Comparative Economic Research, Volume 17, Number 3, 2014
10.2478/cer-2014-0027

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Important Structural Linkages In The Process Of Income Circulation Defined By SAMs[1]

Abstract

The main aim of this paper is to present the analytical possibilities offered by Social Accounting Matrices as regards economic policy. These matrices are synthetic presentations of income flows in the economy, described by the international statistical system - System of National Accounts (SNA). Comparative analyses presented in the paper are based on the structure of transactions observed in SNA for three years (2002, 2007, 2012) for selected countries (Germany, Spain, Poland, Bulgaria). The analysis includes a comparative study of the expenditure and income structure of individual institutional sectors, SAM multipliers as an important analytical tool, and the importance of SNA transactions, evaluated by how their changes influence multipliers.

Keywords*: national accounts, structural similarity coefficients, input-output methods, multipliers*

1. Introduction

In today's information society and global world, the amount of information describing social and economic phenomena is rapidly increasing. The role of

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[1] This paper was developed under the project financed by Polish Science Center no. DEC-2012/07/B/HS4/02928 "Determinants of the development of the Polish economy in the twenty-first century.Empirical analysis and projections based on system of macroeconomic models."

statistics has grown significantly, both as a science concerning mass phenomena research methods and as a methodology of collecting and presenting data.

There is no doubt that any international comparisons must be based on data of the same analytical-cognitive value, regardless of the country. Collecting comparable data is guaranteed by the System of National Accounts, which complies with international statistical norms (SNA, *System of National*… 2009), applied in market or similar economies, and mandatory in all UN member countries. The obligatory system for EU states is the European System of National and Regional Accounts ESA'95 (see e.g. *Europejski System*… 2000). The linkages between individual accounts, presented as a system of national accounts, can take on the matrix form. The Social Accounting Matrix (SAM), also known as the national accounts matrix, is a synthetic presentation of income flows in the economy.

The main aim of this paper is to present the analytical possibilities offered by SAMs, and by the multipliers based on them, mostly as regards economic policy (Round 2003). An attempt has been made to show those linkages of institutional sectors in the process of income distribution whose changes significantly affect the multiplier values. Important linkages in selected countries have been compared for selected years, considering impulses coming from arbitrarily chosen accounts. In addition, changes in the expenditure and income structure were compared, i.e. the share of certain forms of transactions in the overall number of transactions in a given sector. Comparative analysis is based on the shares observed for three years in selected countries. Therefore, it may be treated merely as a certain signal for evaluating the changeability of these coefficients in a given country, while a more thorough study, which we conduct here, must be based on matrix time series. The examination of important linkages is also only an illustration of the problem, as it refers to three selected years and a chosen set of accounts, called exogenous accounts, where changes of expenditures cause changes on the remaining accounts, described as endogenous.

The main objective of the paper does not refer to specific areas of economic policy. Such a task would require building a SAM, which would make it possible to run specific analyses. SAM is a very flexible tool as regards the range of object and subject accounts, as well as their sequence, which means that its construction (assuming that suitable statistical data is provided) is subordinated to a particular purpose of an analysis. It usually involves disaggregation of some forms of resources and uses with reference to either a more detailed examination of institutional sectors accounts, or a more detailed description of objective accounts. In this paper, the standard, basic form of SAM has been adopted, most often used in multiplier analysis with exogenous accounts, including current government and foreign accounts, as well as capital accounts of all sectors (e.g. Pyatt, Round 1985, Cohen 1993).

The choice of the countries selected was in a way arbitrary, but it was determined by the order in which they joined the EU, i.e. the duration of

economic linkages with the EU, as well as the development of the market economy. The analysis includes Germany, Spain, Poland and Bulgaria.

In order to reach the objectives that were set, the paper has been divided in the following way. Section 2 contains a short description of the social accounting system from the point of view of the circulation of institutional sectors' income in a national economy, presented in the form of a social accounting matrix. This matrix is then further used in the analysis. Section 3 contains a comparison of expenditure structures on accounts in the studied countries in 2002, 2007 and 2012. The comparison is based on the structural similarity coefficient. Section 4 presents multipliers for selected countries as an important analytical tool, especially as regards economic policy. Moreover, in Section 4 attention is drawn to the importance of SNA transactions, evaluated taking into account the influence of their changes on the SAM multipliers. The final part contains conclusions and presents a short summary of the obtained results.

2. SNA as a system of data describing the income circulation of institutional sectors

The System of National Accounts is a coherent set of macro-economic accounts, balance sheets and tables, based on established conceptual standards, definitions, classifications and accounting rules. The basic classifications include: classification by transaction subjects – institutional sectors (households and non-profit institutions serving households (NPISH), non-financial corporations, general government, financial corporations, and the rest of the world), as well as by transaction objects - first of all product accounts - CPA (Classification of Products by Activity) or activity accounts – NACE (Nomenclature statistique des Activités économiques).

The basic principle is posting each transaction on the uses side of the given account and on the resources side of another account.

SNA forms a conceptual and analytical scheme for economic and social studies from the point of view of income circulation. Statistical information about an economy includes a description of the processes of the generation, primary distribution and redistribution of income, as well as its use for consumption and accumulation.

