.1	15.9
Transportation and communication	0.0	0.00	-5.3	7.2	11.7
Services	0.0	0.00	1.8	7.1	19.0

GTAP and researcher calculations

For each of the five taxes, we can find the relevant data in the SAM and then calculate those taxes by the following relations. Trade taxes for imports for example can be defined as: Import tariff/(Trade margin import+ Import).

Production taxes can be expressed as: production tax/gross value of production. Sales taxes can be shown by: commodity sales tax/pretax value of commodity purchase. And finally, factor use taxes can be written as: factor tax/pretax factor payment. It is useful for tax policy maker to review the tax data in SAM. We start to extend structure table by calculating and adding Italy's taxes data. Table 9 reports the various tax and tariff rates in Italian economy. It should be noted that Table 5 shows Italy SAM which is aggregated thus some of the relevant data can be traced in disaggregated SAM.

From Table 9, we can see that the Italy's import tariff rates are highest on agriculture products (1.4%) then manufacturing goods (1%) and zero for rest of them. It should be noted that tax can be negative (i.e., subsidies) like production tax on agriculture (-2.3%) and transportation (-5.3%) sector.

THE ANALYSIS OF I/O AND SAM MULTIPLIERS

A comparison of closed and open model in Table 10 and 11 shows that the type II multipliers are bigger in magnitude from the type I multipliers. The reason is that type II multipliers include the induced effects due to change in household expenditures earned from direct and indirect effects. Table 10 highlights the estimated I/O and SAM multipliers for output and income in Italy's economy. By summing the columns of the SAM total requirement matrix we can calculate SAM accounting multipliers which is calculated for industrial activity, production factors and household (Table 11 and 12). In simple terms the higher the multiplier, the stronger its ability to create multiple impacts in the economy. Type I output/output and type II output/output multiplier are found by summing the jth column of the open and closed Leontief inverse matrix, respectively. Output/output multiplier gives us information that one unit of for example, dollar or industry's output will generate a dollar worth of additional output in the economy.

Among the 5 major sectors, the manufacturing industry yields the largest output/output multiplier of $2.51 in closed models, $3.04 in open model and $4.48 in SAM based model. In other words for every $1.00 sale in manufacturing sector for example, total revenue generated by $2.51, 3.04 and 4.48 in open closed and SAM based model, respectively. The utility and construction sector as well as agriculture sector constitute the second and third most important output generating industries with all multipliers respectively. From the other side, a change in output of the sectors will generate additional income to household. In order to quantify the impact of change in each sector's output on household, income multiplier is needed. Agriculture sector is found to be the most important income generating sector with the highest income multiplier of 0.38 in open model, 0.53 in closed model and 0.80 in SAM based model.

Income/income multiplier estimate the total income effect due to the change in wage income. The type I income/income multiplier defines as the ratio of the direct plus indirect income effects to the direct alone (Moore and Petersen, 1955) and type II is a ratio of direct plus indirect plus induced effects to direct effect. According to the Table 10, when the manufacturing sector realizes a $1.00 change in income, the total income will change by $2.52 and 4.10 in open and closed model,

Table 10: Type I multipliers in open model

Open models	AGR	MFG	Utilcons	Transpocom	Services
Type I					
Output/Output	1.70	2.51	2.03	1.69	1.51
Income/Output	0.38	0.27	0.27	0.26	0.34
Income/Income	1.27	2.52	1.70	1.63	1.28

Table 11: Type II multipliers in closed model

Closed modles	AGR	MFG	Utilcons	Transpocom	Services	HH
Type II						
Output/Output	2.34	3.04	2.53	2.12	2.06	1.55
Income/Output	0.53	0.43	0.41	0.35	0.46	-
Income/Income	1.78	4.10	2.54	2.25	1.71	-

GTAP and researcher calculations

Table 12: SAM multipliers

SAM	AGR	MFG	Utilcon	Transpocom	Ser.	Labor	Capital	HH
Accounting	7.33	7.62	7.15	7.32	6.47	4.91	6.87	6.30
Output/Output	3.87	4.48	4.01	3.86	3.42	-	-	-
Income/Output	0.80	0.69	0.67	0.66	0.70	-	-	-
Value added/Output	1.92	1.73	1.73	1.89	1.69	-	-	-
Income/Income	2.68	6.52	4.16	4.23	2.61	-	-	-

respectively. SAM value added/output multiplier shows the value added generated for the economy that results from the increase final demand a particular sector output. Table 12 reports agriculture and mining have highest value added/ output multiplier among the five major sectors. Table 12 summarized all information regarding multipliers in each sector. It should be noted that SAM income/output, SAM value added/output and SAM income/income multiplies are calculated for only industry accounts and illustrated on Table 12.

