**New Approach to Household Disaggregation in the System of National Accounts-2008 and Its Application in Input-Output Models**

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**Abstract:**

The author develops an Input-Output Model of Aggregate Expenditures (IOMAE), in which household consumption is included into the composition of endogenous parameters. This model is based on a hypothesis of homogeneity of intermediate consumption and consumer expenditures, which determines the possibility for summingthem up for modeling.

According to the proposed approach, household income and expenditures are considered across sectors. Each household is viewed as a separate economic unit receiving income in certain sectors and using it for purchasing products of different other sectors.

Households are grouped into sectors based on the sources of their income. The column vector of household consumption is replaced with an Input-Output Matrix of Household Consumption, the structure of which is analogous to the first quadrant of the input-output table.

The author develops a method for creating an Income-Expenditures Matrix (IEM), which includes the Input-Output Matrix of Household Consumption, social transfers, property income, mandatory payments, savings, and other monetary incomes and expenditures.

The method for creating the IEM is explained stage by stage. The author describes key questions in the survey questionnaire, which was used to collect data on household income and expenditures. A distinctive feature of this questionnaire is that income and expenditures are distributed in accordance with the Russian Classification of Economic Activities. The author explains the process of developing the IEM and calculating relevant coefficients.

Finally, the paper presents the results of experimental calculations of the IEM based on the study conducted in the Republic of Buryatia, Russia.

***Keywords*:** Input-Output Model; household disaggregation,monetary inflows and expenditures; household consumption; aggregated expenditures, Social Accounting Matrix, Miyazawa model.

**JEL Classification:** C67; D10; E20; O21.

**The problems of household disaggregation**

Households are one of the institutional sectors set by the System of National Accounts 2008 (2008 SNA) (2008 SNA, p. 17). The results of statistical studies of households are an important source of information about the social and economic development of society. A special place is taken by the studies of household budgets including the distribution of the population based on the level of material prosperity and the structure and volume of incomes and expenditures.

At the same time, 2008 SNA has a number of issues inhibiting the study of households. One of such problems, as it is stated in Chapter 24: The households sector (Items 24.10, 24.18-24.20), is the difficulty in disaggregating the households sector, which arises for a number of reasons. First of all,

… income is earned by individuals but consumption is undertaken by households. While all households contain all individuals, it is very difficult to associate particular income recipients with particular household groups…. Only in the highly stylized situation of one income earner only per household (and only one source of income) can the type of income be matched with the type of household and even then only if households are categorized according to the type of income. The problem could be compared to that of the supply and use tables but whereas it is possible to establish which industries make which products, there is no natural relationship between individuals as income recipients and the household to which they belong when households are grouped by any criterion other than main income source (2008 SNA, p. 521).

This problem – linking “income flows from the SNA with a desirable set of household characteristics is one of the most difficult aspects of building a social accounting matrix” (2008 SNA, p. 521).

Secondly, it is the homogeneity of households: “… it is difficult to find a basis for subsectoring households such that the households in each subsector behave in a similar fashion to one another” (2008 SNA, p. 520). This issue is not normally encountered in industrial classifications and surveys, as well as in the process of creating input-output tables. If a survey covers a large share of companies in a given industry, “it is probably reasonable to suppose that the pattern of expenditure is typical of the whole” (2008 SNA, p. 521). This hypothesis underpins the production approach and consequently the technology matrix first described by Leontief. However, such assumptions are “very suspect” in the case of household groups, which complicates the use of a Social Accounting Matrix.

One of the most popular approaches to disaggregating households is their classification based on the level of income, which essentially defines consumption patterns: “studies showing consumption patterns according to income deciles are quite common” (2008 SNA, p. 522). At the same time, the problem of establishing the relationship between household consumption patterns with incomes of individuals remains unsolved.

The second approach to disaggregating households is based on their grouping according to the nature of their largest source of income. In 2008 SNA, the household sector is divided into four subsectors:

a. Employers;

b. Own-account workers;

c. Employees;

d. Recipients of property and transfer incomes.

According to Item 24.38 of 2008 SNA, households are allocated to subsectors according to which of the four categories of income listed above is the largest for the household. A reference person is identified for each household. It is the person with the largest income or “the person who makes the major decisions with regard to the consumption of the household”. The grouping of households is done based on the following characteristics of the reference person:

a. Occupation of the reference person;

b. Industry, if any, in which the reference person works;

c. Educational attainment of the reference person;

d. Qualifications or skills possessed by the reference person.