Social Accounting Matrix reflects the principle of double entry of every transaction in the system of national accounts, which ensures the balance between rows and columns, where the elements of each row are the resources on a given account, and the columns represent the uses (expenditures). This means that the expenditures of every institutional sector are equal to its resources gained over a given period of time, and at the same time each expenditure of one entity is a resource of another. A similar balance occurs on accounts by kind (object accounts).

The order of accounts in SAM corresponds to the sequence of income flows in an economy, i.e. the first are the product accounts, which are followed by value

added accounts, then current institutional accounts, showing the allocation and reallocation of primary income and use of disposable income, and, finally, capital institutional accounts, showing property growth in individual sectors.

The essential part of SAM usually consists of input-output tables[2]; the symmetric input-output table is used most often. The columns show the costs of production, according to the adopted product classification, i.e. production expenditures, and the rows – the incomings from selling the products for intermediate (production) use and final use.

In the SAMs presented below, the products account is an aggregate, which does not include the division into individual products. Production costs thus regard the whole aggregate; total resources on this account are approached in a similar way.

The first stage of income circulation is the process of production, the effects of which are shown in the form of goods and services for intermediate consumption (1.1) and final use (1.3 and 1.4). The costs of domestic production are shown in 1.1 and 2.1. Domestic production is supplemented with imports (3.1). The primary income of an economy is the value added (2.1), entered on the generation of primary income account. It is, at the same time, the cost of production entered on the products account.

A social accounting matrix and its structure is presented in Fig.1.

Figure 1. Basic structure of SAM

Account	Products	Generation of primary income (production factors) (VA)	Current accounts of institutional sectors	Capital accounts of institutional sectors	Net borrowing / net lending
Products	1.1		1.3	1.4	
Generation of primary income (production factors)	2.1		2.3		
Current accounts of institutional sectors	3.1	3.2	3.3		
Capital accounts of institutional sectors			4.3	4.4	4.5
Net borrowing / net lending				5.4	

Source: see Miller, Blair (2009), Pyatt (1991), Tomaszewicz (2001).

The allocation of primary incomes and secondary distribution of incomes are presented by sectoral current and capital accounts. The process of the allocation of primary incomes reflects the fact that the institutional sectors, e.g.

[2] For EU countries supply and use tables (activity by product) are prepared every year. Every five years with 5-year delay symmetric input-output tables(product by product) are also published.

households or corporations, receive income from their involvement in the activity of primary production factors – labour and capital (3.2). This is income in the form of compensation of employees and profits (operating surplus). The primary incomes (mainly the compensation of employees), which are the costs of the rest of the world, is presented in (2.3). The allocation of primary incomes also includes property incomes (bank deposit interest, dividends, rents). The secondary distribution of incomes shows the result of income redistribution, in the form of disposable income (3.3). Redistribution takes place primarily between the general government and the remaining sectors. Spending disposable incomes creates demand for consumption (1.3) and investment goods (1.4), which are at the same time the resources on the product account. These categories are the categories of use of disposable incomes. This in turn creates the need for goods and services, which closes the circulation loop. Capital expenditure is usually financed not only from saving (4.3), but also from capital transfers (4.4). The system of non-financial accounts is closed by net borrowing (4.5) or net lending (5.4), which are the categories of financial accounts divided by financial instruments.

This paper deals only with non-financial accounts. The role of the financial accounts of institutional sectors in selected European countries is presented in, e.g., Tomaszewicz, Trębska (2012), (2013).

3. Some remarks on changes in SAM coefficients

For each SAM column, it is possible to calculate the share of a given expenditure in the total expenditures on a given account, thus:

$$a_{ij} = \frac{x_{ij}}{X_j} \tag{1}$$

where:

x_{ij} - is expenditure on account j entered as receipt on account i,

X_j - is total expenditure on account j ,

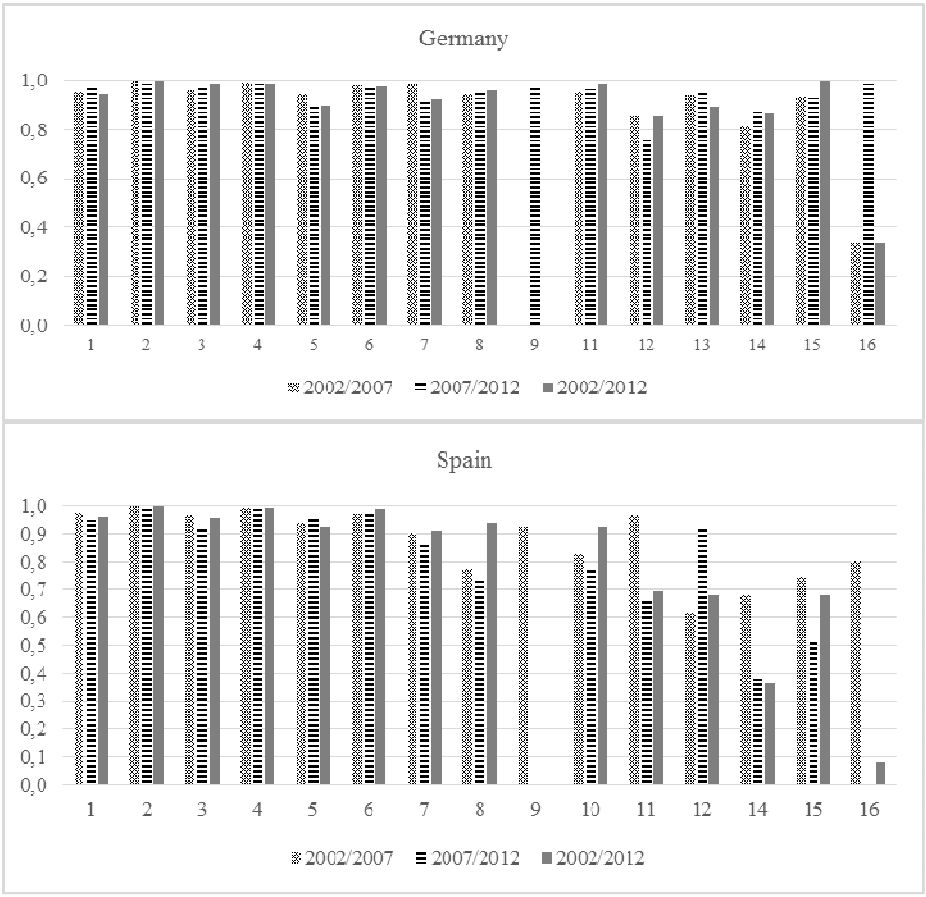
The matrix of such shares will then be a square matrix with a dimension corresponding to the number of accounts in SAM, based on a general assumption that $i,j = 1, \ldots, n$ the matrix of coefficients a_{ij} ($\mathbf{A} = [a_{ij}]$) is $n \times n$.

