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# Updating a Vietnam SAM 2005
# A hybrid approach

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## Abstract

The Social Accounting Matrix (SAM) is one of the most useful tools of economic research. The matrix can be used for policy analysis and economic planning, and offers an efficient means of summarizing complex economic relationships and identifying gaps in statistical information. Being an extension of the existing national economic accounts, a SAM is a consistent and complete representation of the socio-economic system that captures the interdependencies between institutional groups. It is both a conceptual framework and a data system that can support analyses of socio-economic policy issues, used to evaluate the socio-economic impact of exogenous changes, or serve as a database for general equilibrium modeling. This paper describes the construction of SAM 2005 which is constructed using the newly compiled noncompetative I-O table for 2005. In previous versions of SAM constructed for Vietnam, savings is often assumed to be equal to investment. In our new SAM 2005, this unrealistic assumption has been relaxed.

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# I. Introduction

Social account matrix (SAM) can be considered as a natural outgrowth of input-output table which is a widely used framework to provide detailed information on the flow of goods and services as well as on the structure of production costs. By extending market-based transactions of the I-O table to include nonmarket transactions, SAM of a nation or a region will track the monetary flows between industries and institutions. In fact, the input-output table is a subset of the entire SAM. The SAM accounts track all monetary flows, both market and non-market. The market flows are those between producers and consumers of goods and services. Examples of the nonmarket flows are those between households and government, government and households. These flows are often called inter-institutional transfers. As such, SAM is an useful framework for analytical presentation of economic data jointly with other relevant data—such as data on social conditions or the environment—as an integrated whole. Such presentations go beyond what is available today from published national accounting statistics. SAMs allow users of the accounts to more easily analyze socio-economic questions, to supply the information needed for policy development or to build general equilibrium models.

A SAM depicts the entire circular flow of income for an economy in a (square) matrix format. It shows production leading to the generation of incomes which, in turn, are allocated to institutional sectors. In addition, it shows the redistribution of income leading to disposable income of institutional sectors. These incomes are either spent on products or saved. Expenditures by institutional sectors lead to production by domestic industries as well as supply from imports. This format; shows in detail who pays, how much is paid, and to whom the payment is made.[2]

In the last decade, there have been several attempts to build a SAM for Vietnam resulted in SAM 1996, SAM 1997, SAM 1999 and SAM 2000. The latest I-O table on which a

[2] The terminology used within a SAM framework is somewhat different than that of an input-output model. In the I-O table, the typical term for payments to workers and profits is termed value-added while in a SAM framework, we refer to value added as payments to factors of production. The consumption of goods and services by households, government, and firms are usually refered to as final demands in an IO framework. In a SAM framework, the consuming final demand sectors are called institutions.

SAM was built for Vietnam is the I-O table in 2000. The resulting SAM was called the 2000 MacroSAM. This SAM was constructed by SNAD (GSO) and CIEM in collaboration with the Institute of Economics at the University of Copenhagen under the umbrella of the CIEM/NIAS project. This paper documents how the SAM 2005 for Vietnam was constructed. There are great differences between the old versions of SAM and SAM 2005.

1) Earlier versions of SAMs were based on S.U.T tables while SAM 2005 is based on the updated I/O 2005 table. Notably, the I-O 2005 table is a non-competitive type I-O table in which the imports are separated from the domestically produced goods. (The advantage of this source of data is discussed later on in the paper).

2) Earlier versions of SAM built for Vietnam were based on an unrealistic assumption, that is investment equal savings, $I = S$ . In this version of SAM 2005, we relax this assumption. By relaxing the restrictive assumption of previous SAM, allowing $I \neq S$ , our version of SAM 2005 certainly describes much more realistically and precisely the Vietnam's economy. In our SAM 2005, $S$ is only a part of $I$ which includes not only S but also net capital transfers and net lending.

Therefore, we believe that this version of SAM will be of a great help and a more reliable source of data for analyses of socio-economic issues. This paper documents a methodology of the construction of a Macroeconomic of Social Accounting Matrix of Vietnam in 2005. In the first part of the paper we describe how the I-O table was updated from I-O table 2003. We, in the second part, discuss the competitive and non-competitive I-O type tables. In part three of the paper, we discuss how to reconcile the differences between the import-export data provided by the Ministry of Finance and the export and import vector of the updated IO 2005.In section 4, we discuss in the details the construction of SAM 2005.