However, this approach significantly skews the reality, because it does not take into account other members of the household who receive incomes from other sources and activities.

**Input-output models and household consumption**

The standard input-output model developed by Leontief is described with this equation (Miller & Blair, 2009):

*X=A·X+Y*, (1)

where*A* – is the matrix of direct costs, *X=(Xi)*– the column vector of gross output, *Y=(Yi)* – the column vector of end product.

The system of equations (1) can be presented in the following way:

*X=(E-A)-1·Y,* (2)

where *(E-A)-1* – is the matrix of full costs (the Leontief matrix).

Based on the Leontief model, it is possible to calculate indirect and full effects in the economy arising in connection with the changes in the volume of end consumption (household consumption, state expenditures, investments, net export).

Input-output tables are the informational base for making analytical and forecasting calculations of the development of the national economy and its specific regions by sectors. They reflect the production and the use of products of different types of economic activity (TEA). Input-output models developed based on these tables characterize various natural and value-related relations between the spheres of the economic system.

However, input-output models built on the Leontief matrix do not fully reflect the impact of changes of the autonomous demand on economic processes. They do not take into account cross-sectoral relations between the production of value added and end consumption, the main element of which being household consumption. The analytical potential of this model is limited by the exogenous character of household consumption, which is represented in the model by the vector in the structure of the end product and is connected neither to the intermediate consumption nor income.

Nevertheless, it is quite reasonable to assert that household consumption, just like intermediate consumption, ultimately depends on the volume and sectoral structure of the gross output. It allows to view the indicators of household consumption as endogenous parameters. This issue is taken into account in a number of models including *the Miyazawa model* and *Social Accounting Matrix* (SAM).In these models, household consumption, unlike the classical input-output model, is presented in the matrix form.

The Miyazawa model serves to analyze the inter-relations between different groups of households in the process of forming their incomes (Miller & Blair, 2009). A peculiar characteristic of this model is in the fact that household consumption is presented in the form of a matrix for income groups and types of economic activity. Unlike the classical input-output model, the multi-sectoral multiplier proposed by Miyazawa is calculated based on the income instead of gross output. This model’s shortcomings include the lack of a direct connection between the changes of household consumption of a product of a specific type of economic activity and the indicators of gross output.

The SAM model includes inter-related statistical tables for sectors and accounts that reflect the circulation of incomes in the economy (Pyatt & Round, 2012). The most important feature of this model is that it analyzes the peculiarities of distribution in the household sector in more detail.

The main characteristics of the SAM model include the following:

* presentation of accounts in the form of a square matrix, where incomes and expenditures for each account are shown in the form of relevant rows and columns of the matrix;
* reflection of all types of economic activity of the system;
* greater flexibility in the degree of specialization and the emphasis on different parts of the economic system.

Currently, in the SAM, the classification of households (by the place of residence, level of prosperity, sociological factors) does not sufficiently allow to take into account input-output effects associated with the changes in the value and structure of household expenditures.

We believe that such a classification is not always informative enough in the study of multiplier effects. It is related to the fact that the disaggregated SAM is underpinned by the sectoral approach, where the accounts of Production and Goods are viewed by sectors. This principle is quite critical in the study of the impact of changes in the autonomous demand in a specific sector on the development of the whole economy — for example, how will the gross domestic product, the number of employed individuals, household incomes and so on change? In the case, when households are grouped by the place of residence or income level, multiplier effects are shown indirectly — there is no clear connection with the sectors.

In our view, it is feasible to use the sectoral principle of household grouping, when the change of the autonomous demand for the sector’s product directly influences the volume of incomes and expenditures of a specific group of the population. For instance, if the production of food products increases, it directly leads to the growth of incomes of the households, members of which are employed in this sector.

**Sectoral approach to the disaggregation of the household sector and input-output modeling**

The author proposes a new approach to the disaggregation of the household sector, which allows to include household consumption into the endogenous parameters of the input-output model. Essentially, it is a development of a new type of the input-output model based on the synthesis of the classical Leontief model and the Keynesian multiplier model. This approach is based on the hypothesis of the homogeneity of productive and non-productive consumption.

According to the proposed approach, household incomes and expenditures are viewed by sectors. Each household is viewed as a separate economic unit, which receives income in certain sectors and uses it to purchase products of different types of economic activity.