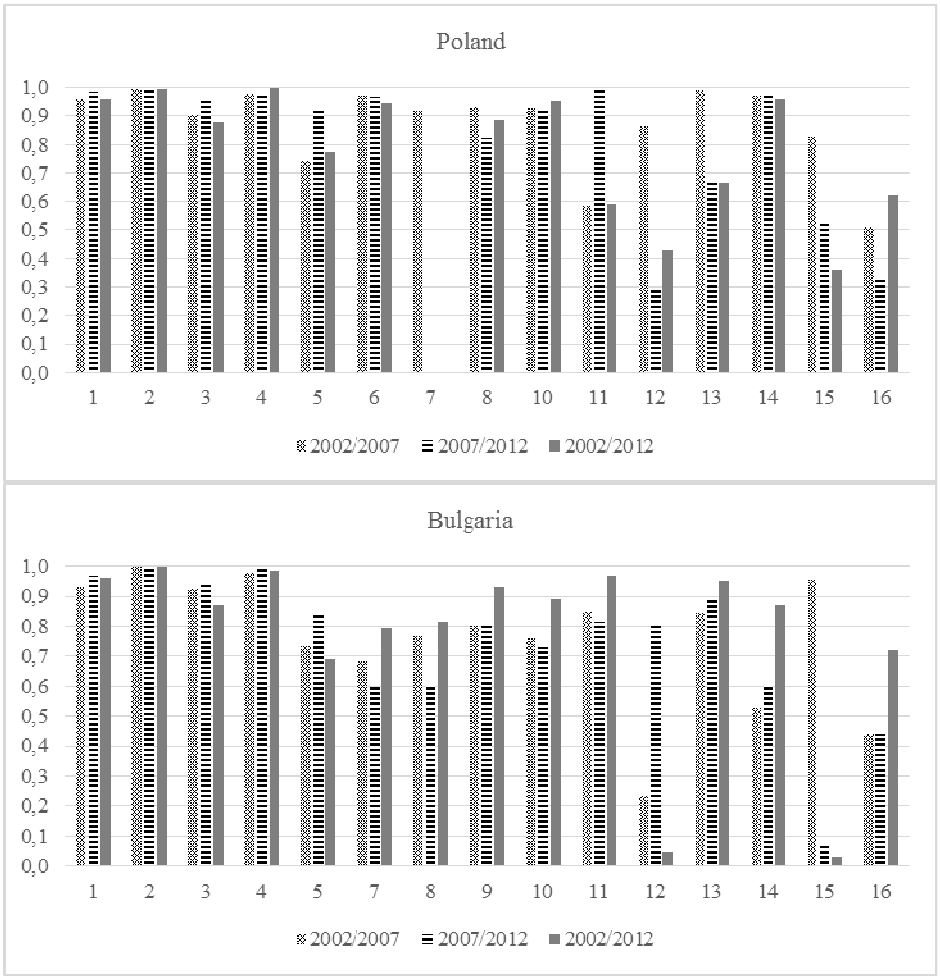
Matrix **A** was calculated for Germany, Spain, Poland and the Bulgaria in 2002, 2007 and 2012. The chosen years were periods of relatively stable economic situations in all the countries.

In order to analyse the changes of the elements of matrix **A**, a simple structural similarity coefficient was used, with a value ranging from 0 to 1. The closer it is to 1, the more similar the expenditure structures in individual years/countries are to one another.

Fig.3 shows structural similarity coefficients for individual countries in the years mentioned above. It should be noted that in the case of negative value transactions, the structure coefficients (and structural similarity coefficients) cannot be calculated. These cases may concern a negative stream of saving in institutional sectors, as well as the negative values of capital transfers entered in SNA. These cases are visible by their lack of or incomplete information regarding the structural similarity coefficients for some accounts.

