The Supply and Use Table as a useful tool for improving Data Quality in Palestine

Abstract

The Supply and Use Tables (SUT) introduced in the System of National Accounts for the year 1993 (SNA 1993) are useful tools used to check the consistency of statistics on flows of goods and services on the principle that the total supply of each product is equal to its total uses. Data for the SUT collected from various sources, so the consistency between those sources is required. The balancing process in the supply and use table in Palestine was a good practice in ensuring data quality from the different data sources, and to improve data quality by adjusting the data sources based on the findings of the balancing issues.

This paper introduce the Palestinian experience in compiling and balancing the SUT for the year 2004 and how this process contributes to the consistency checks in the data, and how this tool will be the basis for improving the tools for compiling the data from its sources.

Key words: *Supply and Use Tables, SNA 1993.*

JEL Codes: E01, E16

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1. Introduction

Supply and use tables are one of the building blocks of economic accounting and a good quality assurance tool for computing reliable GDP figures and other macroeconomic aggregates. Those are a powerful tool with which to compare and contrast data from various sources and improve the coherence of economic information (System of National Accounts, SNA 2008).

As a statistical tool, SUT provide a coordinating framework for checking the consistency of economic statistics obtained from quite different kinds of statistical sources, i.e, industrial surveys, household expenditure surveys, investment surveys and foreign trade statistics. Furthermore, those tables serve as a basis for calculating the economic data in the national accounts and to detect weaknesses in the economic data.

Supply and Use tables permit the analysis of markets and industries and allow productivity to be studied at more level of disaggregation.

The SUT framework has two tables: the supply table and the use table that are closely linked together. The total supply of goods and services in the economy comprises of both domestic production or from Imports. Meanwhile, the total use of goods and services at purchasers' prices in the economy comprise of Intermediate consumption, final consumption, Gross capital formation and Exports of goods and services.

The SUT consists of a rectangular matrix broken down by industry and product, and in both tables (Supply table and Use table), products are presented as rows, and the supply of every product must equal to the use of that product when measured in the same price.

The total supply (SB) of goods and services comprises:

- Output: Domestic production of goods and services at basic prices, classified according to products and industries.
- Total imports classified by products including residents' consumption abroad.
- The adjustment columns added to obtain data at purchasers' prices (taxes less subsidies by product, trade and transport margins by product and CIF/FOB adjustments).

The total uses of goods and services comprise:

- Intermediate consumption: the value of the goods and services consumed as inputs by a process of production classified according to products and industries.
- Final consumption broken down to household final consumption expenditure, final consumption expenditure of non- profit institutions serving households (NPISH) and Government final consumption expenditure.
- Gross Capital Formation that consists of Gross fixed capital formation (GFCF) and changes in inventories.
- Exports of goods and services.

Figure 1 below shows a simplified Supply and Use table:

		Supply table			Use table						
		Products			Industries			Final Uses			
		Agricultural products	Industrial products	Services	Agriculture	Industry	Service activities	Final consumption	Gross capital formation	Exports	Total
Products	Agricultural products				Intermediate consumption by product and by industry			Final uses by products and by category			Total use by product
	Industrial products										
	Services										
Industries	Agriculture	Output of industries by product									Total output by industry
	Industry										
	Service activities										
Value Added					Value added by component and by industry						Total value added
Imports		Total imports by product									Total imports
Total		Total supply by product			Total output by industry			Total final uses by category			

◼ = not applicable

The amount of a product available for use within the economy must have been supplied either by domestic production or by imports. The same amount of the product entering an economy in an accounting period must be used for intermediate consumption, final consumption, capital formation or exports, and this is the main identity for the product balance, and in every row of the supply and use tables is a reminder of the basic identity of the goods and services account.

The supply of every product must be equal to the use of that product when measured in the same prices (purchasers' prices), and the output of an industry must be equal to its cost of production: those two principles are used in balancing the supply and use tables.

