

ANNEX

INTRODUCTION TO SOCIAL ACCOUNTING MATRICES

Social Accounting Matrices (SAM) present macroeconomic data in a matrix framework, i.e. in single entries. This way of data representation enables to see in a single matrix the interaction between production, income, consumption, taxes and transfers, investments and savings. Usually macroeconomic data used are from national accounts, however, other sources such as, for example, input-output tables, balance of payments, general government finances and other data are also employed. Thus, to compare with national accounts or input-output tables, a SAM covers more information about transactions in an economy and institutions and sectors realising these transactions. A SAM provides information about a country's economic and social structure within a particular time period (usually a particular year).

A SAM is represented in the form of a square matrix with rows and columns in which the same accounts (institutions and sectors) are indicated. Incomings are indicated as receipts for the row accounts and outgoings – as expenditure for their column accounts. Totals for corresponding rows (receipts) and columns (expenditure) must be equal for a given account in a SAM, as they are obtained from macroeconomic identities. For example, disposable household income is equal to the sum of their current consumption, paid up taxes, investments and net savings. Due to this characteristic of SAM, in matrix of $n \times n$ size it is possible to have in account $n-1$ a residual variable that balances the account. This is based on the law of the 19th century economist Leon Walras: if there is equilibrium in market $n-1$, market n will also be in equilibrium. This characteristic of SAM assists in trying to assess hardly measured economic variables, for example, “mixed income” the major part of which is composed of undeclared personal income earned in the shadow economy.

The matrix framework allows seeing the economic structure and simplifies data processing: a transaction between two economic entities is reflected only by one entry because income of one entity is expenditure of the other. The System of National Accounts uses the double entry system: the transaction value is reflected as debit in the account of one entity and as credit – in the account of the other entity. Moreover, the matrix framework enables an easier usage of macroeconomic data in a mathematical simulation.

The number of accounts used in a SAM depends on the purpose of the SAM formation. For example, in case of a deeper insight into public finances, one general government account may be insufficient due to over-generalised information. Therefore, SAM can be extended to include additional rows (and columns, correspondingly) by disaggregating the general government account into, for example, the accounts of central government, local government and State Social Security Funds. In general, however, the SAM most often covers 6 main groups of accounts: goods, capital, institutions (i.e. households, enterprises, and general government), net saving, rest of the world, and production activities (see Table A). Usually, the elements of the net saving account are residual, which balance out institutional accounts.

Example of the SAM structure

This section presents an example of the SAM structure, on the basis of which it is possible to construct a table of nominal current economic flows. Every account has the following main income and expenses (see Table A):

1. **Household (H)** income consists of wages and mixed income, also of payments of the state social security system to households; they get dividends from enterprises, and from abroad – labour income and workers' remittances (emigrant transfers). From gross income they pay the personal income tax, social security and health insurance taxes. The remaining disposable income is allocated to final consumption, household investments (acquisition of a new housing) and net saving (or borrowing in case net saving is negative).
2. **General government (G)** income is mainly income from various taxes and transfers from the EU. Expenses consist of social payments, public sector consumption and investment, also of interest payments for the public internal and external debts, other transfers to the rest of the world (e.g., taxes to the EU). As the entire support from the EU is administered by the state, transfers of the EU funds to the private sector are also paid out from this account. Gross income and expenses are balanced by the general government budget balance in the net saving (S-I) account: if it is negative, the budget will be in deficit, and vice versa.
3. **Enterprises account (F)** in this SAM sample is separated from the production activities (A) account that shows the structure of the total output and value added as well as factors of output demand. Companies receive retained earnings, capital depreciation deductions (comprising a non-cash production expenses) and government transfers (e.g., EU support). These receipts are used for the payment of the profit tax and taxes on assets, for real investments (including investments into inventories), while the rest of the world is paid interest on foreign loans. The remaining amount refers to enterprise savings invested into financial assets.