Figure 3. Similarity coefficients of expenditure structures in SAMs

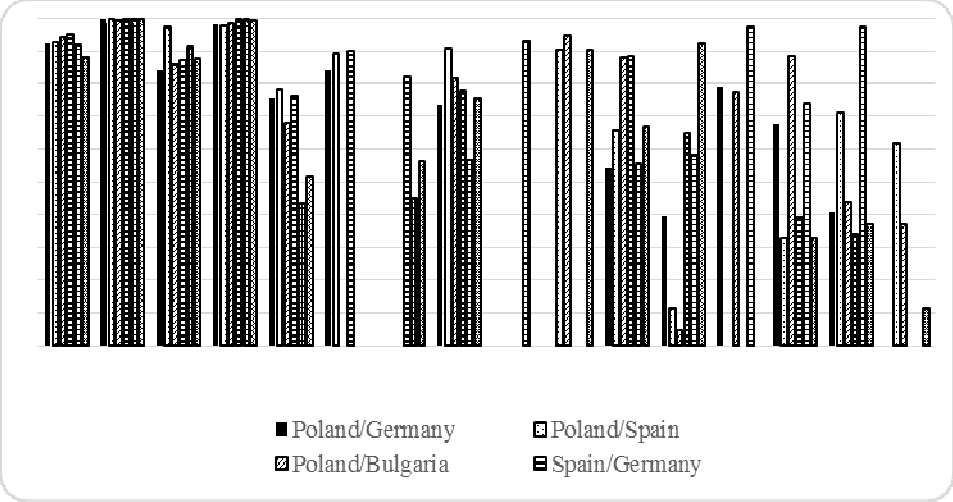




Note: 1 – products account, 2-4 – primary income accounts: 2 - compensation of employees; 3 - operating surplus; 4 – taxes; 5 – property income, 6-10 – current accounts of institutional sectors: 6 - households & NPISH; 7 –financial corporations; 8 –non-financial corporations; 9 –general government; 10 –the rest of the world sector, 11-15 – capital accounts of institutional sectors: 11 - households & NPISH; 12 –financial corporations; 13 – non-financial corporations; 14 –general government; 15 –the rest of the world sector, 16 – net borrowing.

Source: author's own compilation based on Eurostat data.

Figure 4. Similarity coefficients of expenditure structures in SAMs in 2012 for the studied countries



Source: author's own compilation based on Eurostat data.

In analysing the obtained structural similarity coefficients (Fig. 3), one can formulate three general remarks. Firstly, if the structures are similar for 2002/2007 and for 2007/2012, then a similarity between them will obviously be visible for 2002/2012. A similar regularity will be observed if the structures for 2002/2007 and 2007/2012 are not similar. Secondly, changes in the structure of uses on a given account will at the same time mean changes in the structure of resources on other accounts. In the analysis presented below, we are trying to refer to the changes in the structure of resources in the accounts in which resources significantly changed with regard to the change of the uses structure on other accounts. Thirdly, it seems that larger changes of uses structures of institutional sectors, which means smaller values of the structural similarity coefficient, should be observed for the years 2007/2012, because the financial crisis which began in 2008 affected the expenditures structure in 2012 more than the previous crisis from the turn of the twentieth and twenty-first centuries. This will mainly concern the changes of uses on capital accounts, reflecting to a great extent the changes of the financial assets of institutional sectors.

In general, the analysis of the obtained results (Fig. 3) points to the fact that in all the countries, stability in the studied years is shown by the structures of uses on product account, i.e. the structures of production costs (Cf. also Fig.4). Thus, the structure of labour costs, which are the expenditures on the value added accounts, including only two items – compensation of domestic and foreign employees, is also stable. Production cost structure, including the components of the value added, can hardly be expected to change significantly over a period of 5-10 years. However, a slightly larger changeability is characteristic

of the sectoral structure of the operating surplus, which can be particularly affected by mixed incomes of households, which also includes the operating surplus of micro-enterprises. The latter usually fluctuates, both as regards their number and the profits they make. The structural similarity coefficients on product and value added accounts (accounts number 1-4 in Fig.3) are high – their values range from 0.85 to nearly 1 in all studied countries.

In the group of the sectoral current accounts (accounts 6-10), expenditure structures in the compared years are, as expected, less similar for the years 2007/2012 than for 2002/2007 and 2002/2012. For example, in the case of Spain the similarity coefficient of the general government expenditure structures for years 2007/2012 was only slightly higher than 0.7, while for 2002/2007 it was 0.93. In other sectors, the differences are smaller, but they also occur. A similar situation was observed in Bulgaria. Particular differences occurred between the structures of the financial and non-financial corporations' expenditures in 2007 and 2012. Moreover, the structure in 2012 neared that from 2002. A similar regularity was observed for the above-mentioned sectors in Poland. Such a "comeback" of expenditure structures to those observed in 2002 can be noticed on practically all current accounts of institutional sectors, not only in Bulgaria and Poland, but also in Spain. Both 2012 and 2002 marked the beginning of economic recovery. It is worth mentioning that in all the countries included in the study, the structures of current uses (and resources) of households in the compared years are stable. The similarity of expenditure structures' coefficients ranges from 0.95 in Poland to 0.98 in Germany and Spain. The structural similarity coefficients for Bulgarian households could not be calculated due to the negative streams of saving (account 6). For the same reason, it was not possible to establish the structures of the general government expenditures in Poland in 2002 and 2012, in Germany in 2012 (account 9), or of financial corporations in Poland in 2012 (account 7).