2. Advantages of compiling SUT

One of the advantages of using SUT for analysis is that the interrelationship between industries and products and the interrelationship between the different products can also be seen and not only the interrelationship between the different industries as in the traditional IO-Tables.

SUT focus on the goods and services account and enable national accounts compilers to compare data from different sources to check their consistency. In addition to that, SUT provide a mechanism that makes it possible to impute estimates of National Accounts aggregates when there are no data available directly related to that aggregate. For example, in the absence of a survey of expenditure on investment goods, it is possible to use details of the domestic production of particular types of equipment in conjunction with data on their imports to estimate GFCF expenditure on those types of equipment (Katoula, 2011).

Uses of SUT can be presented from a statistical and analytical perspective (ESCAP 2015). For a statistical perspective:

1. SUT provide a quality assurance framework for the consistent computation of GDP based on the production, expenditure and income approaches and as such enhance the quality of other important macroeconomic aggregates.
2. SUT ensure integration & coherence between the three main accounts of the system of national accounts: Goods and services accounts, production accounts and generation of income accounts.
3. It allows estimates from various official statistical and administrative data sources to be combined.

For an analytical perspective:

1. SUTs are the first building block for deriving Input-Output tables.
2. SUT inform policy making, planning and forecasting e.g budgeting and national socio- economic development plans.

In general, SUT not only help produce national accounts statistics of high quality and consistency but also facilitate integrated analysis of economic, environmental and social statistics.

3. SUT: a powerful tool for improving data quality

National statistical offices in different countries experience the importance of the introduction of SUT in improving data quality. One of the main statistical offices is the Statistics Netherlands which publish a paper "Ten years supply and use tables in the Netherlands" concluded the paper by emphasizing that the introduction of SUT was an essential part of their integration system (Nunspect &Takema, 1998).

In Palestine, SUTs were compiled on the year 1998 after 4 years of establishing the bureau. Major improvements were done by the National Accounts department taking advantage of implementing several Technical Missions to ensure adherence of the tables to the international recommendations.

The main problem was how to reconcile various sources of information in balancing consistent SUTs. Two approaches are used to compile GDP, meanwhile different sources, the statistical and non- statistical errors associated with those sources means that the totals arrived at a point that the two approaches are not consistent. The SUT framework represents a structure that enables the statistical offices to confront those sources in a coherent way, with the aim of achieving a single measure of GDP.

PCBS has produced SUTs showing detail for 74 separate industries and 95 products and has balanced the accounts at this level.

Different types of sources were used: surveys data and administrative data. The SUT show the accounts in terms of both industries and products. For products, the supply and use relationship is represented by tables clearly.

For each Product p:

Total Supply$_p$ = Total Use$_p$ such that,

Domestic Supply$_p$ + imports$_p$ + Margins$_p$ + Taxes on products$_p$ – Subsidies on products$_p$
=

Intermediate Consumption$_p$ + Final Consumption$_p$ + Gross Capital Formation$_p$ + Exports$_p$

For industries, the relationship is slightly more complicated, since it is represented in terms of Gross Value Added (GVA).

For each Industry i:

GVA (Production)$_I$ =GVA (Income)$_I$ such that,

Total Output $_I$ –Total Intermediate Consumption $_I$ = Compensation of Employees $_I$ + Mixed income $_I$ + Gross Operating Surplus $_I$ + Taxes on production $_I$ – Subsidies on production $_I$.

3.1 Data Quality tool: Treatment of VAT

One of the main areas for ensuring data quality is within the treatment of VAT. It is necessary within the SUT framework to be able to allocate VAT receipts to the products to which the tax paid accrues. However, the administrative sources used for VAT only allow the identification of the accrued VAT receipts by Government in total, i.e there is no product dimension available. So, it is necessary to impute the VAT on each product according to the framework of SUT.

VAT collection reported by the Government consist of two parts, namely VAT on imports and on locally produced goods and services. The rate of the two differ, as they were 17% and 14.5% respectively for the year 2004.