Table A. Example of the SAM

		1. Goods account	2. Capital account	3. Institution account			4. Net saving account	5. Rest of the world account	6. Production activities account
		C (final consumption)	K (capital)	G (general government)	H (households)	F (enterprises)	S-I (net saving)	ROW (rest of the world)	A (activities)
1. Goods account	C (final consumption)				Final consumption				
2. Capital account	K (capital)								Gross profit
3. Institution account	G (general government)	Taxes (VAT, excises)	Taxes (on dividends)		Taxes (PIC, social and health insurance taxes of employees)	Taxes (on profits, assets)		Current transfers of the EU funds	Taxes (social insurance contributions of employers)
	H (households)		Dividends	Social security transfers				Workers' remittances Labour income	Wages Mixed income
	F (enterprises)		Retained earnings	Current transfers of the EU funds Interest on the domestic debt					Use of capital (depreciation)
4. Net saving account	S-I (net saving)			General government balance	Household saving	Enterprise saving		Current account deficit	
5. Rest of the world account	ROW (rest of the world)		Dividends and reinvestments of foreign capital enterprises	Interest on the external debt Taxes to the EU		Net payments on foreign loans			Imports
6. Production activities account	A (activities)	Consumption at basic prices		Public consumption and investment	Household investment (acquisitions of new housing)	Enterprise investment, changes of inventories		Exports	Intermediate consumption

4. **Production activities (A)** receive income (excluding consumption taxes, which go to general government) earned from the sale of final consumption goods and services to households (including household investment into housing), also they get income from the exports, the sale of intermediate consumption and capital goods to enterprises, and government current consumption and fixed investment. Costs of production activities cover intermediate consumption, imports and value added comprised of wages, a share of social security tax paid by employers, mixed income, capital depreciation and gross profit.
5. **Capital (K)** account refers to distribution of gross profit of enterprises. In the form of dividends it is distributed to households and non-residents, general government receives profit tax, taxes on dividends and assets, while retained earnings remain in enterprises (in foreign capital companies such profit is called reinvestments).
6. **Household consumption (C)** account refers to the distribution of expenses incurred on sales of consumer goods and services: consumption taxes (VAT and excises) go to the general government, and the rest excluding consumption taxes – to production activities.
7. Income received by **the rest of the world (ROW)** comprise of production activities' expenses on imported goods, reinvestments and dividends paid by foreign capital enterprises, general government payments for the public debt and transfers to the EU budget. The rest of the world pays to the activities for goods exported from Lithuania, it makes current transfers from EU funds (mainly – subsidies to farmers), workers' remittances and labour income of those who temporarily departed from the country. The difference between the rest of the world current income and expenses refers to the balance of current account (CAB). A positive figure means a negative CAB of Lithuania. In other words, Lithuania uses foreign savings to finance current account deficit.

Example of the SAM application

The SAM can be used not only for a general understanding of the country's economic structure and a presentation of statistical data but also for the analysis of economic shocks and political changes. Although in performing an analysis an expert assessment aspect is important, the matrix structure introduces limitations on performed calculations and helps to avoid lapses in analysing both a direct and indirect shock impact on the entire economic system.

Among the practical application possibilities of the SAM is the analysis of the impact of fiscal policy decisions on the country's economy and general government budget balance. For example, according to the Government of the Republic of Lithuania Resolution on insured income of 2012¹⁰, retirement and work disablement pensions are planned to be restored this year. According to the Ministry of Finance calculations, this would increase expenses of the State Social Insurance Fund (SODRA) by about LTL 0.5 billion¹¹.

The SAM enables to evaluate both direct and indirect impact of this decision on the general government budget balance and GDP. When the SAM is applied for the analysis of the public finances, it is useful to expand general government (G) and production activities (A) accounts for a more detailed presentation of the real flows in these accounts. Besides, some accounts (e.g., rest of the world) can be simplified because fiscal policy decisions have no influence on a part of the flows. Table B represents an expanded and simplified SAM, where the government account is broken down into two accounts – central government and local government (hereinafter referred to as government) account and the SODRA account, while the production activities account is disaggregated into private and public activities. The entries of SAM, which were insignificant to the analysis, were eliminated.

