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CONSEQUENCES OF THE COVID-19 PANDEMIC IN THE EUROPEAN UNION FROM THE PERSPECTIVE OF GENERAL GOVERNMENT FINANCES – AN ANALYSIS BASED ON THE SOCIAL ACCOUNTING MATRIX

ABSTRACT
The aim of the paper is to assess the effects of the COVID-19 pandemic from the perspective of income circulation processes in the economies of the European Union. The empirical study is based on statistical data compiled according to ESA2010 standards, published by the European Commission in the Eurostat database. The fundamental quantitative relationships between entities grouped into institutional sectors have been synthetically presented in the form of a social accounting matrix (SAM). The analyses of simple macroeconomic indicators show the growing importance of the government sector due to the pandemic. This is evidenced by the growing involvement of this sector in consumption, accumulation and income redistribution between institutional sectors. Simulation analyses based on the SAM model determine to what extent the contribution of the government sector to GDP results directly through feedback loops from final demand and to what extent from current and capital transfers.

Key words: system of national accounts, social accounting matrix, input-output model, general government
JEL codes: E16, C67, H2, H4

Introduction

The analysis presented in this paper aims to indicate the changes that have occurred in the economies of the European Union due to the COVID-19 pandemic. Particular emphasis is placed on the role of the general government sector's expenditures and revenues in income circulation between institutional sectors. The results of the simulations, carried out by using the hypothetical extraction method, are applied in order to assess the impact of government expenses on GDP in 2019, 2020 and 2021. It has been hypothesised that governments' importance increased during the pandemic.

Since 2020, much research has been published to analyse the impact of the COVID-19 pandemic on different areas of interest: social issues, poverty, consumption, unemployment, inflation, international trade and others. Some focus on the short-term direct effects of the lockdown [OECD 2020], while others analyse the problem in the from a broader long-term perspective. The authors of modelling the analysis of the impact on household consumption and poverty concluded that in the absence of social protection,

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the impact of the pandemic "led to a massive economic shock to the system" [Martin et al. 2020, p. 453-479] and a particularly high risk of poverty (during the pandemic) particularly concerns people with low education levels and low income who are "significantly insulated by government transfer payments" [Arndt et al. 2021, Pereirinha et al. 2021, 569-594]. Another study [McKibbin et al. 2020, p. 45-52] modelled the evolution of the COVID-19 pandemic in 2020 and its impact in the economy of G20 economies. Authors of this study, as well as – for example – Picek [2020, p. 325-331], also emphasise the critical role of governments because the COVID-19 pandemic should be seen as "a multi-faceted crisis that will require monetary, fiscal and health policy responses".

The main role of the government at the beginning of 2020 was to reduce the spread of the COVID-19 virus and, at the same time, to minimise the instability of the European countries' economies caused by the lockdown [Zamfir et al. 2022, pp. 4519--4531]. The scope of the government's activities was, therefore, two-fold: firstly, the choice of a strategy for dealing with the pandemic and its implementation [König et al. 2021] (significant actions at the beginning of the pandemic); secondly, providing viable solutions for social and political stability [Instytut Finansów 2022]. The longer-term responses seem to be more important. According to data from the International Monetary Fund (IMF), funds allocated to fight the pandemic worldwide amounted to $10.793 billion (10.2% of global GDP) in fiscal assistance and $6.117 billion (6.2% of global GDP) in liquidity assistance [Fiscal Monitor… 2021].

The support mechanisms in response to the crisis caused by the Coronavirus pandemic focused primarily on securing households against loss of income (e.g., by strengthening partial unemployment programs or subsidies to employees' salaries). An example of such action is remuneration for full-time work in Germany, which was used in 2009 by over 1.5 million people, and similar programmes also widely used during the pandemic crisis in France or Spain (50% of employees used them). Further activities were aimed at enterprises that faced the threat of bankruptcy resulting from problems with liquidity and in obtaining external financing. In many countries such as Germany, France, Great Britain and Poland, aid was granted through subsidies to the employment of employees and direct granting of loans or guarantees to entrepreneurs by the state. A detailed list of assistance activities undertaken in selected EU countries can be found, for example, in the report of the Institute of Finance [Instytut Finansów 2022]. These expenditures of the government were incurred as part of the so-called "anti-crisis shield". It should be emphasised that the aim of the article is not to assess the effectiveness of the anti-crisis shield or the legitimacy of introducing its individual elements. The assessment of government activities is devoted to works, for example, by Bagozzi et al. [2022, p. 359--392] or Christensen and Lægreid [2020, p. 774-779], who investigate government actions during the COVID-19 crisis in Norway.

There are many statistics in various databases reporting changes resulting from the pandemic. The in-depth analysis contained in this paper focuses on the relationship between the government sector and other sectors operating in the economy. The differences in the structures of intersectoral flows in 2019, 2020 and 2021 were identified with the aid of statistical data reflecting the entire sequence of transactions included in the European System of Accounts [European Commission 2013]. This is an internationally compatible accounting framework broadly consistent with the System of National

Accounts [European Commission et al. 2009] (SNA) of the United Nations regarding definitions, accounting rules and classifications. However, the ESA considers the specificity of the functioning of EU members [European Commission 2013, p. 10]; it enables a systematic and detailed description of an economy, its components and its relations with other economies. In ESA, the national economy is described by the activities of institutional units which are grouped into institutional sectors [Miller et al. 2009, p. 499--542] according to their characteristic function in the production process, economic goal and type of activity. Five domestic institutional sectors are distinguished: the non--financial corporations, the financial corporations, the general government, the household sector and the non-profit institutions serving households. In addition, the rest of the world sector consists of non-resident units engaged in transactions with resident institutional units or have other economic links with residents.