# 1. Updating I-O 2005

By construction, an IO table describes the flows among the various sectors of the economy. It represents the value of economic transactions in a given period of time. Transactions of goods and services are broken down by intermediate and final use. An I-

O table also shows the cost structure of production activities: intermediate inputs, compensation to labor and capital, taxes on production.

One of the major differences between SAM 2005 and the earlier versions of SAMs is the source of data and information. While earlier versions of SAM were based mostly on the S.U.T (supply and use tables) framework; our SAM 2005 is based on the updated I-O 2005. Thus having an updated I-O 2005 is of utmost importance.

In order to update I-O table for the year 2005, certain sources of data were used.

1) Data on Intermediate Inputs and Gross Inputs. These are taken from the "Survey on activities of enterprises", undertaken by the General Statistics Office
2) S.U.T 2003 which is available from the GSO
3) Export and Import data were provided by the Ministry of Finance
4) Balance of Payment from XXXXXXXXXXXXX
5) State budget data from Ministry of Finance

The approach of updating the I-O table for the year 2005 was derived from the following basic relations of the IO table:

$$A.X+Y=X \quad (1)$$

$$X= (I-A)^{-1}.Y \quad (2)$$

$$Y = C + G + I + E – M \quad (3)$$

$$M_i/TDD_i<1 \quad (4)$$

$$TDD_i=IC+C+G+CF \quad (5)$$

and

$$\Delta X = (I - A)^{-1}.\Delta Y \quad (6)$$

Where A is the direct input coefficient matrix
X is vector of supply or sectoral output
Y is vector of final demand
$(I - A)^{-1}$ is the Leontief Inverse, or matrix of multipliers
C is final consumption of household
G is final consumption of government
I is gross fixed capital or capital formation
E is export

M is import

$M_i$ is import of commodity i

$TDD_i$ is total domestic demand of commodity i

From these basic relations of the I-O table, the following formulas were derived with taking into account the three changes in X, namely price changes, technical changes and changes in Y (final demand) through the years (equation 7). Given the structure of the Vietnam's economy and the relatively short time break from the last updating of I-O table taken place in 2003, formula (8) was used to calculate the technical coefficient matrix A for the updated 2005 I-O table, which assumes that there was no or only small changes in prices and technical change

$$x_{ij}^{2005} = \left( \frac{x_{ij}^{2003}}{II_j^{2003}} \right) \cdot II_j^{2005} \quad (7)$$

$$x_{ij}^{2005} = \left( \frac{x_{ij}^{2003}}{GI_j^{2003}} \right) \cdot GI_j^{2005} \quad (8)$$

$$va_{kj}^{2005} = \left( \frac{va_{kj}^{2003}}{VA_j^{2003}} \right) \cdot VA_J^{2005} \quad (9)$$

Where $x_{ij}^{2005}$ is the amount of the product of sector i absorbed – as its input – by sector j in 2005

$x_{ij}^{2003}$ is the amount of the product of sector i absorbed – as its input – by sector j in 2005

$II_j^{2003}$ is an element of the vector II in 2003 or the total intermediate input in 2003

$II_j^{2005}$ is an element of the vector II in 2005 or the total intermediate input in 2003

$va_{kj}^{2005}$ is an element of the value added matrix in 2005, where k is factor of value added at factor cost

$va_{kj}^{2003}$ is an element of the value added matrix in 2003, where k is factor of value added at factor cost

$VA_j^{2003}$ is an element of the vector value added in 2003

$VA_J^{2005}$ is an element of the vector value added in 2005

These formulas were used to compute the technical coefficient matrix A and therefore the intermediate demand matrix of the IO table and the value added matrix, which is broken-down into payments to labor and capital, depreciation, and indirect taxes.