The income and expenditure in the government (GN) and SODRA (GS) accounts are calculated separately. In other words, if the majority of taxes (VAT and excises, personal income, profit and other taxes) are directed to the national budget, the SODRA budget receives the social security contribution shares of the households and employers (the latter is paid up by production activities). The same principle is applied to separate the budget expenses. It should be noted that after the breakdown of the general government (G) account into two parts, the row of net saving (S–I) refers to the national and SODRA budgets separately, and their sum represents the general government budget balance.

The expansion of the private activities account into private activity (AP) and public activity (AG) accounts permits to disaggregate the compensation of employees received by households of private and public sectors. The employees' share of the social contributions paid by the private and public sectors to the SODRA budget is calculated pro rata¹².

The aim of the analysis is the balance of income and expenses in all accounts. The introduction of economic shock into the initial balanced SAM imbalances the table (i.e. differences between income and expenses emerge in individual accounts). When assessing economic processes triggered by the primary shock, the SAM accounts are balanced for income to be again equal to expenses. Thus a new entirely balanced matrix is obtained.

¹⁰ The Government of the Republic of Lithuania Resolution No. 1535 on the approval of current insured income of 2012, 28th December 2011.

¹¹ Ministry of Finance "2012 state expenditure by areas", 21st December 2011, <http://www.finmin.lt/web/finmin/2012islaidos>

¹² Households also receive mixed income from production activities. In order to separate mixed income from the wage fund, the former was relocated to the capital account, i.e. both gross profit and mixed income became the income of the capital account, while mixed income and dividends paid to households became the expenses of the capital account.

Table B The initial SAM in 2010 (LTL billions)¹³

	C	H	K	F	GN	GS	ROW	S-I	AP	AG	Total income
C		63.2									63.2
H			28.8		1.9	12.3			20.5	10.5	74.1
K									32.0		32.0
F			3.2						10.0		13.2
GN	10.8	4.6		0.5					0.3		16.1
GS		2.2							6.4	3.3	11.8
ROW									65.8		65.8
S-I		2.5		3.0	-6.1	-0.5	1.0				0.0
AP	52.4	1.5		9.7	1.7		64.8			4.8	134.9
AG					18.6						18.6
Total expenses	63.2	74.1	32.0	13.2	16.1	11.8	65.8	0.0	134.9	18.6	
Total income	63.2	74.1	32.0	13.2	16.1	11.8	65.8	0.0	134.9	18.6	
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	General government budget balance				-6.6						
	General government income				28.0						
	GDP by expenditure approach				93.7						

Note: the row "Total income" is identical to the column of the same name and is used only for the sake of convenience – to see more easily the difference between income and expenses. Rounding errors can occur in the row "Difference" of this and other tables.

A detailed example of the analysis is provided below. The initial economic shock is half billion litas increase of SODRA payments due to the planned restitution of pension payments to the level of 2009. Then the direct and indirect impact of this shock on other economic variables, in particular on general government budget balance and GDP, is assessed.

- Higher pension benefits result in the increase of the social security (GS) transfers to households (H) by LTL 0.5 billion (from LTL 12.3 bn to LTL 12.8 bn). It should be noted that in this analysis the government accounts are always in balance because any mismatch between income and expenses in government accounts is automatically balanced by the corresponding budgets (row S-I). In the case of an increase of social security (GS) expenses, the budget deficit of this fund was also increased automatically by the same amount (from LTL 0.5 bn to LTL 1.0 bn).
- Larger pension benefits increase total household (H) income. This results in a gap of LTL 0.5 billion between household income and expenses (Table C).

Table C. SAM balancing after the increase in SODRA expenses due to the restitution of pensions (LTL bn)

	C	H	K	F	GN	GS	ROW	S-I	AP	AG	Total income
C		63.2									63.2
H			28.8		1.9	12.8			20.5	10.5	74.6
K									32.0		32.0
F			3.2						10.0		13.2
GN	10.8	4.6		0.5					0.3		16.1
GS		2.2							6.4	3.3	11.8
ROW									65.8		65.8
S-I		2.5		3.0	-6.1	-1.0	1.0				-0.5
AP	52.4	1.5		9.7	1.7		64.8			4.8	134.9
AG					18.6						18.6
Total expenses	63.2	74.1	32.0	13.2	16.1	11.8	65.8	0.0	134.9	18.6	
Total income	63.2	74.6	32.0	13.2	16.1	11.8	65.8	-0.5	134.9	18.6	
Difference	0.0	0.5	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	
	State social security (GS) expenses are increased due to larger pension benefits.										
	The increase in household (H) income opens a gap between income and expenses of this account.										