The author proposes a new approach to the disaggregation of the household sector, which is based on the sectoral principle of classification of monetary incomes and expenditures of households (see Fig. 1).

Figure 1. Pattern of forming monetary incomes and expenditures of households by types of economic activity



For example, the first member of the household receives income in two sectors: Transportation/Communication and Agriculture. The income of the second member of the household comes from two other sources: Construction and Trade. Moreover, this household also receives other monetary incomes. All the incomes form the total income of the household, which is the source of financing the total expenditures of the household. All the expenditures are grouped by the types of economic activity. Other expenditures, mandatory payments, and the growth of savings are considered separately.

The author developed a special survey to collect data on household income and expenditures. Its distinctive feature is in the fact that the distribution of expenditures and incomes is done by the types of economic activity in accordance with the Russian Classification of Economic Activities (OKVED). The survey includes questions concerning the amount and sources of incomes of each household member by types of economic activity, as well as questions concerning the total income (Dondokov et al., 2014). It also has questions about household expenditures that are grouped by types of products.

The new approach is based on the use of the input-output method for households by analogy with the enterprises (sector):

1. **Input** includes household incomes by types of economic activity. In enterprises (sector), its analogue are production costs.

2. The indicators of the household’s **Output** include its expenditures also distributed by types of economic activity. In enterprises (sector), output parameters are the values of the production output.

3. The input-output table is the result of the collection and processing of the source information by sectors (Leontief's classical model). The author introduces a new term, which designates the corresponding informational base for households — the Sectoral Matrix of Monetary Incomes and Expenditures of Households (see Table 1). The D matrix in its structure is analogous to the input-output table.

Let’s describe the D matrix. It has three groups of indicators. The sectoral matrix of household consumption C=($C\_{ij}$) is in the upper left part (first quadrant), where $C\_{ij}$ – is the expenditures for the consumption of the products of the i-type of economic activity made by the households that received their income from the j-type of economic activity.

The C matrix is a square matrix. Household expenditures by types of economic activity are shown in rows. The columns of the C matrix show household income by types of economic activity. The C matrix is the key element of the D matrix.

The three columns in the right part of the matrix are for the incomes that are not related to specific types of economic activity:

- social transfers (F);

- property income (H);

- other monetary incomes (L).

The three bottom rows show the expenditures that are not related to specific types of economic activity:

- mandatory payments (M);

- other expenses (P);

- savings (S).

Let’s describe the main equations in the D matrix:

1. The equation of the distribution of household incomes:

$\sum\_{j=1}^{n}D$j + Dn+1 +Dn+2 +Dn+3 = $\sum\_{u=1}^{n+3}D$, (3)

where Dj – is the income received by the household in the j-type of economic activity;

$\sum\_{j=1}^{n}D$j – income received by the household in all types of economic activity;

Dn+1 – income received by the household from social transfers;

Dn+2 – property income;

Dn+3 – other monetary income;

$\sum\_{u=1}^{n+3}D$u – cumulative income of the household.

Table 1. Sectoral Matrix of Monetary Incomes and Expenditures of Households

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  ji | Household incomes by types of economic activity (TEA) | Social transfers | Property income | Other monetary incomes | Total |
| 1 | … | n | Total |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Household expenditures by types of economic activity | 1 | С11 | … | С1n | $\sum\_{j=1}^{n}C$1j | F1 | H1 | L1 | R1 |
| … | … | … | … | … | … | … | … | … |
| n | Сn1 | … | Cnn | $\sum\_{j=1}^{n}C$nj | Fn | Hn | Ln | Rn |
| Total | $\sum\_{i=1}^{n}C$i1 | $$…$$ | $\sum\_{i=1}^{n}C$in | $\sum\_{i=1}^{n}\sum\_{j=1}^{n}C$ij | $\sum\_{i=1}^{n}F$i | $\sum\_{i=1}^{n}H$i | $\sum\_{i=1}^{n}L$i | $\sum\_{i=1}^{n}R$i |
| Mandatory payments | M1 | … | Mn | $\sum\_{j=1}^{n}M$j | Mn+1 | Mn+2 | Mn+3 | $\sum\_{u=1}^{n+3}M$u |
| Other expenses | P1 | … | Pn | $\sum\_{j=1}^{n}P$j | Pn+1 | Pn+2 | Pn+3 | $\sum\_{u=1}^{n+3}P$u |
| Savings | S1 | … | Sn | $\sum\_{j=1}^{n}S$j | Sn+1 | Sn+2 | Sn+3 | $\sum\_{u=1}^{n+3}+S$u |
| Total | D1 | … | Dn | $\sum\_{j=1}^{n}D$j | Dn+1 | Dn+2 | Dn+3 | $\sum\_{u=1}^{n+3}D$u |