Macroeconomic analysis based on ESA considers the actions of institutional sectors in terms of production, generation of income, allocation of primary income, secondary distribution of income and the use of income. All of them form a sequence of interrelated accounts. Each of them is recorded as a bilateral, balancing statement of revenues and expenses, and their sequence can be written in the form of the so-called "social accounting matrix" (SAM) [Miller et al. 2009, pp. 499-542]. Such a matrix synthetically presents the basic quantitative relationships (transactions) occurring in income circulation between institutional sectors. The methodological part of the paper is devoted to the principles of construction of such matrices and examples of their use also as a deterministic simulation model. The analysis of changes in the functioning of EU economies due to the pandemic was carried out based on a series of SAMs comprised of data officially published by the European Commission in the Eurostat database. The empirical analysis is divided into two parts. The first one concentrates on the changes in SAM structures visible in the macroeconomic indicators formulated for the purposes of the analysis. The second part contains a simulation analysis which estimates a hypothetical decline in GDP if the governments of EU countries had refrained from covering the expenses related to counteracting the effects of the pandemic. The last part summarises the statistical and simulation analysis.

Materials and methods

The statistical analysis is based on the full sequence of non-financial accounts included in the ESA, with the term "non-financial" specifying the scope of the flows included. These are transactions reflecting the activities of institutional sectors within the so-called "real economy"; there are no transactions related to the acquisition of financial assets or incurrence of liabilities. The non-financial account sequence ends with the balancing item – net lending/net borrowing, which is the difference between the sum of all revenues (primary incomes as well as current and capital transfers received) and the sum of all expenses (consumption and accumulation as well as current and capital transfers paid). At the same time, by definition, this item is equal to the difference between the net acquisition of financial assets and the net incurrence of liabilities. In this way, the sequence of non--financial accounts is linked to the financial account.

Table 1. SAM scheme

SAM					USES					
					I	II	III	IV	V	Total
Resources	current accounts	products account		I						
		primary income	D1 D2X3 B2A3 D4	II						
		institutional sectors	S11 S12 S13 S14_S15 S2	III						
	capital account	institutional sectors	S11 S12 S13 S14_S15 S2	IV						
		B9		V						
	total									

S11 – non-financial corporations, S12 – financial corporations, S13 – general government, S14 – households, S15 – non-profit institutions serving households (NPISH), S2 – rest of the world, D1 – compensations of employees, D2X3 – taxes on production and imports less subsidies, B2A3 – operating surplus and mixed income, D4 – property income, B9 – net lending/net borrowing.

Source: own elaboration.

This paper presents linkages between the accounts in ESA in the form of social accounting matrix (SAM). Its structure may vary depending on the purpose of the analysis conducted on its basis, the required degree of detail of the accounts and the availability of statistical data. The choice of SAM form may concern entities executing transactions (industries, institutional sectors) and their grouping on individual accounts, as well as the level of disaggregation of transactions within the selected account – for example, forms of current transfers [Boratyński 2005, p. 50-51]. Social accounting matrices are not published; hence their final form depends on the creativity of the person who undertakes their construction. In this paper, the matrix built for each EU country consists of 25 sub-matrices, of which only 12 contain elements other than 0 (marked in grey in Table 1).

Sub-matrix I,I is a scalar that reflects the amount of intermediate consumption. Sub-matrices I,III and I,IV (row vectors) contain elements of final demand, with the distinction of consumption of the general government, households and NPISH, and exports (sub-matrix I,III), as well as investments of domestic institutional sectors in sub-matrix I,IV. The value recorded in this sub-matrix for the rest of the world sector relates only to acquisitions less disposals of valuables. Sub-matrix II,I (column vector) contains the individual elements of value added and taxes on products less subsidies. The same economic categories are then presented in sub-matrix III,II as primary income of institutional sectors: compensation of employees as income of households and the rest of the world, taxes less subsidies as income of the general government and the rest of the world, operating surplus as income of all domestic institutional sectors and mixed income of households. In addition, sub-matrix III,II contains resources in the form of property income. In sub-matrix II,III, property income is recorded as the uses of institutional sectors. This sub-matrix also includes compensation of employees paid by the rest of the

world sector. In sub-matrix III,I, which is a column vector, there is only one transaction – imports of goods and services as the resource of the rest of the world.

Sub-matrix III,III shows the intersectoral flows of current transfers. It was constructed based on the resources and uses tables of the following transactions recorded in the secondary distribution of income account: current taxes on income, wealth, etc., net social contributions, social benefits other than social transfers in kind, other current transfers and, additionally, the adjustment for changes in pension entitlements. The flows in the columns represent the uses of the institutional sectors, which are simultaneously the resources of other sectors recorded in the rows (table in the form of from-whom-to-whom, also called payer-payee matrix). This sub-matrix is created by summing the flow tables for each transaction mentioned above. For transactions that are recorded on the resource/use side of only one sector, the payer-payee matrix can be written in an unequivocal manner. For example, in most EU countries, the adjustment for a change in pension entitlements is recorded as a use of financial corporations and household resources, so the table for this transaction consists of only one element – the flow between these two sectors. In case there are at least two sectors on the side of payers and beneficiaries, the elements of the flow table are estimated. This study adopted the idea of estimation procedure of intersectoral flows tables proposed by Tsujimura and Mizoshita [2004, p. 3-9]. The same method based on input-output methodology was applied, for example, by Li [2008, p. 215-239] for the construction of SAM supplemented with financial account transactions for China and Bustamante-Ayala et al. [2022, p. 5305-5319] for the Mexican economy. Burkowski and Kim [2018] used this method to investigate the financial system in the Brazilian economy, while Tomaszewicz and Trębska [2017, p. 7--26] used it to analyse the intersectoral flows of financial instruments in Poland. Okuma [2013, p. 387-404] applies input-output analysis to the inter-sector flow of funds accounts and simulates the ripple effects of financial shocks transmitted in sectoral interlinkages.

The same estimation method was applied for the calculation of the intersectoral flows of capital transfers, which are recorded in sub-matrix IV,IV. These are flows in the form of capital taxes, investment grants and other capital transfers.

In sub-matrix IV,III, there are savings in the domestic institutional sectors. As a balancing item for current accounts, they can take positive or negative values depending on whether the current revenue is higher or lower than the current expenditure. Savings constitute both the use of the current account and the resources of the capital account as one of the sources of financing the capital expenditure. For the rest of the world sector, the current account balance is recorded here, taking into account the balance of foreign trade (imports minus exports), primary incomes and current transfers. The balancing items for the entire sequence of non-financial accounts of individual institutional sectors are recorded in sub-matrices V,IV (net lending) and IV,V (net borrowing).