- To simplify the analysis in the case of the private consumption, the household saving ratio is assumed to remain unchanged. Therefore, the household consumption is increased by the total difference between income and expenses observed in Table C (LTL 0.5 bn).

¹³ The annual data for 2011 is still unavailable, thus data of earlier years is used for the analysis. It should also be mentioned that data for 2010 is not precise due to the SAM simplification. However, insignificant approximations do not influence the final results of the analysis as long as the used data reflect the general economic structure.

4. After increasing the final consumption of goods and services, a multiplier process takes place. First, there is a change in the collection of consumption taxes and in sales income earned by private activities. Second, the private activities, in their turn, increase expenses, and so on. When balancing the economic system in this way, other entries of the table change; however, the main changing variable remains to be household consumption. Final results of the analysis are provided in Table D.

Table D. *Balanced SAM after the increase of social payments (LTL bn)*

	C	H	K	F	GN	GS	ROW	S-I	AP	AG	Total income
C		63.8									63.8
H			28.9		1.9	12.8			20.6	10.5	74.8
K									32.1		32.1
F			3.2						10.0		13.2
GN	10.9	4.6		0.5					0.3		16.3
GS		2.2							6.4	3.3	11.9
ROW									66.1		66.1
S-I		2.5		3.1	-5.9	-1.0	1.3				0.0
AP	53.0	1.5		9.7	1.7		64.8			4.8	135.5
AG					18.6						18.6
Total expenses	63.8	74.8	32.1	13.2	16.3	11.9	66.1	0.0	135.5	18.6	
Total income	63.8	74.8	32.1	13.2	16.3	11.9	66.1	0.0	135.5	18.6	
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	General government budget balance				-6.9 (-6.6 before simulation)						
	General government income				28.1 (28.0 before simulation)						
	GDP by expenditure approach				94.1 (93.7 before simulation)						

When comparing Table B and Table D, differences of separate entries indicate the impact of the increase of pension benefits on respective economic indicators. In general, the results show that an increase in social benefits by LTL 0.5 billion worsen the overall government budget balance by approximately LTL 300 million (to LTL 6.9 bn). Thus, a total impact on the general government budget balance is smaller than the initial amount of a half billion, because with an increase of general government expenses, its income grows simultaneously (by almost LTL 170 m to LTL 28.1 bn). The decision to increase pension benefits also positively affects nominal GDP (by approximately LTL 400 m to LTL 94.1 bn). The estimated elasticity of general government budget balance to GDP is 1.2, i.e. if the government budget balance would deteriorate by LTL 1 billion because of such decision, the nominal GDP would grow by LTL 1.2 billion.

Different economic impact would have a fiscal policy decision to increase the public sector wage fund instead of pension benefits. This is related to the fact that wages are a component of value added. Thus the analysis of higher public sector wage impact on economic variables is presented for the sake of comparison. As before, the initial economic shock is an increase of the wage fund in the public sector by half million litas, and Table B is used as the initial SAM.

1. The public sector wage increase would result in higher public activity (AG) expenses both on the wages (increase from LTL 10.5 bn to LTL 10.9 bn) and contributions to SODRA (from LTL 3.3 bn to LTL 3.4 bn), by LTL 0.5 billion in total. Income of this activity (AG) also grows by a respective amount (from LTL 18.6 bn to LTL 19.1 bn). After these modifications the public activity account (AG) remains balanced because both its income and expenses rise by LTL 0.5 billion.
2. As mentioned before, general government (G) accounts are always in balance due to automatically adjusting budget balances (row S-I). In other words, after a half billion increase of public activity (AG) income (this corresponds to government (GN) expenses on the public activity), the national budget deficit expanded by the same amount (from LTL 6.1 bn to LTL 6.6 bn). Simultaneously, when the public sector paid more social security contributions paid by employers, the SODRA budget deficit improved (from LTL 0.5 bn to LTL 0.4 bn).
3. The additional income of the household account (H) results in increased taxes paid to the general government budget. Again, general government accounts (GN and GS) are balanced automatically: the national budget improves due to the personal income tax and the SODRA budget becomes better because of a share of social contributions paid by employees. However, the gap between household income and expenses remains (Table E).