2. The equation of the distribution of household expenditures:

$\sum\_{i=1}^{n}R$i + $\sum\_{u=1}^{n+3}M$u + $\sum\_{u=1}^{n+3}P$u + $\sum\_{u=1}^{n+3}+S$u = $\sum\_{u=1}^{n+3}D$u , (4)

where Ri – is the expenditures of the household for purchasing the products of the i-sector;

$\sum\_{i=1}^{n}R$i – total consumer expenditures of the household;

$\sum\_{u=1}^{n+3}M$u – expenditures for mandatory payments;

$\sum\_{u=1}^{n+3}P$u – other expenditures of the household;

$\sum\_{u=1}^{n+3}S$u  – savings;

$\sum\_{u=1}^{n+3}D$u – cumulative expenditures (income) of the household.

The last column of the D matrix is composed of two blocs: the vector of consumer expenditures R=(Ri) and other expenses. The R vector is the vector of household consumption of the classical Leontief model.

In the Leontief model, the column vector Xj = (Xij) reflects the technology of production in the j-sector (composition of expenditures and added value) and is called the production method. The new model uses an analogous approach.

Let’s introduce a new term: “technology of consumption” — the Q column vector, which reflects the structure of household expenditures. It is calculated by dividing the values of the indicators of the last column of the D matrix by the value of cumulative expenditures. All columns of this matrix are calculated based on the structure of expenditures set by the Q vector.

Let’s consider the process of composing the Input-Output Matrix of Household Consumption using an example of a particular household. The data about its income and expenditures are formed based on the information from the survey form filled out by the studied household.

Let’s suppose that two members of the household receive income in the form of salary in two sectors. One of them also receives income from entrepreneurial activity in the third sector. This household includes one retiree, whose income comes from the retirement benefits, and one student who receives a stipend. Besides, this household receives property income by leasing a garage and also has other income. The total income is 100,000 rubles per month. Information about the income is shown in Table 2.

Table 2. Source data on the monetary income of the household,

000 rubles/month

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name of indicator | Salary | Income from entrepreneurial activity | Social transfers | Property income | Other income |
| TEA1 | TEA2 | TEA3 | TEA1 | TEA2 | TEA 3 |  |  |  |
| Income of the 1st member of the household | 40 |  |  |  |  | 10 |  |  |  |
| Income of the 2nd member of the household |  | 25 |  |  |  |  |  |  |  |
| Income of the 3rd member of the household |  |  |  |  |  |  | 13 |  |  |
| Income of the 4th member of the household |  |  |  |  |  |  | 2 |  |  |
| Total income of the household |  |  |  |  |  |  |  | 7 | 3 |
| Total monetary income of the household | 40 | 25 |  |  |  | 10 | 15 | 7 | 3 |

Expenditures of this household are 100,000 rubles per month including the expenditures for purchasing goods, labor, and services of all three sectors of the economy. Moreover, there are mandatory payments and other expenses. Some money of this household is accumulated in the form of savings. The distribution of expenditures is shown in Table 3.

Table 3. Source data on the expenditures of the household,

000 rubles/month

|  |  |  |
| --- | --- | --- |
| No. | Name of expenditures | Value of the indicator, 000 rub/month  |
| 1 | Expenditures of the household in the 1st type of economic activity | 35 |
| 2 | Expenditures of the household in the 2nd type of economic activity | 20 |
| 3 | Expenditures of the household in the 3rd type of economic activity | 25 |
| 4 | Mandatory payments | 9 |
| 5 | Other expenses | 6 |
| 6 | Savings  | 5 |
| 7 | Total expenditures of the household | 100 |

Based on the data from Table 2, we form a table of the household’s income and calculate the $\vec{K}$ row vector of the income coefficients for this household.