As stated above, equation (8) was used with an assumption that technological change and the change in prices have not occurred during the last two years, which we believe is a reasonable assumption. One issue with the vector GI is of course the property of this vector since it is an industry-by-industry vector. Therefore this must be recalculated to get a commodity-by-commodity vector. This could be done with the data from the S.U.T 2003 as follows:

From S.U.T 2003, the supply matrix S is taken out. This is an industry-by-commodity matrix. With a simple formula presented below, the commodity-by-commodity GI vector can be calculated

$$GI^{c}_{2005} = s'.GI^{a}_{2005} \qquad (10)$$

Where

$GI^{c}_{2005}$ is vector of gross input by commodity of the year 2005

$GI^{a}_{2005}$ is column vector of gross input by industry of the year 2005

s is coefficient matrix of S with dimension (industry x product)

s' is transpose of s with dimension (product x industry)

The use matrix of the S.U.T can be used to get the use matrix of the 2005:

$$U_{2005} = U_{2003}.GI^{a}_{2005} \qquad (11)$$

With

$U_{2003}$ is coefficient matrix of use table in 2003

$U_{2005}$ is coefficient matrix of use table in 2005

From the above formulas, now the A matrix of I-O 2005 can be computed using the following formula:

$$A = U_{2005}.s^{-1} \qquad (12)$$

With $s^{-1}$ is an inverse of matrix s (commodity technology assumption).[3]

[3] In deriving the matrix A some elements of the matrix is negative and thus should be corrected by changing it to 0. Further, to balance the I-O table, we use RAS method.

The value added matrix and the final demand matrix is left to be computed. The value added matrix can be calculated from the formula:

$$B = A.GI^{c}_{2005} \qquad (13)$$

where B is the matrix containing both the A matrix and the value added matrix.

The final demand or the Y was computed using equation (3).

As for the computation of the final demand matrix, we derive the following formula using equations (3) and (5)

$$CF_j = GO_j - IO_j - C - G - E + \left(M_j + T_j\right) \qquad (14)$$

with $IO_j$ is the intermediate output of industry j and $T_j$ is the import tax.

## 2. Competitive and non-competitive I/O tables

***Competitive I/O table:*** in the competitive I-O table the intermediate inputs include both commodities produced domestically and imported. For the purpose of analyzing the economy based on I-O tables, the competitive table is not of much use for the reasons stated above; the competitive table does not separate the intermediate inputs which are produced by domestic industries from the imported intermediate inputs. Thus the precision and the usefulness of the analysis based on the competitive table is a matter for arguing.

***Non-competitive I-O table:*** in this kind of I-O tables, the intermediate inputs are broken-down into commodities produced domestically and commodities imported from the rest of the world. In contrast to the competitive I-O table, a non-competitive table with import clearly separated from intermediate inputs produced domestically and thus with two intermediate input coefficient matrix $A^d$ (domestic A) and $A^m$ (import A) will give the users a much better picture of the economy.

Following is the indirect method to derive the non-competitive I-O table from the competitive I-O table. From the basic relations of the I-O table with equations from (1) to (6), we take the equations (4) and (5) to compute the ratio of imported goods in Total domestic demand. From this structure of imported goods in domestic demand, the intermediate input matrix can easily be achieved. The value added matrix of non-

competitive table remains the same as in the competitive table. In the final demand matrix, all the elements are different except for the export vector.

## 3. Export and Import data

The data on exports and imports provided by the Ministry of Finance were used for our SAM 2005. These data are classified according to the HS code and had to be changed to the CPC codes. At this stage, one issue arose: the export and import data of the Ministry of Finance do not coincide with the export and import vector of the updated IO 2005. Some corrections therefore had to be taken; the following section will discuss this issue in detail.

In Table 1, export data provided by the MOF is compared against the export from the I/O 2005. It is obviously from that the Table that some of the export data provided by the MOF for commodities listed below if compared with the value of Gross Input do not make sense. Take the example of the Raw rubber: the value of export alone, which is VND 11,327,976 millions exceeds the value VND 3,720,931 million of Gross Input which is defined as the sum of the value of II, C, G and E less import. Another group of commodities facing the same problem is Coffee beans.. Similarly, there are significant differences in eight other groups of commodities including: Coal, Metallic ore, Processed wood and wood products, Basic organic chemicals, Precise and optics equipment, meter (all kinds), Other special-purpose machinery, Electrical machinery, Gasoline, lubricants (already refined) that export value is higher than the total output.