Table E. SAM balancing after the increase in public wage fund (LTL bn)

	C	H	K	F	GN	GS	ROW	S-I	AP	AG	Total income
C	63.2										63.2
H		28.8			1.9	12.3			20.5	10.9	74.5
K									32.0		32.0
F			3.2						10.0		13.2
GN	10.8	4.7		0.5					0.3		16.2
GS		2.2							6.4	3.4	12.0
ROW									65.8		65.8
S-I		2.5		3.0	-6.5	-0.3	1.0				-0.3
AP	52.4	1.5		9.7	1.7		64.8			4.8	134.9
AG					19.1						19.1
Total expenses	63.2	74.1	32.0	13.2	16.2	12.0	65.8	0.0	134.9	19.1	
Total income	63.2	74.5	32.0	13.2	16.2	12.0	65.8	-0.3	134.9	19.1	
Difference	0.0	0.3	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	
	Public activity (AG) expenses are increased through the public wage fund and contributions to SODRA.										
	After an increase of household (H) income, households pay more taxes to general government; however, a gap between income and expenses of their account (H) remains.										

4. The same principles and assumptions as those used in the case of higher social benefits are applied in the analysis. Due to a constant household saving ratio assumption, private consumption is increased by the total difference of income and expenses observed in Table E (LTL 0.3 bn). Furthermore, similar to the previous case, a multiplier process takes place. Below are final results of the analysis.

Table F. Balanced SAM after the increase of the public wage fund (LTL bn)

	C	H	K	F	GN	GS	ROW	S-I	AP	AG	Total income
C	63.6										63.6
H		28.9			1.9	12.3			20.6	10.9	74.6
K									32.1		32.1
F			3.2						10.0		13.2
GN	10.8	4.7		0.5					0.3		16.3
GS		2.2							6.4	3.4	12.0
ROW									66.0		66.0
S-I		2.5		3.0	-6.5	-0.3	1.2				0.0
AP	52.7	1.5		9.7	1.7		64.8			4.8	135.3
AG					19.1						19.1
Total expenses	63.6	74.6	32.1	13.2	16.3	12.0	66.0	0.0	135.3	19.1	
Total income	63.6	74.6	32.1	13.2	16.3	12.0	66.0	0.0	135.3	19.1	
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	General government budget balance				-6.8 (-6.6 before simulation)						
	General government income				28.3 (28.0 before simulation)						
	GDP by expenditure approach				94.4 (93.7 before simulation)						

According to the obtained results, a half billion litas increase of the wage fund in the public sector expands the general government deficit by LTL 200 million (to LTL 6.8 bn). The reason of lower than the initial impact is the increase in the collection of public income (by LTL 300 m to LTL 28.3 bn), which is rather similar to the results of the social benefit increase. The results, however, are different in the case of nominal GDP as it increases by almost LTL 760 million (or 0.8%). The estimated elasticity of the general government budget balance to GDP is 3.6; in other words, if the general government budget deficit would expand by LTL 1 billion due to the rise in public sector wages, nominal GDP would increase by approximately LTL 3.6 billion.

A comparison of both analysed cases reveals that the public sector wage changes have a substantially stronger effect on the economy than the changes of social benefits. Thus, similar at first glance fiscal policy decisions may result in different economic consequences. This is immensely important in planning fiscal consolidation measures. For example, taking into account the results of SAM analysis, the attempts to reduce general government budget deficit by LTL 1 billion would decrease Lithuania's GDP by approximately LTL 1.2 billion in case of a decision to reduce social benefits. A decision to reduce public sector wages would have a substantially stronger impact on country's GDP of about LTL 3.6 billion. Therefore, when planning to take value-related decisions, official authorities have to envisage these consequences and take them into account.