$\vec{K}$ =$\left(K\_{1}; K\_{2;}K\_{3};K\_{4};K\_{5}\right)$ =$\left(0,4;0,25;0,1;0,15;0,07;0,03 \right)$

Table 4. Incomes of the household by types of economic activity,

000 rubles/month

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Indicator | TEA1 | TEA2 | TEA3 | Social transfers | Property income | Other income | Total income of the household |
| Household income  | 40 | 25 | 10 | 15 | 7 | 3 | 100 |
| Coefficients of household incomes, the share of the sum of incomes | 0.4 | 0.25 | 0.1 | 0.15 | 0.07 | 0.03 | 1.0 |

The next stage is to calculate an individual D matrix of income and expenditures of this household by multiplying the Q column vector of expenditures by the $\vec{K} $row vector of the income coefficients:

 $D=Q×K$ (5)

Table 5. Individual matrix D of incomes and expenditures of the household, 000 rubles/month

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  ji | Household income by types of economic activity | Social transfers | Property income | Other monetary income | **Total** |
| 1 | 2 | 3 | Total |
| Household expenditures by types of economic activity | 1 | **14** | **8.75** | **3.5** | 26.25 | 5.25 | 2.45 | 1.05 | **35** |
| 2 | **8** | **5** | **2** | 15 | 3 | 1.4 | 0.6 | **20** |
| 3 | **10** | **6.25** | **2.5** | 18.75 | 3.75 | 1.75 | 0.75 | **25** |
| Total | 32 | 20 | 8 | 60 | 12 | 5.6 | 2.4 | **80** |
| Mandatory payments | 3.6 | 2.25 | 0.9 | 6.75 | 1.35 | 0.63 | 0.27 | **9** |
| Other expenses | 2.4 | 1.5 | 0.6 | 4.5 | 0.9 | 0.42 | 0.18 | **6** |
| Savings  | 2 | 1.25 | 0.5 | 3.75 | 0.75 | 0.35 | 0.15 | **5** |
| **Total** | **40** | **25** | **10** | **75** | **15** | **7** | **3** | **100** |

The bottom row of the matrix shows the distribution of the household’s income. The total sum of incomes received from paid work and entrepreneurial activity is 75,000 rubles. In the first sector, the income is 40,000 rubles, in the second — 25,000 rubles, and third — 10,000 rubles. The remaining 25,000 rubles were received as social transfers, property income, and other monetary income.

 The last column shows the distribution of household expenditures. The total expenditures of the household are 80,000 rubles. The structure of each of the columns of the D matrix corresponds to the structure of total expenditures — the technology of consumption, which is characterized by the Q vector: Q=(35; 20; 25; 9; 6; 5).

Let’s consider the first column of the matrix, which reflects the use of income received in the first type of economic activity. Out of 40,000 rubles, 14,000 rubles were used to purchase the products of the first sector (35 %), 8,000 rubles — for the second sector (20 %), and 10,000 rubles — for the third sector (25 %). In total, 80 % of the total income received in the first sector were consumer expenditures. The remaining money were spent to cover other expenses — mandatory payments (9%), other expenses (6%), and savings (5%).

Other columns of the D matrix are characterized by the analogous structure of expenditures (ratios).

By summing up individual income-expenditure matrices for all the studied households, we create a general sectoral matrix of household incomes and expenditures. Table 6 presents the results of the study of household budgets in one Russian region.

Table 6. Sectoral Matrix of Monetary Incomes and Expenditures of Sample Households, Republic of Buryatia, Russia, 2015