However, it is not known which products are to be charged and at what rate as often the SUT commodities are rather broad and consist of a mix of imports and locally produced items. The allocation of total VAT receipts to products within the SUT framework makes use of an estimation model. This model uses as its inputs estimates of final household consumption on which VAT is charged (since the VAT is in fact a consumption tax that is ultimately charged to the households in the products and services they buy) alongside with the rate of VAT applied from the administrative data (tax authorities). So the implied VAT of a product derived from:

VAT accrued = Expenditure at purchasers' prices * VAT rate/ (1+ VAT rate)

Those data once applied allows the production of matrices of VAT payments for intermediate consumption and final consumption; all by product. The results of summation of the imputed VAT receipts then compared with the value of VAT receipts to government which forms the overall control total for this accounts.

The preliminary calculations of VAT included in household consumption indicate that the reported household consumption of purchased goods is substantially below the values that the VAT collection imply. For 2004, the difference is apparently about 22% or $440 million.

	West Bank	Gaza Strip
Government Collection	344,584	158,686
VAT estimation, SUT	283,229	147,051
Extra VAT	61,355	11,635
Extra Consumption (Under coverage)	368,911	70,513

The VAT discrepancy found that household consumption is under- estimated, and the simplest way to adjust the data is to insert the expected missing values (pro- rated household consumption & its VAT) as expected adjustment margins" in the household sector adjustments sheet. This approach leaves the original household consumption data and only modifies the misreporting or under- reporting of Consumption to be distributed in an identical way as the reported expenditures.

3.2 Data Quality tool: Products and Industries

The amount of a product available for use within the economy must have been supplied either by domestic production or by imports. The same amount of the product entering an economy in an accounting period must be used for intermediate consumption, final consumption, capital formation or exports. This is the basic for the product balance (SNA 2008).

Output + Imports = Intermediate Consumption+ Final Consumption+ Gross Capital Formation + Exports

The compiler of National Accounts can use his judgment based on the most solid sources to reach a balance by adjusting the components as necessary. In SUT the goods and services account for the total economy is broken down in two dimensions: in the rows by products and in the columns by industry and by categories of final uses.

The above product balance identity must be applied for each product.

The main restrictions on the level of detail is the availability of the data required and the quality of the available data. The first confrontation of data is carried out by the compilers of the original data within the framework of the rows (products) in the supply and use framework. Those compilers of the balancing process can identify areas of inconsistency between various sources which can then be investigated.

Three main areas (products) were identified in the Palestinian SUT for 2004 and those lead to improve data quality.

Some of those products were related to other products which help to investigate the original data and the interrelation between them.

The process of balancing SUT reporting that Livestock, Milk and Olives were the main products with the large discrepancies, and the related products with them such as meat products, dairy products and olive oil record similar discrepancies. So, this lead to compile the balancing process taken into consideration the interrelationship between those products.

3.2.1 Over Supply of Livestock

The unbalanced SUT has a large over- supply of livestock and a large under supply of the product of the slaughtering industry. So, referring to the product balances identity this could be presented as follows:

The supply and Use of Livestock Product:

Supply		Use			
Output	185,234 $	Intermediate Consumption	25,967 $		
Imports	23,415 $	Final Consumption	22,687 $		
TTM	18,884 $	GCF	-		
Other Changes*	1,287 $	Change in Inventories	346 $		
		Exports	52 $		
Total Supply	**228,820 $**	**Total Use**	**49,052 $**	**= Discrepancies**	**179,768 $**

(subtraction symbol shown between Total Supply and Total Use)

* Other changes refer to changes for the purchasers prices.
Values in USD thousands

Balancing this product needs the corresponding product related to its which is the Meat product.

The supply and use of the Meat product presents the opposite picture, since the use of meat is higher than the supply of it. Those discrepancies call for reviewing the data from its sources to check the accuracy of both the original data and its classifications.

