Mechanisms of National Income Distribution: a Comparative SAM Analysis of Canada, Germany, and Portugal

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by

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Abstract

Modern income studies are firmly rooted in, and restricted to, the micro-approach. Following economic theory of the household they begin by defining a concept of "personal income" observable in household surveys, and end by correlating this variable to other variables of the same households. Households are thus the one, and only, object of inquiry.

While such focussing on one specific type of economic institution may be sensible for certain purposes it also has its short-comings for others. It seems, for example, that the current trend of income distribution towards social polarisation cannot be explained by looking at households alone, but that other institutional units, by their participation in the distribution process, also exert an important influence. As a consequence, it may be warranted to enlarge the scope of research to including all institutional units of an economy, adding a macro-economic perspective to the micro approach.

A means of carrying out such project is being provided by social accounting matrices (SAMs), which pursue each type of income, from its source to its use, through the whole economic circuit. Based on the standard assumption of constant expenditure coefficients the effect of different mechanisms of distributing and redistributing national income to different groups of households may be brought to light and studied. The paper compares three countries, namely, Canada, Germany, and Portugal, in this respect. It finds that distribution structures of the three countries are similar at the aggregate level of national accounts, and if disaggregated, as is the case for Portugal income from capital is differently distributed from labour income.

1 Introduction

Input-output analysis deals with economic production, by tradition. Beginning from some final demand assumed to be exogenous to the model standard input-output technique allows to determine the input of primary factors, either paid out of value added, or unpaid such as environmental costs, incurred by production satisfying a given final demand. The principal idea looming behind such studies is that of an economic circuit in which the products of an economy are mutually inputs to each other, and circulate in a complex manner, before they reach their final destination. Final use (the "second quadrant") is linked to primary factors of production (the "third quadrant") via intermediate use (the "first" quadrant). The "fourth quadrant", in the language of input-output, is left empty, analytically and statistically.

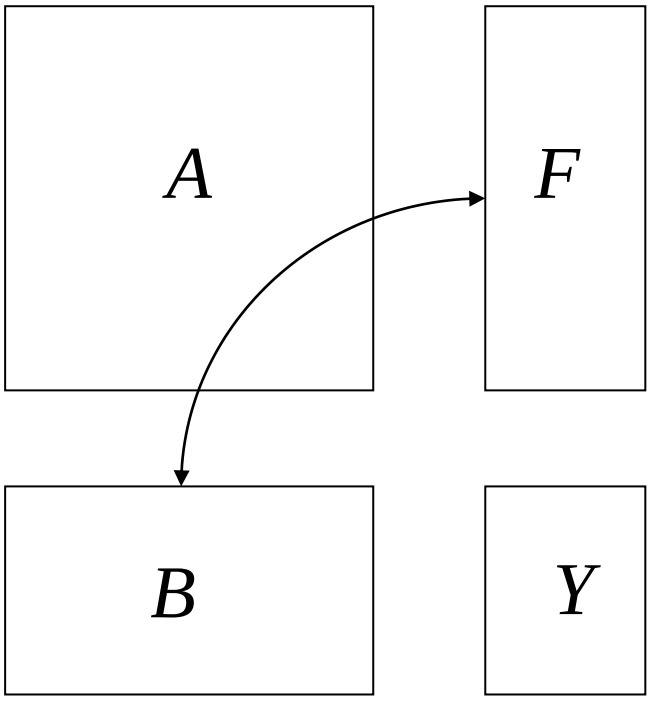
The paper attempts to fill the empty space. Its focus is not the circuit of products, but circulation of income through the institutional sectors of an economy, transforming primary income generated into final income disposable for purchase of goods and services. The statistical data required for such analysis are found in "social" accounting matrices that extend the concept of economic circuit beyond the realm of production into the social, and political, arena of distribution of income (Pyatt and Round 1977, 2012). Economic income is generated from value added in industries. It is paid out as employee compensation to households, and tax on production to general government, the remainder being withheld as operating surplus, within the corporate sector. Institutional units use the receivables to pay property income to those whose property they use (interest, dividends etc.). The balance is named "primary income" of a sector, in the national accounts. Secondary distribution begins with this balance, and registers all direct taxes paid and received, contributions to, and benefits from social insurance institutions, and so on. The circuit of different forms of income is as involved and complex as the circuit of products. In this way of reasoning we propose to deviate from the traditional national accounts definition of exogenous sectors, in this paper, and to apply another definition, more apt to analyse the circuit of income flows. "Rearranging a system of accounts does not change it in any fundamental respect, it simply encourages a different way of looking at it." (Stone 1977, p. xx) Our different way of looking at it consists of questions like: What is the share of labour income in paying for transfers, as compared to capital income? Or the reverse which of the two forms of primary income contributes more to social transfers? The income circuit is not less complex than the circulation of products in a modern society, and while the latter are well studied in input-output research, a similar focus has not