(000 rubles)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Household incomes by types of economic activity |  |  |  |  |
|  |  | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Social transf. | Prop. income | Othermonet. incomes | Total |
| Household expenditures by types of economic activity | A | 2,18 | - | 0,13 | 1,02 | 0,77 | 1,48 | 3,32 | 1,60 | 0,47 | 1,67 | 0,05 | 1,06 | 1,54 | 1,99 | 0,95 | - | 4,37 | 0,20 | 0,47 | 23,27 |
| B | 6,89 | - | 0,40 | 3,22 | 2,43 | 4,68 | 10,51 | 5,05 | 1,50 | 5,27 | 0,16 | 3,35 | 4,87 | 6,28 | 3,02 | - | 13,81 | 0,64 | 1,49 | 73,58 |
| C | 1,31 | - | 0,08 | 0,61 | 0,46 | 0,89 | 2,01 | 0,96 | 0,29 | 1,00 | 0,03 | 0,64 | 0,93 | 1,20 | 0,58 | - | 2,63 | 0,12 | 0,28 | 14,03 |
| D | 165,16 | - | 9,70 | 77,28 | 58,23 | 112,22 | 252,15 | 121,22 | 36,00 | 126,34 | 3,88 | 80,28 | 116,81 | 150,69 | 72,34 | - | 331,20 | 15,35 | 35,64 | 1764,50 |
| E | 0,35 | - | 0,02 | 0,16 | 0,12 | 0,24 | 0,53 | 0,25 | 0,08 | 0,26 | 0,01 | 0,17 | 0,24 | 0,32 | 0,15 | - | 0,69 | 0,03 | 0,07 | 3,70 |
| F | 6,68 | - | 0,39 | 3,13 | 2,36 | 4,54 | 10,20 | 4,90 | 1,46 | 5,11 | 0,16 | 3,25 | 4,73 | 6,10 | 2,93 | - | 13,40 | 0,62 | 1,44 | 71,38 |
| G | 14,50 | - | 0,85 | 6,79 | 5,11 | 9,85 | 22,14 | 10,65 | 3,16 | 11,09 | 0,34 | 7,05 | 10,26 | 13,23 | 6,35 | - | 29,08 | 1,35 | 3,13 | 154,95 |
| H | 4,37 | - | 0,26 | 2,04 | 1,54 | 2,97 | 6,67 | 3,21 | 0,95 | 3,34 | 0,10 | 2,12 | 3,09 | 3,99 | 1,91 | - | 8,76 | 0,41 | 0,94 | 46,67 |
| I | 14,21 | - | 0,83 | 6,65 | 5,01 | 9,65 | 21,69 | 10,43 | 3,10 | 10,87 | 0,33 | 6,91 | 10,05 | 12,96 | 6,22 | - | 28,49 | 1,32 | 3,07 | 151,80 |
| J | 2,16 | - | 0,13 | 1,01 | 0,76 | 1,47 | 3,30 | 1,59 | 0,47 | 1,65 | 0,05 | 1,05 | 1,53 | 1,97 | 0,95 | - | 4,33 | 0,20 | 0,47 | 23,09 |
| K | 1,16 | - | 0,07 | 0,54 | 0,41 | 0,79 | 1,77 | 0,85 | 0,25 | 0,89 | 0,03 | 0,56 | 0,82 | 1,06 | 0,51 | - | 2,32 | 0,11 | 0,25 | 12,38 |
| L | 1,38 | - | 0,08 | 0,64 | 0,49 | 0,94 | 2,10 | 1,01 | 0,30 | 1,05 | 0,03 | 0,67 | 0,97 | 1,26 | 0,60 | - | 2,76 | 0,13 | 0,30 | 14,71 |
| M | 5,87 | - | 0,34 | 2,75 | 2,07 | 3,99 | 8,96 | 4,31 | 1,28 | 4,49 | 0,14 | 2,85 | 4,15 | 5,35 | 2,57 | - | 11,76 | 0,55 | 1,27 | 62,68 |
| N | 13,48 | - | 0,79 | 6,31 | 4,75 | 9,16 | 20,59 | 9,90 | 2,94 | 10,32 | 0,32 | 6,56 | 9,54 | 12,30 | 5,91 | - | 27,04 | 1,25 | 2,91 | 144,07 |
| O | 12,78 | - | 0,75 | 5,98 | 4,51 | 8,69 | 19,52 | 9,38 | 2,79 | 9,78 | 0,30 | 6,21 | 9,04 | 11,66 | 5,60 | - | 25,64 | 1,19 | 2,76 | 136,58 |
| P | 0,09 | - | 0,01 | 0,04 | 0,03 | 0,06 | 0,14 | 0,07 | 0,02 | 0,07 | 0,00 | 0,05 | 0,07 | 0,09 | 0,04 | - | 0,19 | 0,01 | 0,02 | 1,00 |
| Mandatory payments | 21,15 | - | 1,24 | 9,90 | 7,46 | 14,37 | 32,30 | 15,53 | 4,61 | 16,18 | 0,50 | 10,28 | 14,96 | 19,30 | 9,27 | - | 42,42 | 1,97 | 4,57 | 226,01 |
| Other expenses | 5,69 | - | 0,33 | 2,66 | 2,01 | 3,87 | 8,69 | 4,18 | 1,24 | 4,35 | 0,13 | 2,77 | 4,02 | 5,19 | 2,49 | - | 11,41 | 0,53 | 1,23 | 60,80 |
| Savings | 60,54 | - | 3,56 | 28,33 | 21,34 | 41,13 | 92,42 | 44,43 | 13,19 | 46,31 | 1,42 | 29,43 | 42,81 | 55,23 | 26,52 | - | 121,40 | 5,63 | 13,06 | 646,75 |
| Total | 339,95 | - | 19,98 | 159,08 | 119,85 | 230,99 | 519,00 | 249,51 | 74,09 | 260,05 | 7,99 | 165,25 | 240,43 | 310,17 | 148,91 | - | 681,71 | 31,60 | 73,37 | 3631,93 |