The SAM constructed according to the principles presented above guarantees equality of sums in rows and columns. The sum of all elements of sub-matrices I,I, II,I and III,I shows the total supply (intermediate consumption, value added, taxes on products and imports). The same value that is the sum of the elements written in sub-matrices I,I, I,III and I,IV represent the total demand (intermediate and final consumption, exports and accumulation). The sums by rows (institutional sectors) of the columns of sub-matrix III,II are primary incomes by production factors (compensations of employees, operating surplus and mixed income as well as property income). Sub-matrices I,III, II,III, III,III and

IV,III show the distribution, redistribution and use of current income, so their sums in columns are the current expenditure of individual, institutional sectors. The sums of sub-matrices I,V, IV,IV and V,IV reflect the total capital expenditure of individual sectors (accumulation, capital transfers paid and net lending). On the other hand, the sums in the rows of sub-matrices IV,III, IV,IV and IV,V represent the total capital resources of the institutional sectors: saving, capital transfers obtained and net borrowing. The totals in the accounts by institutional sector (i.e., the totals in columns/rows III and IV) are not directly reflected in the sequence of accounts.

SAM contains information on basic macroeconomic indicators used to assess the condition of the economy or the financial condition of individual, institutional sectors – in particular:

- gross domestic product (B1GQ[2]), which is the sum of final consumption (P3) of the general government (S13), households and non-profit institutions (S14_S15), accumulation (P5G) of all domestic institutional sectors and exports (P6) minus imports (P7); in SAM built according to the scheme presented in Table 1, the GDP is, therefore, the sum of the elements of sub-matrices I,III and I,IV reduced by the value of the only element written in sub-matrix III,I. GDP calculated according to the income approach is the sum of compensation of employees (D1), taxes on production and import less subsidies (D2X3) and the operating surplus and mixed income (B2A3); in SAM, it is the sum of the elements recorded in sub-matrix II,I:
  $$B1GQ = P3\_S13 + P3\_S14\_S15 + P5G + P6 - P7 = D1 + D2X3 + B2A3 \quad (1)$$
- disposable income of each domestic institutional sector is the sum of current resources minus the sum of current transfers paid; thus, for example, the disposable income of the first sector (S11) is equal to the sum of the elements recorded in the first row of sub-matrix III,II and III,III minus the sum of the elements recorded in the first column of sub-matrix III,III in SAM.

Based on the above two macroeconomic aggregates, several indicators can be determined, which are herein used in the empirical analysis to assess the economic effects of the pandemic in terms of the general government sector finances:

- share of the general government consumption and investments in GDP;
- share of its current resources (sum of elements of the third row of sub-matrix III,II and III,III) in GDP;
- the structure of its current resources, in particular the share of taxes on production and imports less subsidies;
- share of transfers received and paid by the general government in the total of intersectoral flows of current transfers;
- share of its capital expenditure (sum of elements of the third column of sub-matrices I,IV, and IV,IV) in GDP;
- share of transfers received and paid by the general government sector in the total of intersectoral flows of capital transfers;
- net borrowing (the third element of sub-matrix IV,V) in relation to GDP.

[2] ESA symbols are used.

A simple statistical analysis of the above indicators is supplemented with a simulation based on SAM, treated as a multi-equation, deterministic, static model of the economy. This is an extension of the input-output methodology for investigating the relationships between the production process and income circulation [Pyatt 2001, p. 139--163.]. Using SAM for simulation analyses requires distinguishing endogenous and exogenous accounts in SAM. The division of SAM into endogenous and exogenous accounts may differ depending on the purpose of the simulation analyses carried out on its basis. In this case, the simulation aims to determine the impact of various forms of government spending on GDP so that the exogenous accounts include the general government's current and capital expenditure (but only those that are distinguished in the SAM accounts by institutional sector) as well as current and capital expenditure of the rest of the world, which is by default treated as exogenous in simulation analyses based on SAM. The general principle of SAM division is presented in Table 2.

Table 2. Endogenous and exogenous accounts in SAM

		Uses		Total
		Endogenous accounts	Exogenous accounts	
Resources	Endogenous accounts	**Z**	**Y**	**x**
	Exogenous accounts	**R**	**W**	**r**
Total		$\mathbf{x}^T$	$\mathbf{r}^T$	

Source: [Tomaszewicz 2001, p. 12].

Matrix **Y** consists of four columns representing the current and capital expenditure of the general government and the rest of the world, which is the resource on every account except for the general government and the rest of the world. Matrix **W** includes current and capital transfers between the general government sector and the rest of the world (or between the units included in these two sectors). Matrix **R** consists of rows showing the revenues of the general government and the rest of the world, except for the transactions included in **W**. Matrix **Z** contains all other transactions recorded in SAM. All the uses recorded on endogenous accounts depend on exogenous variables.

The simulated GDP is calculated based on the appropriate elements of the $\mathbf{Z}'$ matrix, determined according to the following formula:

$$\mathbf{Z}' = \mathbf{A}_\mathbf{z}\widehat{\mathbf{x}'}, \tag{2}$$

where: $\mathbf{A}_\mathbf{z} = \mathbf{Z} \cdot \hat{\mathbf{x}}^{-1}$ is a matrix of shares of individual expenses in endogenous accounts in total expenses (calculated from the base SAM), $\mathbf{x}' = (\mathbf{I} - \mathbf{A}_\mathbf{z})^{-1}\mathbf{y}'$ is a simulated vector of total revenues on endogenous accounts, $\mathbf{y}' = \mathbf{Y}' \cdot \mathbf{i}$ is a column vector obtained by summing the rows of the $\mathbf{Y}'$ matrix, in which the chosen values of the columns representing government expenditure are equal to 0 with the simulation assumption that government expenditure (i.e., consumption or accumulation or transfers) would not be incurred and the expenditure of the rest of the world would not change.

GDP is calculated according to Formula 1, which requires determining the imports from the **R** part of SAM:

$$\mathbf{R}' = \mathbf{A_r}\widehat{\mathbf{x}'}, \tag{3}$$

where: $\mathbf{A_r} = \mathbf{R} \cdot \hat{\mathbf{x}}^{-1}$.