yet been put on the circulation of income. To do so requires a new way of using traditional SAM techniques. We begin by recalling some basic input-output tools used in the analysis of production, explaining how they may be adapted to an analysis of income (section 2). We then apply the new technique to distribution, taking Canada as the first example (section 3), followed by Germany (section 4), and finally Portugal (section 5), which prepares the most detailed social accounting matrix of these three countries. In section 6, a step is taken from accounting to modelling in that the effects of a rise in wages, and of a rise in direct taxes are examined by means of the input-output model. Section 7 concludes.

2 Adapting input-output analysis of production to analysis of income

Figure 1 illustrates the normal set-up of an input-output table. Matrix ***A*** represents a matrix of input coefficients (intermediate use), matrix ***B*** represents a matrix of factor coefficients, and matrix ***F*** stands for a matrix of final use which may be equal to GDP if exports are registered net.

Figure 1 Elementary scheme of input-output analysis



The corresponding definitions and equations are well-known and standard (Miller, Blair 2009). If $x_{i,j}$ describes the intermediate flows from industry *i* to industry *j*, exchanged between *n* industries, and x_j is the total output of industry *j* matrix ***A*** of input coefficients (first quadrant) is defined by equation 1,

(1) $$\boldsymbol{A} = \{a_{ij}\} = \{x_{ij} / x_j\};\ i, j = 1,..., n\ .$$

Furthermore, if $\{v_{ij}\}$ represents the payments to primary factors of kind i (compensation of employees, entrepreneurial income, operating surplus, taxes on production) in industry j the corresponding matrix $\boldsymbol{B}$ of factor coefficients (third quadrant) is given by

(2) $$\boldsymbol{B} = \{b_{ij}\} = \{v_{ij} / x_j\},\ i = 1,...,4;\ j = 1,..., n..$$

Quadrants 1, 2, and 3 comprise the data underlying traditional input-output analysis; they describe flows of products, and ignore flows of income, except for the equation needed to close the circuit of products, namely that GDP generated (in terms of value added) equals GDP expended (in terms of products). The fourth quadrant that would have to contain the flows of income distribution and redistribution remains empty. Social accounting matrices address this quadrant, and thus provide a more elaborate picture of the overall economic circuit than a traditional input-output table.

There is a certain table within the production circuit that fits into the empty space of the fourth quadrant, in that it links value added to products, in a direct way. The corresponding formula is

(3) $$\boldsymbol{Y} = \boldsymbol{B(I - A)^{-1} F}\ ,$$

which maps GDP by products, ***F,*** directly into its corresponding expression in terms of value added, ***Y***. The transformation $\boldsymbol{(I - A)^{-1}}$ is well-known as the „Leontief-Inverse“ and its use is standard in input-output analysis. Tables 1 and 2 apply equations 1 - 3 to a simple example. Two commodities (X1, X2) are produced paying wages for primary input of labour (L) and property income to capital (P); they are used for final consumption (C) or for capital formation (I).