"The multiplier analysis is useful when interest lies in estimating the impact of changes in final demand but ignores the role of supply" (Gravino, 2012). In the next section we are going to discuss about the linkages in economy.

BACKWARD AND FORWARD LINKAGE ANALYSIS

In input output table, industrial sectors are dependent on each other because they need input from other sectors in their production process. Any particular sector has two kinds of effects on its downstream and upstream sector. For better understanding suppose sector j is affected by sector i; this effect could be direct i-j (a) or indirect (b) by other sectors like x and y (I-x-y-j) (Fig. 2).

Based on input output model when sector j increases its output it means there is demand from sector j to other sectors whose outputs are employed as intermediate goods in sector j. In input output literature this demand from upstream sectors is called backward linkage or input provision that can be expressed by the following ratio:

$$\text{Forward linkage} = \frac{\text{Value of total intermidiate sales by sector i}}{\text{Value of i's total output}} \quad (18)$$

Direct effect in backward linkage is given by the sum of jth column in technical coefficient matrix. According to Chenery and Watanabe, the strength of backward linkage can be expressed by the following relation:

$$BL(d)_j = \sum_i^n a_{ij} \quad (19)$$

It should be noted that simple backward linkage is equal with simple output multiplier in open input output model. According to Rasmussen total backward linkage for sector j is the column sum of the jth Leontief matrix $(I-A)^{-1}$:

$$BL(t)_j = \sum_i^n l_{ij} \quad (20)$$

where, l_{ij} is the ijth element of Leontief inverse matrix. Also, he proposed the following relationship for normalization of backward linkage and called it power dispersion index:

$$\overline{BL(d)_j} = \frac{BL(d)_j}{1/n\sum_j^n BL(d)_j} = \frac{\sum_{i=1}^n a_{ij}}{1/n\sum_{j=1}^n a_{ij}\sum_{i=1}^n a_{ij}} \quad (21)$$

where the numerator of fraction is j's backward linkage and denominator is average of all backward linkage. A sector with high backward linkages means that expansion of its production is more beneficial to the economy than other sectors. From the other side, forward linkage addresses the relationship between a sector and its lower sectors that are using its products:

$$\text{Forward linkage} = \frac{\text{Value of total intermidiate sales by sector i}}{\text{Value of i's total output}} \quad (22)$$

This linkage was first proposed by Chenery and Watanabe (1958). Forward linkage can be expressed as follows:

$$FL(d)_j = \sum_i^n b_{ij} \quad (23)$$

b_{ij} is output generated in sector j if total outlays of sector i are increased by one unit. Beyers (1976) and Jones (1976) suggested the Ghosh Method is more appropriate for direct forward linkage and in consequence, b_{ij} is row sum of Ghosh matrix. In addition, the strength of total forward linkage can be calculated by the row sum of Ghosh inverse matrix that is $(I-B)^{-1}$:

$$FL(t)_j = \sum_i^n g_{ij} \quad (24)$$

where, g_{ij} is the ijth element of Ghosh inverse matrix. The parallel to Eq. 21 power dispersion index of forward linkage is computed as:

$$\overline{FL(d)_j} = \frac{FL(d)_j}{1/n\sum_j^n FL(d)_j} = \frac{\sum_{j=1}^n b_{ij}}{1/n\sum_{j=1}^n b_{ij}\sum_{i=1}^n b_{ij}} \quad (25)$$

where, the numerator of fraction is i's forward linkage and denominator is average of all forward linkages.