Analysing the effect of the changes in the expenditure structure on capital accounts, it has to be first of all noted that they depend mostly on the possibility to finance these expenditures (with saving, capital transfers and liabilities), i.e. on the changes of the relations between lending and borrowing. The difference between these categories in SNA sequence is the balancing item - net lending/net borrowing (Cf. Fig.1 and the annex, with an example of SAM for Poland).[3] The structures of capital uses are relatively stable, if in all the studied years the given sector is a net lender (e.g. non-financial corporations in Germany) or a net borrower (e.g. non-financial corporations in Spain, general government in Poland).

Capital expenditure structures clearly show that, as regards net borrowing (which also means net lending), they are changeable in the studied years,

[3] If net lending is higher than net borrowing, then net borrowing on the account is entered as 0 (a corresponding coefficient of matrix A equals 0) for a given sector.

because in different years a given sector might have been a net lender or a net borrower. With the generally small similarity of structures for the above mentioned reason, the smallest similarity is observed when the years 2007/2012 are compared, because the changes of the capital expenditure structure in 2012 were larger due to the crisis. It is easy to observe, for example, that the change of the structure of capital expenditure of general government in Spain in 2012 as compared to 2007 (the similarity coefficient – 0.38) was the result of capitalizing financial corporations, which significantly changed the structure of resources of the latter (for years 2007/2012 the similarity coefficient was 0.48). Another example is Poland, where after joining the EU the structure of capital expenditures of the rest of the world sector changed in 2012 compared to 2002. The reason was the pronounced increase in capital transfers in the form of investment grants for non-financial corporations and the general government. The similarity coefficient for 2002/2012 is 0.36, whereas for 2002/2007 it was 0.83.

4. Important structural linkages

Studies of important structural linkages are based on the analysis of SAM multipliers, which enable measuring the effects, which take the form of a growth of resources in given accounts (endogenous accounts), resulting from an increase of expenditures in other accounts (exogenous accounts) (e.g. Miller, Blair 2009). Studying the importance of the coefficients showing the share of particular expenditure to the total expenditures in a given endogenous account boils down to analysing the impact of these coefficients' changes on the changes in multipliers. Classical multipliers, established on the basis of the product account in its disaggregated form (input-output symmetric table), point to how much gross output will increase (resources on the product endogenous account) if the final demand (expenditure on exogenous account) grows by a unit[4] (e.g. Tomaszewicz 2001).

Like in the case of input-output production multipliers, using this methodology in analyses based on SAM requires distinguishing between endogenous and exogenous accounts and, as was mentioned above, this division (presented schematically in Table 2) depends on the purpose of the multiplier analyses.

[4] The value of this unit is expressed in national currency unit (1 euro, 1 PLN, 1 Bulgarian Lev).

Table 2. SAM in the classification into endogenous and exogenous accounts

		Uses		Total
		Endogenous accounts	Exogenous accounts	
Resources	Endogenous accounts	$\mathbf{Z} = \mathbf{A}_z\hat{\mathbf{x}} = [x_{ij,z}]$	**Y**	x_1 … x_z
	Exogenous accounts	**R**	**W**	x_{z+1} … x_n
Total		$x_1 \ldots x_z$	$x_{z+1} \ldots x_n$	

Source: Based on Pyatt, Round (1985), Tomaszewicz (2001).

Table 2 shows that the whole SAM was divided into z endogenous accounts and $s = n - z$ ($s=z+1,\ldots,n$) exogenous accounts.

The $z \times z$ matrix **Z** shows transactions between endogenous accounts. It is the product of matrix $\mathbf{A}_z = [a_{ij,z}]$ and vector of total uses (resources) $-\mathbf{x}_z$ on these accounts presented in the diagonal matrix $\hat{\mathbf{x}}_z$, where $a_{ij,z}$ is the coefficient showing the share of a given expenditure (being simultaneously the resource on endogenous account *i)* in the total value of expenditures on endogenous account *j* (*i,j*= 1,…*z)*. Hence:

$$\mathbf{A}_z = \mathbf{Z} \cdot \hat{\mathbf{x}}^{-1} \tag{2}$$

The $s \times z$ matrix **R** shows expenditures on endogenous accounts, entered as resources on exogenous accounts.

The columns of $z \times s$ matrix **Y** show the expenditures on exogenous accounts. The changes of the values of matrix **Y** are treated as impulses causing changes on endogenous accounts.