On the other hand, there are commodities whose export values are underreported. An example is Sugarcane. The export value reported by the MOF is rather small, being VND 621 million. Gross output of VND 3,937,145 million many times exceeds this number. Since sugarcane is mainly used as intermediate input in sugar production, final consumption is of much less quantity so the rest must be eventually exported. Other underreported exports are also products used mostly or completely as intermediate goods in production of other final goods, including: Stone, Milk, butter and other dairy products, Sugar, refined, Other food manufactures, Chemical fertilizer, Pesticides, Processed rubber and by-products, Plastic (including semi-plastic products), General-purpose machinery, Automobiles, Other transport means, Other electrical machinery and equipment, Ferrous metals and products (except machinery equipment), Animal feeds, Electricity, gas, Communication services, Banking, credit, treasury, Education and

training, Other services. Notably the export of Electricity and gas is recorded by the MOF as zero. The fact that exporting of Gas and Electricity to Laos do not go through customs partly explains this reality. In total, there are 41 groups of commodities where the export data provided by the MOF do not coincide with the export data in the updated I/O table 2005.

**Table.1 Comparison of Export data**

| (1) | (2) | | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| **No.** | **Commodities classified in I/O table** | | **Export by MOF** | **Export in I/O 2005** | **(3) – (4)** | **GO** |
| 1 | 2 | Raw rubber | 11,327,976 | 3,475,935 | 7852041 | 3,720,931 |
| 2 | 3 | Coffee beans | 11,547,266 | 8,736,511 | 2810755 | 9,102,519 |
| 5 | 16 | Coal | 10,623,024 | 5,423,024 | 5200000 | 11,865,474 |
| 10 | 21 | Crude oil, natural gas (except exploration) | 109,322,476 | 119,157,819 | -9835343 | 121,089,757 |
| 13 | 34 | Processed seafood and by-products | 39,048,312 | 36,248,312 | 2800000 | 44,527,418 |
| 17 | 44 | Processed wood and wood products | 27,746,900 | 17,746,900 | 10000000 | 20,225,890 |
| 21 | 52 | Processed rubber and by-products | 3,110,380 | 6,110,380 | -3000000 | 12,868,285 |
| 26 | 67 | Other special-purpose machinery | 16,834,411 | 4,834,411 | 12000000 | 6,247,718 |
| 30 | 71 | Other electrical machinery and equipment | 16,978,945 | 21,478,945 | -4500000 | 26,993,088 |
| 31 | 73 | Non-ferrous metals and products | 8,558,416 | 14,058,416 | -5500000 | 24,458,805 |
| 32 | 74 | Ferrous metals and products (except machinery equipment) | 1,088,396 | 5,088,396 | -4000000 | 5,614,637 |
| 33 | 81 | Leather goods | 53,996,914 | 48,496,914 | 5500000 | 71,960,871 |
| 35 | 86 | Gasoline, lubricants (already refined) | 4,961,588 | 961,588 | 4000000 | 1,596,434 |
| 41 | 112 | Other services | 4,054,057 | 8,054,057 | -4000000 | 27,766,366 |

# 4. SAM building

In this section, the construction of the SAM 2005 will be discussed in detail. This is because constructing a SAM table is a rather complicated task and requires a deep knowledge of the SNA, the IO table, and S.U.T framework as well as different updating

and balancing methods namely the RAS method, not least the knowledge on the performance of the Vietnam's economy

The Social Accounts track the monetary flows between industries and institutions. The relation between a SAM and an I-O table is the fact that the input-output accounts are a subset of the entire social accounts recorded in a country. The social accounts track all monetary flows, both market and non-market. The market flows are those between producers of goods and services and consumers, both industrial, and non-industrial (i.e. households, government, investment, and trade). The non-market flows are those between households and government, government and households, capital and households and so on. These flows are often called inter-institutional transfers. A classical and very simple aggregate version of SAM is presented in Table 2.

**Table 2. SAM Framework expansion from S.U.T (Supply and Use tables)**

| | (1) Industry | (2 ) Commodity | (3) Factors | (4 ) Institutions | (5) Saving (Capital formation) | (6 ) ROW | (7) Total |
|---|---|---|---|---|---|---|---|
| 1-Industry | | 1x2 | | | | | 1x7 |
| 2-Commodity | 2x1 | | | 2x4 | 2x5 | 2x6 | 2x7 |
| 3-Factors | 3x1 | | | | | | 3x7 |
| 4-Institutions | 4x1 | | 4x3 | 4x4 | 4x5 | 4x6 | 4x7 |
| 5. Saving | | | | 5x4 | | 5x6 | 5x7 |
| 6-ROW | | 6x2 | | 6x4 | 6x5 | | 6x7 |
| (7) Total | 7x1 | 7x2 | 7x3 | 7x4 | 7x5 | 7x6 | |