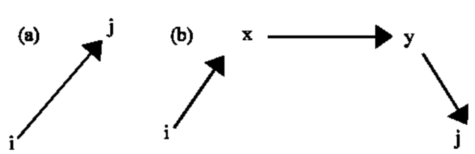

Fig. 2: Direct and indirect sector linkage

Table 13: Classification of backward and forward linkage

	Direct or total forward linkage	
Parameters	Low (<1)	High (>1)
Direct or total		
Low (<1)	Generally independent (4.5)	Dependent on interindustry demand (1)
Backward linkage	Dependent on interindustry supply (3)	Generally dependent (2)
High (>1)		

Miller *et al.* (2011) and researcher calculation

Table 14: Linkage results, Italy 2004 data

Sectors	BL (d)	BL (t)	$\overline{BL(d)}$	$\overline{BL(t)}$	FL (d)	FL (t)	$\overline{FL(d)}$	$\overline{FL(t)}$
AGR (1)	0.34	1.70	0.79	0.90	1.24	3.81	2.11	1.70
MFG (2)	0.69	2.51	1.61	1.33	0.60	2.28	1.02	1.01
Utilcon (3)	0.48	2.03	1.10	1.08	0.32	1.61	0.55	0.72
Transpocom (4)	0.37	1.69	0.86	0.89	0.47	1.96	0.80	0.87
Serv. (5)	0.27	1.51	0.63	0.80	0.30	1.57	0.51	0.70

Miller and Blair (2009) and researcher calculation

CLASSIFYING BACKWARD AND FORWARD LINKAGE RESULTS

The normalized values of forward and backward linkages of five main sectors in the economy of Italy are collected in Table 13. In case on normalized backward linkage (either direct or total) two strongest (above average) are manufacturing and utility and construction in that order. The two strongest (above average) forward linkages (either direct or total) are agriculture and mining and manufacturing sector in that order. The results are arranged in Table 13 and 14. By calculating normalized form of backward and forward linkage we are able to identify the most important sectors in economy. Any sector which has both backward and forward linkage indicators greater than one is classified as a key sector and play an important role in the development strategy of country. Linkage indicators for all sectors: agriculture and mining, manufacturing, utility and construction, transportation and communication services are classified into four zones that are summarized in Table 2×2 (Table 13). The value of the linkages are calculated for Italy's economy and summarized in Table 14.

We realized that sector (2) that is manufacturing is the key sector among Italy's industries that need special attention by the policy maker in the country. Other dependency indicators ranking are also shown.

CONCLUSION

The social accounting matrix provides a systematic framework for modeling the circular income-output flow of a region's economy (Thorbecke and Jung, 1996). In addition the most common feature of compiling this database is to provide a predictive tool for estimating policy impacts for multi-industry/multi-sectoral through the application the SAM-multipliers (Ciaschini and Socci, 2007).

The matrix structure provides useful information about the foundation of Italy's economy. A SAM data consist of all information about economic both in macro and micro level. At this study some of Italy's key macroeconomic indicator as well as "structure table" in order to identify most important part of economy are calculated and reported.

I/O multiplier and SAM multiplier provide a technique to analysis properly policy issues impacts on different sectors of economy. In fact, multiplier coefficients are able to determine which sectors have the greatest effects on economic activity and which the smallest. Among the 5 major sectors, the manufacturing Industry yields the largest output/output multiplier in closed, open and SAM models.

Regarding the linkages effects between sectors, the largest forward linkage is found for agriculture followed by other sectors, manufacturing, transportation and communication utility and construction, services; While the largest backward linkage is for the manufacturing and smallest for services. Manufacturing sector had both normalized backward and forward linkage greater than one so this sector is the key sector among Italy's industries in 2004.

The present study enables policy makers to make rational decision to gain better results by supporting and protecting-subside or decreasing tax-key sectors in the economy. However we aware that our approach may have some limitations like fixed input output coefficient, fixed technology which are extremely important thus our results need to be interpreted and used cautiously. Our recommendation for future study would therefore be modeling like Computable General Equilibrium (CGE) model that capture the supply and demand relationships between.

A variety of economic agents and institutions with prices that providing the common flow of information to coordinate the system.

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