The supply and Use of Meat Product:

Supply		Use			
Output	17,104 $	Intermediate Consumption	1,943 $		
Imports	14,087 $	Final Consumption	290,104 $		
TTM	49,457 $	GCF	-		
Other Changes*	7,570 $	Change in Inventories	131		
		Exports	1,542 $		
Total Supply	**88,218 $**	**Total Use**	**293,720 $**	**= Discrepancies**	**-205,502 $**

(subtraction symbol shown between Total Supply and Total Use)

Returning back to the Agricultural and Economic Survey data it was noticed that the livestock production don't match with the intermediate consumption of livestock, and the production of meat didn't take into consideration the slaughtering activity. This investigation argue that the problem resulted from the classification of slaughtering activity since most of the slaughtering activities classified in the economic surveys as trade activity meanwhile it is an industrial activity. This misclassification leads to under reporting in the production of meat under the industrial activity and the intermediate consumption of livestock.

Reallocating of the discrepancies between both livestock and meat product leads to the following balancing results:

Livestock Product:

Allocating the discrepancy of (179,768 $) to the intermediate Consumption:

Supply		Use		
Output	185,234 $	Intermediate Consumption	25,967 $	**+ 179,768 $**
Imports	23,415 $	Final Consumption	22,687 $	
TTM	18,884 $	GCF	-	
Other Changes*	1,287 $	Change in Inventories	346 $	
		Exports	52 $	
Total Supply	**228,820 $**	**Total Use**	**228,820 $**	**= Discrepancies**	**-**

Meat Product:

Allocating the discrepancy of (205,502 $) to the output item.

Supply		Use		
Output	17,104 $	Intermediate Consumption	1,943 $	
	+ 205,502			
Imports	14,087 $	Final Consumption	290,104 $	
TTM	49,457 $	GCF	-	
Other Changes*	7,570 $	Change in Inventories	131	
		Exports	1,542 $	
Total Supply	**293,720 $**	**Total Use**	**293,720 $**	**= Discrepancies**	**-**

3.2.2 *Milk and Dairy Products: Attempts to measure the household enterprises' activities*

Household enterprises are important in the Palestinian economy since those create an employment opportunity and contribute to the production activities.

Measuring those activities for the household enterprises is not always obvious, therefore Supply and Use Tables try to capture those activities based on the implications of each activity, and the knowledge about the share of household enterprises in each activity.

Production of dairy products is one of the major industries where the household enterprises perform. The supply and use components of both the Milk product and the Dairy products and the interrelation between those two products lead to better understanding of the role of household enterprises in this regard.

The following tables show the supply and use for both Milk and Dairy Products:

The supply and Use of Milk Product:

Supply		Use			
Output	91,085 $	Intermediate Consumption	14,000 $		
Imports	-	Final Consumption	5,258		
TTM	5,351	GCF	-		
Other Changes*	-	Change in Inventories	-		
		Exports	-		
Total Supply	**96,436 $**	**Total Use**	**19,258 $**	**= Discrepancies**	**77,178 $**

The supply and Use of Dairy Products:

Supply		Use			
Output	35,426 $	Intermediate Consumption	For Dairy: 7,800 $ Others: 5,369 $		
Imports	26,147 $	Final Consumption	98,536 $		
TTM	17,862 $	GCF	-		
Other Changes*	8,702 $	Change in Inventories	718 $		
		Exports	2,822 $		
Total Supply	**88,137 $**	**Total Use**	**115,245 $**	**= Discrepancies**	**-27,108 $**

One of the calculations that was done is estimating the input/ output ratio of milk and dairy products. The results show large production of milk with small proportion being used as intermediate consumption for producing dairy and other products.

On the other hand, there is underestimate of the production of dairy products since it covers only the production of industrial enterprises registered under the annual economic surveys without taking into consideration the production of the household enterprises.

Discussion with data sources and specialists in the Palestinian economy suggest that the intermediate consumption of milk shall be increase by the amount of discrepancy to match the input/ output ratio and to cover the inputs used by the household enterprises.
Otherwise, the production of dairy products have to be increased by the amount added to the inputs of milk to be matched as an input/ output ratio also to the dairy products within the production of the household enterprise for dairy products.