The $s \times s$ matrix **W** shows the transactions between exogenous accounts. Taking a vector $\mathbf{y} = \mathbf{Y} \cdot \mathbf{i}$ of exogenous values, where **i** is a vector $(z \times 1)$ consisted of values 1, the following relation is obtained:

$$\mathbf{x}_z = \mathbf{A}_z\mathbf{x}_z + \mathbf{y}\,. \tag{3}$$

On condition that there is a matrix inverse to $(\mathbf{I} - \mathbf{A}_z)$, after introducing suitable transformations, it can be written:

$$\mathbf{x}_z = (\mathbf{I} - \mathbf{A}_z)^{-1}\mathbf{y} \tag{4}$$

denoting matrix $(\mathbf{I}-\mathbf{A}_z)^{-1}$ as $\mathbf{M}_z$:

$$\mathbf{x}_z = \mathbf{M}_z\mathbf{y}\,. \tag{5}$$

Elements of matrix $\mathbf{M}_z = [m_{ij,z}]$ are interpreted as multipliers; they give information about how resources on account i=1,…,z will change under the influence of a unit increase in exogenous expenditures concerning account j=1,…,z. Appropriate matrix operations make it possible to decompose matrix $\mathbf{M}_z$. This decomposition allows the interpretation of matrix $\mathbf{M}_z$ elements to be more detailed (Cf. e.g. Stone, 1985).

The SAMs used for the purpose of the multiplier analysis presented below reflect the integrated form of the SNA data published in Eurostat. The choice of exogenous accounts corresponds to standard solutions, in which the exogenous accounts are: the current account of general government and the rest of the world, as well as the capital accounts of all the institutional sectors. As has been mentioned, the construction of SAM will depend on the aim of multiplier analyses, but also on the possibility to obtain appropriate statistical data, including that which is not provided by the SNA. For instance, a detailed analysis of the households' reaction to certain exogenous impulses usually involves a deeper division of this sector, e.g. into decile groups. Also the choice of the exogenous accounts depends on the aim of the multiplier analysis, e.g. the choice of only some of the government expenditures as exogenous, presented in a sufficiently detailed way as regards the special economic policy objectives. Depending on the structure of expenditures on exogenous accounts, some impulses may be defined precisely, while others will be an aggregate of impulses. For instance, in the SAM presented in the annex, an illustration of the first case is one unit impulse, which is the increase in the expenditure of the rest of the world in the form of compensation of employees (which influences the resources on all the accounts of the country to which these incomes are allocated). An illustration of the other case is an aggregate impulse in the form of a one unit increase in the government and the rest of the world consumption demand, together with the investment demand of all the sectors.

Due to the space limitations of this paper, only the multipliers for 2012 are presented. Moreover, the observed regularities for the studied countries practically do not change when compared to the years 2002 and 2007. One can notice a basic regularity – the sum of changes of resources on endogenous accounts, caused by particular expenditures on exogenous accounts, are usually from over 2 to over 5 times larger than the original impulse. For instance, a unit

increase in the expenditures on products on the exogenous accounts results in an increase in resources on all the endogenous accounts in total 4.7 times larger in Germany, 5.2 times in Spain, 4.8 in Poland and 4.1 in Bulgaria (sum of column 1 in the multipliers tables 3a-3d). In particular, resources on the product account will increase 2.4 times in Germany, 2.6 times in Spain, 2.7 times in Poland and 2.5 times in Bulgaria, while primary income will grow by approximately 1 in Germany (0.498+0.368+0.11), also by 1 in Poland, by 1.2 in Spain and 0.8 in Bulgaria. Another example - the impulse coming from the compensation of employees paid by the rest of the world causes nearly a five-fold (4.956 times) increase of resources on all endogenous accounts in Germany, in comparison to the primary impulse by a unit (1.477 of which is the increase in the current household incomes), and respectively a 5.6-fold increase in Poland and Bulgaria, and 5.5-fold increase in Spain (sum in column 2 in tables 3a-3d). In turn, a unit increase in the expenditures in the form of government and the rest of the world transfers to households will cause an increase in the current incomes of households (the sixth element of the sixth columnin tables 3a-3d):1.4 (1.418) times in Bulgaria, 1.6 times in Spain, 1.5 times in Poland and Germany. The global effect of this impulse is the sum in column 6.

Table 3a. Multipliers matrix for Germany in 2012

	Endogenous accounts							
	Products account	Production factors			Property income	Current accounts		
		Compensation of employees	Operating surplus +mixed income	Taxes on production -subsidies		households +NPISH	Financial corporations	Non-financial corporations
	1	2	3	4	5	6	7	8
1	2.390	1.393	0.836	0.000	0.949	1.402	0.985	0.554
2	0.498	1.290	0.174	0.000	0.198	0.292	0.205	0.115
3	0.368	0.214	1.129	0.000	0.146	0.216	0.152	0.085
4	0.110	0.064	0.039	1.000	0.044	0.065	0.045	0.026
5	0.227	0.209	0.592	0.000	1.555	0.211	1.127	0.841
6	0.748	1.477	0.887	0.000	1.007	1.487	1.045	0.587
7	0.114	0.135	0.256	0.000	0.536	0.136	1.405	0.304
8	0.258	0.173	0.760	0.000	0.324	0.174	0.282	1.180
Total	4.713	4.956	4.671	1.000	4.759	3.982	5.247	3.691

Source: author's own compilation based on Eurostat data.

Table 3b. Multipliers matrix for Spain in 2012

[a]	1	2	3	4	5	6	7	8
1	2.556	1.667	0.933	0.000	0.620	1.672	0.604	0.299
2	0.540	1.352	0.197	0.000	0.131	0.353	0.128	0.063
3	0.506	0.330	1.185	0.000	0.123	0.331	0.120	0.059
4	0.123	0.080	0.045	1.000	0.030	0.081	0.029	0.014
5	0.178	0.174	0.353	0.000	1.547	0.175	0.972	0.524
6	0.868	1.620	0.907	0.000	0.603	1.625	0.587	0.291
7	0.125	0.131	0.238	0.000	0.743	0.132	1.474	0.279
8	0.264	0.190	0.599	0.000	0.269	0.190	0.217	1.101
Total	5.160	5.545	4.458	1.000	4.067	4.560	4.131	2.630

[a]headarrayof Table3a

Source: author's own compilation based on Eurostat data.