**Input-Output Model of Aggregate Expenditures**

In the System of National Accounts, the production account includes intermediate consumption and gross value added (GVA). In turn, GVA is divided into five parts: compensation of employees, gross mixed income, gross operating surplus, consumption of fixed capital, taxes less subsidies on production. The first three elements are the source of financing household expenditures including consumer expenditures.

That is why, it deems possible to directly connect the use of GVA with the financing of household expenditures by types of economic activity. For example, the GVA received in the first sector is used to cover corresponding expenditures $ \sum\_{i=1}^{n}C$i1 reflected in the first column of the D matrix. It is necessary to note that there are no other sources for financing the stated expenditures.

Therefore, the following hypothesis becomes quite logical: with the growth of the output and sales of the products of a specific type of economic activity, the GVA of this sector increases as well, which leads to the increase in consumption of the households that receive their income in this sector.

Based on this assumption, the author develops an Input-Output Model of Aggregate Expenditures (IOMAE), in which household consumption is included into the composition of endogenous parameters. This model is based on a hypothesis of homogeneity of intermediate consumption and consumer expenditures, which determines the possibility for *summing* them up for modeling. For instance, for sugar producers, it makes no difference who consumes sugar: a confectionery plant, which uses sugar to produce sweets, or a household, which drinks tea with sugar. In the first case, we have productive consumption, while in the second case — non-productive consumption.

Key principles of the IOMAE:

1. Disaggregation of monetary incomes and expenditures of households by types of economic activity.

2. Inclusion of household consumption into the composition of endogenous parameters (like in the Keynesian multiplier model).

3. Summing up productive and consumer expenditures.

4. Synthesis of the Keynesian multiplier and the Leontief input-output model.

5. The column vector of household consumption of the classical input-output modelis replaced with two components: the C matrix of household consumption, the structure of which is analogous to the Leontief technology matrix, and the vector of household consumption financed from other sources — Z=(Zi): social transfers, property income, and other monetary income. The Z vector is calculated in the following way (see Figures 2-3):

Zi = Rj – $\sum\_{j=1}^{n}C$1j. (6)

Figure 2. The Leontief model



Figure 3. Input-Output Model of Aggregate Expenditures



The endogenous parameters of the model are the indicators of the aggregate consumption of the products by enterprises and households (see Table 7). The peculiarity of this model lies in the expansion of the scope of action of the multiplier mechanism as a result of inclusion of household consumption into the composition of endogenous parameters.

Table 7. Distinctive features of the Input-Output Model of Aggregate Expenditures

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Distinctive features | Classical input-output model | Input-Output Model of Aggregate Expenditures |
| 1 | The form of the model presentation | Matrix | Matrix |
| 2 | Composition of exogenous parameters | ∆Y | ∆I, ∆G, ∆NE |
| 3 | Composition of endogenous parameters | Direct material costs | The sum of direct material costs and consumer expenditures |
| 4 | The form of presentation of household consumption | Column vector | Matrix |
| 5 | Formula of the multiplier of gross output | (E-A)-1 | (1-(a+c))-1 \*(E-(A+C))-1 |
| 6 | Formula of the income multiplier | - | (1-a)/(1-(a+c))-1 \*(I-∑Aij) ∙ (E-(A+C))-1 \*\* |

\* formulas of scalar multipliers;

\*\* I — unit vector

The use of the new approach will allow to conduct a more complete evaluation of the contribution of sectors to the economy of a country or region and rank them in accordance with the production of gross domestic product, the number of employed population, and tax revenues to the region’s budget. Input-Output Model of Aggregate Expenditures can also be incorporated into the Social Accounting Matrix.

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