Additional discrepancies were reallocated to the remaining components of the use side of the dairy product according to the share of them in the total use.

The following are the balancing results for both the Milk and Dairy Products:

Milk Product:

Adding the discrepancy of (77,178 $) to the intermediate Consumption for dairy products industry as an inputs for the Household Enterprises:

Supply			Use			
Output	91,085 $		Intermediate Consumption	14,000 $	**+ 77,178 $**	
Imports	-		Final Consumption	5,258		
TTM	5,351		GCF	-		
Other Changes*	-		Change in Inventories	-		
			Exports	-		
Total Supply	**96,436 $**	**-**	**Total Use**	**96,436 $**	**= Discrepancies**	**-**

Dairy Products:

Adding the above discrepancy of (77,178 $) to the output item as an output for the household Enterprises, and the remaining discrepancy to be reallocated to the components of the use side based on their share from the total use.

Supply			Use			
Output	35,426 $		Intermediate Consumption	For Dairy: 7,800 $ Others: 5,369 $	**+ 3,975 $** **+ 2,762 $**	
	+77,178 $					
Imports	26,147 $		Final Consumption	98,536 $	**+ 41,796 $**	
TTM	17,862 $		GCF	-		
Other Changes*	8,702 $		Change in Inventories	718 $	**+ 356 $**	
			Exports	2,822 $	**+1,181 $**	
Total Supply	**165,315 $**	**-**	**Total Use**	**165,315 $**	**= Discrepancies**	**-**

3.2.3 *Olives and Olive oil products: Double check process*

Data for olives comes from the agricultural statistics for the quantity of production of olives, meanwhile the main source for the data about olive oil is an annual survey that covering the olive presses operating in Palestine and provide data about the pressed olive quantities and quantity of extracted olive oil on daily basis. This survey was implemented on the basis of a comprehensive census of all statistical units (olive presses) and therefore this survey is free of statistical sampling errors (Olive Presses Survey, 2004).

The quantity of production for the olives from the agricultural statistics recorded 128,000 tons that were produced during the year 2004, meanwhile the olive presses survey showed that 90,000 tons were used as intermediate consumption to produce olive oil. This was a useful approach to double check the consistency of the data within the Supply and Use tables.

Assuming that the remaining production of olives go directly to the households, so any discrepancies could be checked and under coverage of data shall be estimated.

The following tables show the supply and use for both olives and olives oil:

The supply and Use of Olives Product:

Supply		Use		= Discrepancies	28,688 $
Output	107,564 $	Intermediate Consumption	For producing olive oil: 75,566 $		
			Other Industries: 576 $		
Imports	139 $	Final Consumption	3,276		
TTM	593 $	GCF	-		
Other Changes*	-	Change in Inventories	-		
		Exports	190 $		
Total Supply	**108,296 $**	**Total Use**	**79,608 $**	**= Discrepancies**	**28,688 $**

(Total Supply) **-** (Total Use)

The supply and Use of Olive oil Product:

Supply		Use		Supply is larger than Use	
Output	80,167 $	Intermediate Consumption	2,800 $		
Imports	209 $	Final Consumption	55,078 $	*Supply is larger than Use*	
TTM	6,742 $	GCF	-		
Other Changes*	2,360 $	Change in Inventories	15,000 $		
		Exports	9,258 $		
Total Supply	**89,478 $**	**Total Use**	**82,136 $**	**= Discrepancies**	**7,342 $**

(Total Supply) **-** (Total Use)

The above tables show the balancing issues for both the olives and the olive oil. All data sources were checked and the data was correct, this leads us to try to find other sources for absorbing this discrepancy.