SAM multipliers calculated on the basis of matrix $(\mathbf{I} - \mathbf{A_z})^{-1}$ indicate the change in GDP caused by the increase in exogenous expenses by 1. Additionally, the results were presented in a way that allows determining to what extent the contribution of the government sector to the creation of GDP in 2019 and 2020 results from its final expenditure and to what extent from current and capital transfers.

The analysis of the simulation results based on the SAM model requires realising that it is a static model; therefore, it does not take into account the effects delayed in time. The simulation results depend on the adopted assumptions; in this case, it is imperative to assume that the coefficients of matrix **A** are constant – regardless of the government's behaviour. However, adjustments in the form of changes in the structure of revenues and expenditures of institutional sectors, treated as endogenous in the model, should be expected. Moreover, the simulation results depend on the selection of variables treated as exogenous in the model and the share of expenses recorded in these accounts in the total sum of transactions concluded in SAM.

Limiting the conclusions of the simulation analyses to compare the impact of different types of expenditure on GDP, as done in this study, does not seem to raise methodological reservations.

Results and discussion

The results presented in this section refer to the European Union countries, except for Bulgaria (due to a complete lack of data on national accounts in the Eurostat database for this country) and Malta (due to significant data gaps), preventing the construction of SAM according to the adopted scheme. Therefore, it was possible to construct SAM for 25 countries for 2019, 2020 and 2021. Despite the lack of data for Bulgaria and Malta, the Eurostat database contains aggregate data for 27 EU countries, so the outcomes were supplemented with averaged effects for the EU calculated based on aggregate data for 27 countries (EU27). The economic impact of the pandemic was identified by comparing data for 2020 with data for 2019. Additionally, some outcomes were also referred to in 2021. To increase the transparency of the figures, they were prepared for the ten largest EU countries (with the highest GDP).

In 2020, gross domestic product – in real terms – decreased in most European Union countries. The largest drops in gross domestic product in 2020 were recorded in Spain, Greece, Italy and Portugal – more than 8%; in these countries, even in 2021, the GDP volume did not return to the 2019 level [Eurostat 2022a].[3] These countries were most affected by the effects of the 2008 financial crisis and, therefore, reacted particularly strongly to the recent pandemic crisis [Ladi et al. 2020, p.1041-1056.]. At the same time, an increase in general government expenditure was observed. The share of general government consumption in GDP (see Figure 1) increased in 2020 in all EU countries (on average in the EU27 by 2 percentage points (p.p.) – from 20.7% in 2019 to 22.7% in 2020).

[3] https://ec.europa.eu/eurostat/databrowser/view/gov_10a_exp/default/table?lang=en (accessed: 22.09.2022)

The largest increase in this share – exceeding 3 p.p. – was recorded in Cyprus, Croatia and Spain, with the lowest in countries where it was already high in 2019 – Sweden and Denmark. In 2021, it was still higher than in 2019 in all countries; in the EU27, it was at 22.3%. The share of the general government accumulation in GDP also increased in all EU countries (except for Slovakia) in EU27 from 3.0% in 2019 to 3.4% in 2020 and 3.2% in 2021.

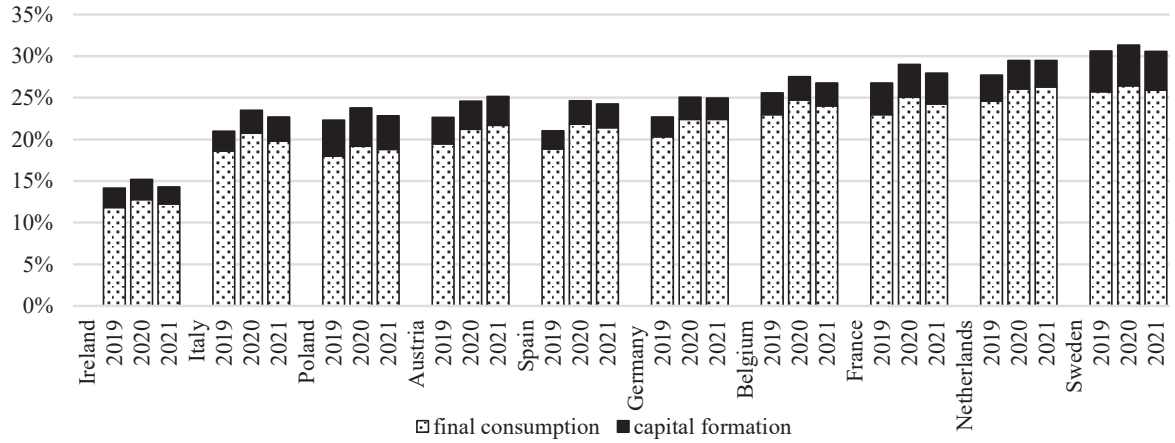

Figure 1. The share of consumption and investment expenditure of the general government in GDP
Source: own elaboration based on the Eurostat database (accessed: 3-11-2022).

The increase in the share of expenditure on consumption and investment purposes was accompanied by a decrease in the ratio between the sum of current revenues and GDP in most EU countries (in the EU27 from 43.4% in 2019 to 42.6% in 2020 – i.e., a decrease by 0.8 p.p. on average) except for Spain, France, Croatia, Latvia, Hungary, Romania and Slovakia. In particular, the share of taxes on production and imports (minus subsidies in GDP) decreased from 11.8% in 2019 to 10.4% in 2020 and 10.9% in 2021 in the EU27. In all countries, the share of this transaction in the current revenues of this sector also decreased. This is due to the increase in the amount of subsidies paid by the general government, which increased by over 200% in many countries (almost 60% in the EU27).

The decline in fiscal and other receipts, coupled with increased social benefits paid by the government, is also evident in the secondary distribution of income account – in the structure of SAM sub-matrix reflecting the intersectoral flows of current transfers. The share of this sector's resources in total transfers (see Figure 2) decreased in the EU27 by 2 p.p. in 2020 (from 47.4% to 45.4%), while the share of expenses (see Figure 3) increased by 2.4 p.p. (from 30.1% to 32.5%). Such a tendency was observed in all EU countries, but the share in revenues decreased the most in Belgium, the Czech Republic and Austria (by over 3 p.p.), while the share of expenses increased the most in Lithuania, Romania and Ireland (by over 4 p.p.).