Table 3c. Multipliers matrix for Poland in 2012

[a]	1	2	3	4	5	6	7	8
1	2.675	1.958	1.131	0.000	0.893	1.974	1.353	0.287
2	0.366	1.268	0.155	0.000	0.122	0.270	0.185	0.039
3	0.522	0.382	1.221	0.000	0.174	0.385	0.264	0.056
4	0.130	0.095	0.055	1.000	0.043	0.096	0.066	0.014
5	0.128	0.136	0.270	0.000	1.283	0.137	0.749	0.396
6	0.683	1.522	0.879	0.000	0.694	1.535	1.052	0.223
7	0.088	0.111	0.175	0.000	0.417	0.112	1.283	0.143
8	0.235	0.177	0.547	0.000	0.182	0.178	0.212	1.058
Total	4.827	5.648	4.431	1.000	3.809	4.687	5.164	2.215

[a]headarrayof Table3a

Source: author's own compilation based on Eurostat data.

Table 3d. Multipliers matrix for Bulgaria in 2012

[a]	1	2	3	4	5	6	7	8
1	2.478	2.191	0.879	0.000	0.406	2.193	0.517	0.106
2	0.305	1.270	0.108	0.000	0.050	0.270	0.064	0.013
3	0.404	0.357	1.143	0.000	0.066	0.357	0.084	0.017
4	0.126	0.111	0.045	1.000	0.021	0.111	0.026	0.005
5	0.045	0.057	0.115	0.000	1.031	0.057	0.203	0.143
6	0.468	1.417	0.568	0.000	0.263	1.418	0.334	0.069
7	0.054	0.052	0.148	0.000	0.082	0.052	1.030	0.036
8	0.213	0.189	0.602	0.000	0.093	0.190	0.143	1.019
Total	4.093	5.644	3.608	1.000	2.011	4.649	2.402	1.409

[a]headarrayof Table3a

Source: author's own compilation based on Eurostat data.

The examples discussed above show the role of multipliers in different kinds of analyses, especially as regards economic policy. From this point of view, it also seems important to study the significance of matrix A_z coefficients, considering the influence of the their changes on multiplier values. In the literature on the subject, special formulas have been established which show the percentage change of multipliers due to percentage changes of the individual element $a_{ij,z}$ of matrix $\mathbf{A}_{z,}$ It was also confirmed that each change of the coefficient $a_{ij,z}$ exerts the largest influence on the corresponding multiplier $m_{ij,z}$ (Cf. Miller Blair 2009). In this paper a 10% change of every matrix $\mathbf{A}_z$ coefficient was assumed, and it was determined how each change of the individual coefficient, with the other coefficients unchanged, influences the percentage changes of multipliers. Table 4 shows these coefficients of matrix A_z the 10% change of which caused the largest changes of the multipliers, exceeding 10%, in all the studied countries. Therefore, for all the countries these coefficients may be considered as important.

Table 4. Important structural coefficients $a_{ij,z}$

Country	a_{16}	a_{57}	a_{21}, a_{62}	a_{75}	a_{58}	a_{31}	a_{11}	a_{83}	a_{63}
	percentage change of corresponding multipliers								
Germany	14.81	13.75	13.29	13.20	11.73	11.43	10.76	10.34	<10
Spain	16.24	14.84	14.01	14.95	10.41	12.07	11.34	<10	<10
Poland	15.65	11.70	13.03	11.96	10.35	12.48	13.45	10.10	10.39
Bulgaria	14.74	<10	13.05	<10	<10	11.60	11.93	<10	<10

Source: author's own compilation based on Eurostat data.

From Table 4 it follows that important transactions are transactions on the product account. Namely, on the resources side there are the revenues coming from households consumption (a_{16}), being simultaneously the expenditures on households account, and the use of goods and services in the form of intermediate consumption (a_{11}). In turn, on the uses side, expenditures on compensation of employees (a_{21}) and operating surplus (a_{31}) as the cost of primary factors involved in the production process, being revenues on those primary incomes accounts, are important. At the same time, the importance of the transactions which are an expenditure on the operating surplus account and the revenues of non-financial corporations (a_{83}) and households (a_{63}) is visible. These are the sectors in which the operating surplus plays a significant role in their primary incomes. As regards households, this is the result of the inclusion of micro-enterprises in this sector. It was also revealed that the important transactions are those on the property income account, especially property income which is the expenditure of financial corporations (a_{57}) and resource of financial corporations (a_{75}), as well as property income being the expenditure of non-financial corporations (a_{58}).

5. Conclusions

From the analysis of structural similarity coefficients it follows that there was a big similarity of expenditures structures on product and value added accounts. The values of structural similarity coefficients ranged from 0.85 to nearly 1 in all studied countries in the compared years. Smaller similarity was observed in the structures of current expenditures of institutional sectors. As expected, the structures were less similar for years 2007/2012 than for 2002/2007. Moreover, the structure in 2012 neared that from 2002. Such a reversion of expenditure structures in 2012 to those observed in 2002 is visible on practically all current accounts of institutional sectors.