The above supply and use tables were for West Bank (one of the two regions in Palestine), meanwhile the other region in Palestine which is Gaza Strip has less production of olive oil due to the limitation of growing olives at that region. Those limitations lead us to check the supply and use tables for this region to try to find the gaps there, and the balancing issues for Gaza strip showed the opposite story than West Bank, since in Gaza Strip more olive oils were used without having the main sources for that production, and this means that this consumption comes from other sources outside the Strip and mainly from West Bank which have large production of olive oil more than what it was consumed.

The following are the Supply and Use tables for olive oil in Gaza Strip:

The supply and Use of Olive oil Product in Gaza Strip:

Supply		Use			
Output	4,758 $	Intermediate Consumption	500 $	*Use is larger than Supply*	
Imports	-	Final Consumption	18,623 $		
TTM	-	GCF	-		
Other Changes*	3,329 $	Change in Inventories	-		
		Exports	-		
Total Supply	**8,087 $**	**Total Use**	**19,123 $**	**= Discrepancies**	**-11,036 $**

The above balancing process for Olive oil product for both regions recorded an intra trade between both West bank and Gaza Strip of about (7,342 $). This absorb and solve the problem of discrepancy in both regions for Olive oil product.

As for the olives, and since there are 38,000 tons (out of 128,000 tons) went to the households, so the discrepancy was absorbed by assuming that part of it (around 2,000 $) will be for the households spent as gifts to their families, meanwhile the remaining (26,688 $) was an inputs for the household enterprises. Those inputs were calculated based on the value equation where:
Value= Price * Quantity
(Price 0.702 $ * Q 38,000)= 26,688 $

The following are the balancing results for both the olives and olive oil Products:

Olives Product:

Adding the discrepancy of (26,688 $) to the intermediate Consumption for producing olive oil by the Household Enterprises and the remaining of (2,000 $) as gifts:

Supply		Use			
Output	107,564 $	Intermediate Consumption	For producing oil: 75,566 $	**+For Household Enterprises: 26,688 $**	
			Other Industries: 576 $		
Imports	139 $	Final Consumption	3,276	**+ Gifts of 2,000 $**	
TTM	593 $	GCF	-		
Other Changes*	-	Change in Inventories	-		
		Exports	190 $		
Total Supply	**108, 296 $**	**Total Use**	**108,296 $**	**= Discrepancies**	**-**

Olive oil Product:

Adding the discrepancy of (7,342 $) as an intra trade between both West Bank and Gaza Strip.

Supply		Use		
Output	80,167 $	Intermediate Consumption	2,800 $	**+ Intra trade with Gaza Strip by 7,342 $**
Imports	209 $	Final Consumption	55,078 $	
TTM	6,742 $	GCF	-	
Other Changes*	2,360 $	Change in Inventories	15,000 $	
		Exports	9,258 $	
Total Supply	**89,478 $**	**Total Use**	**89,478 $**	**= Discrepancies**	**-**

(Total Supply **89,478 $** - Total Use **89,478 $** = Discrepancies **-**)

4. Conclusion

The Supply and Use Tables (SUT) are useful tools used to check the consistency of statistics on flows of goods and services on the principle that the total supply of each product is equal to its total uses.

For many countries the introduction of SNA'2008 implies the importance of the supply and use tables as an essential part of their integration system.

The main conclusions that can be drawn from the Palestinian experience in balancing the Supply and Use tables are the following: First, balancing process contributes to better estimates as well as better quality and consistency. Second, the supply and use tables represent very clearly the available source data in an integration framework and provide a better quality control system for the data from its sources and makes it easier to analyze the results and check the consistency.

Balancing procedure can be done manual or automatic. The manual method is the preferred to ensure utmost reliability of the estimates taking into account the quality of the various source data. Large discrepancies between supply and use of a product are analyzed and subject to discussions between the National Accountants and the data sources specialists.

The national accountant normally does not change data on domestic output, but find solutions by cooperation with the concerned specialists, and the results also are checked by the specialists to see if the results are acceptable.

Finally, Supply and Use Tables not only help produce national accounts statistics of high quality and consistency but also facilitate integrated analyses of economic, environmental and social statistics.

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