Transactions between the general government (mainly the sub-sector of social security funds) and households dominate the structure of payer-payee matrix for current transfers. These are social contributions and social benefits. The government sector's links to other sectors are mainly related to existing taxes on income and other current transfers. Payments from all sectors to the general government, especially from households, have

decreased in most countries. This especially concerns payments from households as the pandemic resulted in a decline in the level of social contributions and taxes on income, which was related to a decline in labour revenues and operating surpluses and mixed incomes. The largest decrease in the share of household payments to the general government was recorded in Ireland, Italy, Slovakia, Belgium, France and Hungary – above 2 p.p. This share did not decrease or increase insignificantly in Luxembourg, Portugal, Sweden or Cyprus. In the cross-sectoral structure of general government revenues, only the share of intra-sector transfers increased, mainly related to flows between sub-sectors (i.e., central government and social security funds).

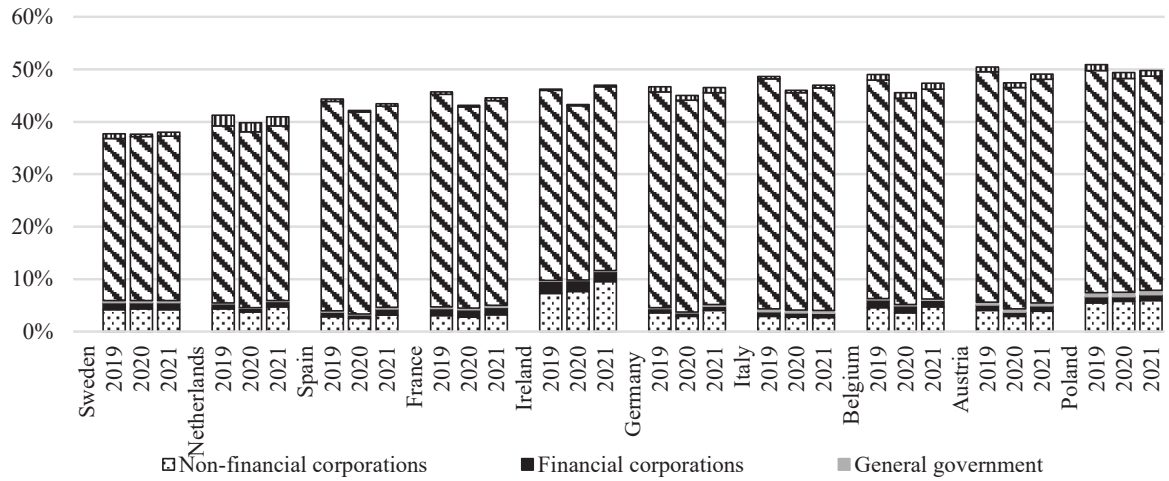

Figure 2. Intersectoral structure of general government resources in terms of current transfers
Source: own elaboration based on the Eurostat database (03.11.2022).

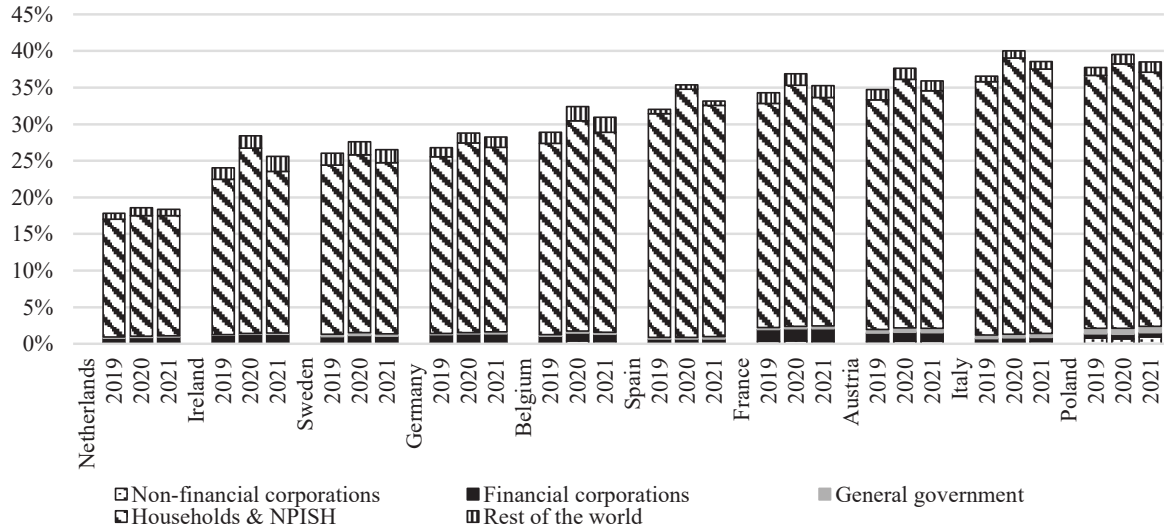

Figure 3. Intersectoral structure of general government uses in terms of current transfers
Source: own elaboration based on the Eurostat (03.11.2022).

In the case of the government sector's expenditure on current transfers, payments to households and the rest of the world increased in all EU countries and, in most countries, also to other sectors (see Figure 3). The largest increase in the share of current transfers to households was mainly due to the higher amount of transfers paid from other social insurance benefits (i.e., healthcare and unemployment benefits). In 2020, a particularly large increase in this share was recorded in Lithuania, Ireland, Spain and Italy (over 3 p.p.).