| | |
|---|---|
| Cell 1x2 | Make matrix (producer's price) |
| Cell 2x1 | Use matrix (producer's price) |
| Cell 3x1 | Labor and capital share |
| Cell 4x1 | Tax on production |

| | |
|---|---|
| Cell 7x1 | Gross input by industry at producer's price |
| Cell 6x2 | Imports |
| Cell 7x2 | Gross output by commodity at producer's price |
| Cell 4x3 | Redistribute income (property income) |
| Cell 7x3 | Total redistribute income by factor income |
| Cell 2x4 | Household and Government consumption expenditure |
| Cell 4x4 | Income receipt from transfer by each other institutional |
| Cell 5x4 | Saving by institutional |
| Cell 6x4 | Transfer expenditure of institution to foreign |
| Cell 7x4 | Total expenditure of institution |
| Cell 2x5 | Gross capital formation by products |
| Cell 6x5 | Capital transfer |
| Cell 7x5 | Balancing of accumulation account |
| Cell 2x6 | Exports of goods and services |
| Cell 4x6 | Transfer income with foreign |
| Cell 5x6 | Capital transfer |
| Cell 7x6 | Total receipt from foreign |

| | |
|---|---|
| Cell 1x7 | Gross output by industry at producer's price |
| Cell 2x7 | Gross output by commodity at producer's price |
| Cell 3x7 | Total income from production by factor |
| Cell 4x7 | Total income by institution |
| Cell 5x7 | Balancing of accumulation account |
| Cell 6x7 | Balancing of foreign account |

In Table 2, each cell represents a sub-matrix. Rows represent an institutional or industry receipt of income. Columns represent an institutional or industry payment or expenditure. In a SAM table, rows and columns balance exactly so all flows are counted. Following is the explanation of the data contained in each cell of the above example of an aggregated SAM.

1. Industry is the industry sectors from the I/O table
2. Commodity is the commodities also from the I/O table
3. Factors include the value-added elements:
    - Types of Labor incomes (L)
    - Type of capital incomes (K)
4. Institutions include
    - Households
    - Government
    - Enterprises (basically consists of corporate profits)
    - Capital
    - Inventory
5. ROW (rest of the world)
    - imports
    - exports

Again, the building of SAM 2005 requires a certain source of data, namely:

1) Data of Intermediate Inputs and Gross Inputs are taken from the "Survey on activities of enterprises", undertaken by the General Statistics Office
2) S.U.T 2003
3) Export and Import data were provided by the Ministry of Finance
4) Balance of Payment
5) State budget
6) Updated non-competitive I/O 2005

In this SAM 2005, while the main attribute of a classical SAM remains the same. There in addition some changes. The detailed elements of the SAM 2005 are in the following table.

**Table 3. SAM 2005 expansion from I/O table**

| | (1) Commodity | (2 ) Factors | (3) Institutions | (4 ) I-S | (5 ) ROW |
|---|---|---|---|---|---|
| 1 Commodity | 1x1 | 1x2 | | | 1x5 |
| 2--Factors | 2x1 | | | 2x4 | |
| 3- Institutions | 3x1 | | | | |
| 4-Saving | | 4x2 | 4x3 | 4x4 | 4x5 |
| 5-ROW | 5x1 | | 5x3 | 5x4 | 5x5 |

From table 2 we can convert to table 3 by the following formua

$A = U.S^{-1}$

Where: A presents (1x1) matrix of table 3

U – (2x1) matrix of table 2 and S is (1x2) matrix of table 2 that is why dimension of A matrix is (commodity x commodity)

## Conclusion

In an attempt to provide a precise and reliable source of data for economic-policy making, the SAM 2005 of Vietnam was created, overcoming the weaknesses of the earlier versions of Vietnam' SAMs. This paper very briefly dealt with the construction of both an updated I-O table, namely non-competitive I-O and the SAM. The authors of SAM 2005 hopes that this version of SAM will be an useful source of reference for users of CGE modeling framework and SAM multipliers or demographic – economic analysis as well as other analyzers of Vietnam's economy in a way that is a reliable supply of the information needed for policy development..

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