The changes of the expenditures structure on capital accounts depend mostly on the possibility to finance these expenditures (with savings, capital transfers and liabilities), i.e. on the changes of the relations between lending and borrowing. The balancing item - net lending/net borrowing was significantly changeable in the studied years, which meant generally a small similarity of expenditures structures on capital account. The smallest similarity is observed when the years 2007/2012 are compared, because the changes of the capital expenditures structure in 2012 were larger due to the crisis.

When ranking the countries according to the stability of expenditures of institutional sectors in the compared years, the highest coefficients of similarity of expenditures structures, practically on all the accounts, are observed in Germany. It seems that the lowest stability of expenditures structure among the studied countries, especially on capital accounts, is characteristic for Bulgaria.

As was mentioned above, due to the limited space available in this paper, the SAM multipliers are presented only for 2012, but the observed regularities do not change compared to the years 2002 and 2007 for the studied countries. Generally, the sum of changes of resources on endogenous accounts, caused by particular expenditures on exogenous accounts, are usually from over two to over five times larger than the original impulse.

The sample analysis of multipliers shows their role as a tool for various economic policy analyses, especially as regards government expenditures. Results of the examination of the importance of structural linkages in the process of income circulation under given exogenous impulses depend on the division of accounts into endogenous and exogenous. With the adopted division, transactions relating to the products account, the generation and allocation of primary incomes, property income and households consumption expenditures on goods and services, proved important.

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Annex. SAM for Poland in 2012

SAM 2012 POLAND (mln PLN)		Endogenous accounts								Exogenous accounts								Total
			Production factors				Current accounts			Current accounts		Capital accounts						
		Products accounts	Compensation of employees	Operating surplus +mixed income	Taxes - subsidies	Property income	Households +NPISH	Financial corporations	Non-financial corporations	General government	Rest of the world	Households +NPISH	Financial corporations	Non-financial corporations	General government	Rest of the world	Net lending/net borrowing	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Endogenous accounts	1	1862717	0	0	0	0	980 362	0	0	287645	744748	80 427	6 051	165735	73 475			4 201 160
	2	575 343	0	0	0	0	0	0	0	0	11 400	0	0	0	0	0	0	586 743
	3	819 722	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	819 722
	4	203 431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203 431
	5	0	0	0	0	0	22 877	91 990	117013	45 275	15 318	0	0	0	0	0	0	292 473
	6	0	581879	392269	0	69 803	730	77 528	0	226384	20 926	0	0	0	0	0	0	1 369 519
	7	0	0	38 545	0	86 660	43 989	1 653	5 400	515	0	0	0	0	0	0	0	176 762
	8	0	0	349874	0	21 190	0	6 202	0	12 463	0	0	0	0	0	0	0	389 729
Exogenous accounts	9	0	0	39 034	203431	21 119	271 751	6 305	32 657	0	1 197	0	0	0	0	0	0	575 494
	10	739 947	4 864	0	0	93 701	730	0	0	7 681	0	0	0	0	0	0	0	846 923
	11	0	0	0	0	0	49 080	0	0	0	0	0	0	0	4 514	1 050	26 150	80 794
	12	0	0	0	0	0	0	-6 916	0	0	0	0	0	0	0	716	12 251	6 051
	13	0	0	0	0	0	0	0	234659	0	0	0	0	0	2 995	11 959	0	249 613
	14	0	0	0	0	0	0	0	0	-4 468	0	293	0	0	0	22 702	62 458	80 985
	15	0	0	0	0	0	0	0	0	0	53 334	74	0	2 473	0	0	0	55 881
	16	0	0	0	0	0	0	0	0	0	0	0	0	81 405	0	19 454	0	100 859
Total		4201160	586743	819722	203431	292473	1369519	176762	389729	575495	846923	80 794	6 051	249613	80 984	55 881	100859	

Source: contructed on the basis of series of SAMs proposed in Ph.D. thesis – Trębska (2012).

Streszczenie

WAŻNE POWIĄZANIA STRUKTURALNE W PROCESIE CYRKULACJI DOCHODÓW W SAM

Głównym celem artykułu jest przestawienie wybranych możliwości analitycznych – w szczególności w zakresie polityki ekonomicznej – jakie stwarzają macierze rachunkowości społecznej (SAM). Macierze te są syntetycznym opisem cyrkulacji dochodów w gospodarce prezentowanym przez system międzynarodowej sprawozdawczości statystycznej – System Rachunków Narodowych. Przedstawiona w artykule analiza porównawcza opiera się na strukturach transakcji obserwowanych w SRN w trzech latach (2002, 2007, 2012) w wybranych krajach (w Niemczech, Hiszpanii, Polsce i Bułgarii). Analiza zawiera badanie porównawcze struktury wydatków i dochodów poszczególnych sektorów instytucjonalnych oraz mnożników SAM jako ważnego narzędzia analitycznego, a także ocenę ważności transakcji w SRN poprzez badanie wpływu ich zmian na zmiany mnożników.

***Słowa kluczowe**: rachunki narodowe, współczynniki podobieństwa struktur, metody analizyinput-output, mnożniki*