The intersectoral structure of capital transfers is more spatially varied (see Figure 4). The share of the government sector's revenues in total capital transfers ranged from 13-15% in 2019 in Austria, Luxembourg and Cyprus to over 60% in Latvia, Slovakia and Finland. In most EU countries, this share decreased in 2020 – in the EU27 from 33.0% in 2019 to 24.2%, the most in Latvia, Poland, Denmark, Lithuania, Spain, Greece and Hungary – by more than 15 percentage points. Increases were recorded only in Cyprus, Croatia, Romania, the Netherlands and Germany. In the latter two countries, this was due to an increase in capital taxes, which are taxes on gains on financial savings of households. Government revenues of this kind increased only in these two countries (Austria and Finland) and decreased in all the others. However, in most countries, investments grants received by the government increased in 2020; these are transfers largely paid by the rest of the world sector – especially in countries that joined the Union relatively recently. Therefore, the structure of government revenues from capital transfers is mainly due to the importance of the above-mentioned types of transfers. In some countries, payments from households clearly dominate – in Denmark, Belgium, France, Finland, Luxembourg, the Netherlands, Germany and Ireland (in countries with a high share of capital taxes in total capital transfers). In others, more than 50% of government revenues from capital transfers are payments from the rest of the world sector (in Poland, Latvia, Lithuania, Estonia, Czech Republic, Romania, Slovenia, Portugal, Slovakia, Hungary and Greece – in countries where most investment grants are paid by the rest of the world) or intra--government transfers (in Cyprus and Italy).

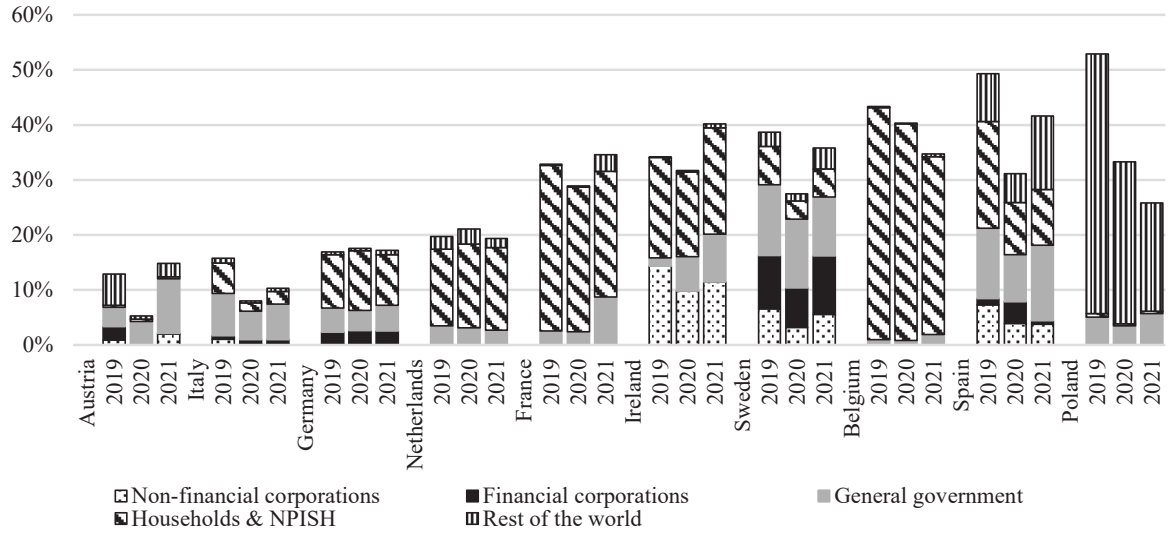

Figure 4. Intersectoral structure of general government resources in terms of capital transfers

Source: own elaboration based on the Eurostat database (03.11.2022).

The general government pays capital transfers in two forms – investment grants and other capital transfers. The last category is challenging to define unambiguously, but it was crucial during the pandemic because it encompasses, among other things, payments made by the general public or by the rest of the world to owners of property damaged or destroyed by war, other political events or natural disasters, transfers from the general public to businesses and microenterprises to cover losses accrued over several fiscal years or exceptional losses resulting from causes [European Commission 2013, p.121-122]. As expected, in most EU countries, the share of government expenditure in total capital transfers increased in 2020 (in the EU27 from 59.0% in 2019 to 66.3% in 2020 – i.e., an increase of 4.3 p.p. on average). The largest increases in this share were recorded in Austria, Latvia and Denmark (above 20 p.p.), with decreases only in Cyprus, Spain, Romania, Croatia and the Netherlands. The increases are mainly caused by transfers paid to non-financial corporations (in the EU27 by 6.5 p.p.) – see Figure 5.

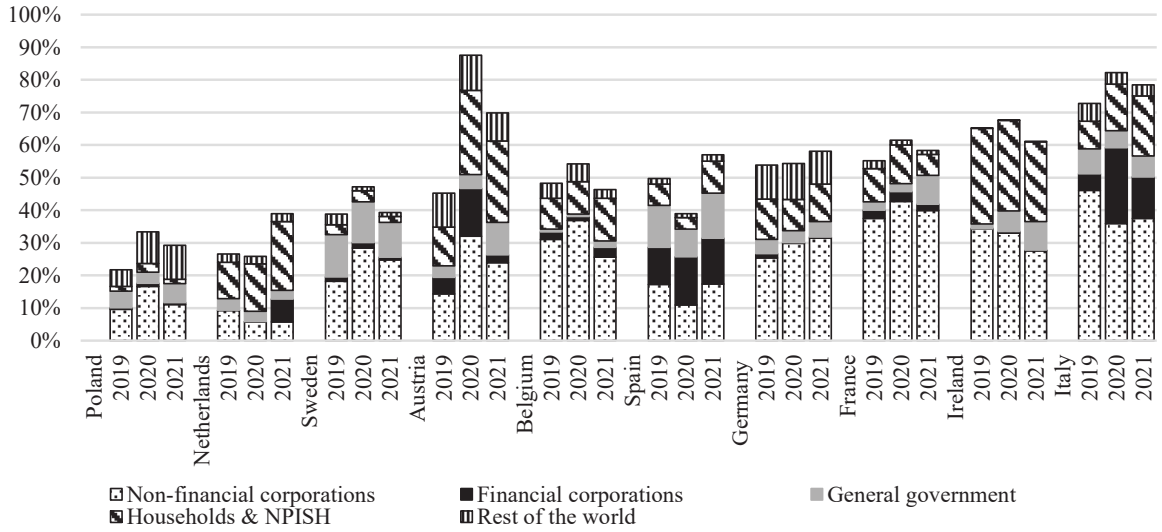

Figure 5. Intersectoral structure of general government uses in terms of capital transfers
Source: own elaboration based on the Eurostat database.

The scale of government economic support has been analysed in this article, with the distinction of individual forms of support (i.e., by type of expenditure). There are many analyses in which the government's involvement in the fight against the pandemic is assessed in an aggregated way as the sum of government expenses [Pereirinha et al. 2021, p. 569-594] or with the use of specific indexes [Hale et al. 2021, p. 529-538]. According to the data of the European Commission (also see the report prepared by the Institute of Finance [2022]), expenditures on combating the effects of the pandemic in 2020 amounted to 4.5% of GDP in Poland, 3.3% in Germany, 3.5% in France, 6.6% in Italy and 4.2% in Spain.

The results of the second part of empirical research in this paper - simulation experiments – show hypothetical declines in GDP caused by the government refraining from spending in the form of final consumption, accumulation or transfers. The SAM model reflects a system of feedback between production, distribution and use of disposable income. In other words, this is a circular flow of income – from production and products

to production factors, to income and expenditure of institutional sectors, and back to products [Laursen et al. 2004, p. 19]. The assumed decline in government expenditure for final consumption or accumulation affects domestic production and imports, compensation of employees (household income), operating surplus (producer income) and transfers related to the fiscal burden. Final expenditure of other institutional sectors is also changing, and these, in turn, affect production, etc. The cumulative effect measured as a decline in GDP (see Formula 1) may be greater or less than the change of consumption/accumulation of the general government depending on how sensitive imports are to changes in this sector's final expenditure. SAM multipliers (see Table 3), which measure, in this case, the change in GDP caused by the change in the general government final demand by 1, can be more than 1 when the change in other domestic sectors' final demand is greater than the change in imports or less than 1 in the opposite situation.

Table 3. Decomposition of GDP multipliers in SAMs models for 2019

Country	Indirect effects		Change in GDP (sum of direct and indirect effects)	Indirect effects		
	Final demand of other domestic sectors	Exports net		Compensation of employees	Taxes on production and imports less subsidies	Operating surplus and mixed income
Initial change in final demand of the general government = 1						
Germany	0.653	-0.480	1.173	0.626	0.115	0.432
France	0.692	-0.415	1.276	0.651	0.176	0.449
Italy	0.793	-0.395	1.398	0.561	0.177	0.659
Spain	0.835	-0.445	1.390	0.643	0.143	0.604
Netherlands	0.371	-0.577	0.794	0.380	0.088	0.327
Poland	0.635	-0.549	1.085	0.425	0.138	0.522
Sweden	0.531	-0.465	1.066	0.506	0.215	0.345
Belgium	0.426	-0.640	0.786	0.385	0.078	0.322
Ireland	0.313	-0.726	0.587	0.165	0.040	0.382
Austria	0.582	-0.541	1.040	0.505	0.128	0.408

GDP multipliers <1 are also observed in the Czech Republic, Denmark, Estonia, Cyprus, Lithuania, Luxembourg, Hungary, Slovenia and Slovakia

Source: own calculations.

Changes in GDP caused by a decline in the general government's final demand can be decomposed into direct effects (consumption and accumulation of the general government are GDP components, so their decline by 1 involves a decline in GDP by 1) and indirect effects concerning final demand of other domestic sectors and imports. For example, a decline in the final demand of the general government in Germany in 2019 by €1 million would cause a EUR 1.173 million decline in GDP, which is 1 (direct effect) plus 0.653 (change in final demand of other domestic sectors) minus 0.480 (change in imports). Opposite example is e.g. Ireland, where decline in final demand of general government in 2019 by 1 million euro would cause only 0.587 million euro decline in GDP, which is 1 (direct effect) plus 0.313 (change in final demand of other domestic sectors) minus 0.726 (change in imports). Another method of decomposing GDP allows for the indication of the effects of reducing government expenditure, distinguishing changes in compensation of employees (D1), operating surplus and mixed income

(B2A3), as well as taxes on production and imports less subsidies (D2X3). For example, the aforementioned hypothetical decrease in GDP by EUR 1.173 million in Germany, caused by a decrease in government spending by 1, consists of a decrease in D1 by 0.626, a decrease in B2A3 by 0.432 and a decrease in D2X3 by 0.115. In turn, for example, in Poland and Italy, due to a relatively large number of micro-enterprises, B2A3 is declining more strongly than D1.

The government's refusal to pay transfers has an impact by decreasing the current and capital revenues of other institutional sectors, as well as their ultimate expenditure, output, etc. Since some of the earnings do not have to be utilised to meet final demand (for example, for financial investments that are not included in GDP), the predicted impact of transfers is less significant than the impact of final demand. Therefore, SAM multipliers, which measure the change in GDP caused by the change in general government transfers, are usually less than 1. Moreover, an increase in the propensity to save by households and a decrease in demand for tangible investments during the pandemic caused a decrease in the value of these multipliers in 2020 compared to 2019 in most EU countries (see Table 4).

Table 4. GDP multipliers in SAMs models for 2019 and 2020 – changes in GDP caused by an increase in general government expenditure (final demand, current and capital transfers) by EUR 1 million

Country	Final demand		Current transfers		Capital transfers	
	2019	2020	2019	2020	2019	2020
Germany	1.173	1.184	0.725	0.696	0.965	0.868
France	1.276	1.284	0.824	0.785	1.191	1.144
Italy	1.398	1.360	0.957	0.858	1.184	0.681
Spain	1.390	1.369	0.964	0.876	0.787	0.596
Netherlands	0.794	0.820	0.473	0.462	0.579	0.461
Poland	1.085	1.053	0.795	0.741	0.918	0.560
Sweden	1.066	1.112	0.701	0.694	0.976	0.998
Belgium	0.786	0.784	0.499	0.456	0.709	0.631
Ireland	0.587	0.638	0.389	0.406	0.575	0.558
Austria	1.040	1.072	0.689	0.662	0.919	0.689

Source: own calculations.

In the literature, you can find other examples of applications of multiplier analyses based on SAM. For example, Betho et al. [2022, p. 823-860] used a SAM-based multiplier analysis to estimate the total impact of COVID-19 on the economy and distinguish between the contributions of foreign and domestic shocks to changes in production and employment across a range of economic sectors. Their estimates indicate that economic growth in 2020 was 3.6 percentage points lower because of COVID-19 than it would have been otherwise. However, the analysis of the impact of the pandemic on economic activity had a completely different goal and simulation assumptions. Its purpose was to calculate the combined effects of specific demand and supply shocks, assuming that the SAM structure with a built-in IO table in 2020 would be the same as in 2015. Other examples are the assessment of the first six months of the pandemic in Rwanda (simulation based on SAM for Rwandan economy in 2018) [Aragie et al. 2021], the application of a multiplier model based on the SAM structure for Myanmar's economy in 2019 [Diao et al. 2020] or the 2015 SAM for South Africa [Arndt et al. 2020]. In contrast,

the simulation analysis presented in this article estimates a hypothetical decline in GDP if the government had not incurred expenses related to counteracting the effects of the pandemic. They are based on the current 2020 and 2021 SAM structures.

Conclusions

The effects of the COVID-19 pandemic are visible in the entire sequence of interrelated elements of the income circulation process in the economy. A loss in income from such production components as labour and capital – a decrease in wages and operational surplus – was a result of production limits caused, among other things, by interruptions in the supply of raw materials, a decrease in consumption and investment demand. This caused a reduction of some redistributive transfers – mainly income taxes. At the same time, the value of transfers paid to corporations and households increased. All of this resulted in a significant deterioration of the situation of public finances.

The above observations are reflected in officially published statistical data. Analysing the European Commission data on the most important transactions allows for identifying the following changes observed in most EU countries due to the pandemic.

1. The share of general government consumption and accumulation in GDP increased with a simultaneous decline in the share of exports. Government expenditure increased on average by 9.2% in the EU in 2020 – in particular, related to general economic, commercial and labour affairs (by 97.2%), unemployment (by 65.3%) and broadly understood health (by 9.7%) [Eurostat 2022b].[4]
2. The ratio between the sum of current revenues of the general government and GDP decreased – especially the share of taxes on production and imports less subsidies in GDP due to the decrease in taxes and significant increase in subsidies paid by this sector.
3. The decrease in fiscal revenues, including income taxes and social contributions, was accompanied by an increase in social benefits paid by the general government. Thus, in the structure of the intersectoral flows table in terms of current transfers, the share of government expenditure increased while the share of its revenues decreased.
4. Due to the lockdown caused by the pandemic, the amounts of transfers from the general government to corporations and micro-enterprises to cover losses increased significantly. Thus, the share of government payments increased in the structure of intersectoral flows table in terms of capital transfers.
5. The increase in general government expenditure and a decrease in this sector's revenues must have led to the emergence or deepening of the general government deficit, which was observed in most of the European Union. The net borrowing of this sector increased in the EU27 from 0.1% of GDP in 2019 to 6.3% in 2020 and 4.2% in 2021 (in Poland, it increased from 0.7% of GDP in 2019 to 7.1% in 2020 and 1.8% in 2021).

In 2020 in Poland, support for the healthcare sector reached 0.2% of GDP[5], exemptions from the payment of social security contributions and health – 0.6%, subsidies

[4] https://ec.europa.eu/eurostat/databrowser/view/gov_10a_exp/default/table?lang=en (accessed: 22.09.2022)
[5] According to data provided by Polish Ministry of Finance presented in Instytut Finansów 2022.

to the salaries of companies and subsidies for the self-employed and on civil law contracts – 0.9%, non-returnable support for companies – 1.8%, care, solidarity and other allowances – 0.2%.

The analysis of the spatial diversification of the significance of the general government in individual spheres of the functioning of the EU economies suggests some substitutability. In some countries, the government plays a particularly important role in final demand (e.g., Sweden and the Netherlands), and in others in the redistribution of income (e.g., Poland and Italy) – see Figures 1 and 3. However, the simulation results for all EU countries clearly indicate that the government has the strongest impact on GDP through final consumption, slightly less through current transfers, and much less through accumulation and capital transfers.

The multiplier analysis carried out using the linear SAM model gives results with an unambiguous interpretation – an increase in government spending causes an increase in GDP, while the decomposition of GDP multipliers allows the identification of the relationship between the impulse and the effect in the form of GDP growth. Their interpretation can be given a much more universal character, going beyond the subject of public spending during the COVID-19 crisis. These multipliers, therefore, show that in European countries, the increase in net borrowing of general government due to the increase in final demand increases GDP, causing the increase of mainly domestic sectors' primary income, leading mainly to an increase in imports. The conclusions could be much more in-depth if the simulation tool was a social accounting matrix with final demands disaggregated by product classification (an input-output table inside SAM). Unfortunately, such data is released with a delay of several years; therefore, at the time of conducting research for this article, it was not possible to assess the effects of changes in final demand in 2020 based on input-output tables.

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Skutki pandemii COVID-19 z perspektywy finansów sektora instytucji rządowych i samorządowych w gospodarkach Unii Europejskiej. Analiza na podstawie macierzy rachunkowości społecznej

STRESZCZENIE

Przedmiotem analiz przedstawionych w niniejszym artykule jest ocena skutków pandemii COVID-19 z perspektywy procesów cyrkulacji dochodów w gospodarkach Unii Europejskiej. Badanie empiryczne opiera się na danych statystycznych opracowanych według standardów ESA 2010, publikowanych przez Komisję Europejską. Podstawowe ilościowe relacje zachodzące między podmiotami pogrupowanymi w sektory instytucjonalne, zostały syntetycznie przedstawione formie macierzy rachunkowości społecznej (SAM). Analizy prostych wskaźników makroekonomicznych pokazują wzrost znaczenia sektora rządowego w obliczu pandemii. Świadczy o tym wzrost zaangażowania tego sektora w konsumpcję, akumulację, a przede wszystkim w proces redystrybucji dochodów między sektorami instytucjonalnymi. Analizy symulacyjne przeprowadzone w oparciu o model SAM pozwoliły na wskazanie w jakim stopniu wkład sektora instytucji rządowych i samorządowych w tworzenie PKB wynika (bezpośrednio i poprzez sprzężenia zwrotne w gospodarce) z jego popytu finalnego, a w jakim z transferów bieżących i kapitałowych.

Słowa kluczowe: system rachunków narodowych, macierz rachunkowości społecznej, metody input-output, sektor instytucji rządowych i samorządowych