Table 1 Example of input-output table

	X1	X2	C	I	Sum
X1	2	5	3	0	10
X2	3	0	0	7	10

L	4	1			5
P	1	4			5
Sum	10	10	3	7	

From table 1 we may infer that one additional unit of product X1 generates 0.4 units of wages and 0.1 units of profits, additionally. But this is only the direct effect. The sum of direct and indiretc effects is shown in table 2, which is compiled by entering data of table 1 into equation 3. It may be interpreted as follows: Products used for final consumption pay 1.98 value units to labor and 1.02 value units to capital, directly and indirectly, in both industries while products entering into capital formation pay 3.02 value units to labor and 3.98 value units to capital.

Table 2 Mapping final demand into primary factor payments

	C	I	Sum
L	1,98	3,02	5,00
P	1,02	3,98	5,00
Sum	3,00	7,00	

We propose now to extend the use of the Leontief-Inverse from analysing production to analysing the structure of flows of income in an economy. Figure 2a illustrates the proposal. It models a social accounting matrix between three institutional sectors, non-financial coroporations (NFC), financial corporations (FC), general government (GG) and two classes of households, namely wage earners (HH1), and profit earners (HH2). The last column shows the final use of products (FU) to which the disposable income (DI), assumed to be retained by households and general government only, and entered in the last row (DI/FU), is being put. The upper left corner of the table represents the flow of goods and services between three institutional sectors, the production of which yields a vector of value added (VA) of (40, 20, 40), respectively, in these sectors. Value added in production is acquired by households HH1 in the form of labor income (35), by households HH2 in the form of capital income (50), and by general government GG in the form of taxes on production (15). The lower right hand corner pictures the circuit of income transactions, which look very simple in this case: HH2 pay taxes on income of 28 to GG, which transfers income of 18 to HH1 (social benefits), retaining 25 for itself as disposable income for public expenditure. One can see how a social accounting matrix extends the observation boundary beyond the realm of mere production, covered in ordinary input-output tables, into the realm of distribution.

Figure 2 Redefining exogeneity

a) Traditional definition

	NF	FC	GG	VA	HH1	HH2	GG	DI/FU
NFC	81	21	41					60
FC	22	12	12					10
GG	60	3	0					30
VA	40	20	40					
HH1				35			18	
HH2				50				
GG				15		28		
DI/FU					53	22	25	
Total	203	56	93	100	53	50	43	100

b) New definition

	NF	FC	GG	HH1	HH2	GG	VA	DI/FU
NFC	81	21	41					60
FC	22	12	12					10
GG	60	3	0					30
HH1						18	35	
HH2							50	
GG					28		15	
VA	40	20	40					
DI/FU				53	22	25		
Total	20	56	93	53	50	43	100	100

The account (row/column) of value added (VA) is endogenous, in a traditional SAM, because one is interested in the flow of products from their production to consumption, where distribution is no more than an intermediary link. When the focus is put on distribution, however, it makes sense to separate the circuit of distribution of income from that of

production of goods and services, which scheme has been followed in figure 2b. Exogenous sectors are characterised by the fact that the assumption of proportionality of columns, which governs the figures of endogenous columns, is relaxed; every figure of an exogenous column is allowed to vary independently. Repercussions of such variation on the endogenous columns are then determined by means of mathematical analysis. Distribution of income is fully endogenised, and determined by production, in figure 2a. In figure 2b, in contrast, distribution may vary independently of production. Thus increasing value added received by households HH2 by one unit, from 50 to 51, for example, results in receivables in the proportion 28:22 as taxes for government and disposable income of households, without necessily affecting production. The new technique will now be applied to Social Accounting Matrices ofv three different countries, Canada, Germany, and Portugal.

3 Direct and indirect distribution of income: the case of Canada

Data of table 3 have been taken from a social accounting matrix constructed by Statistics Canada for year 2000. We put accounts 3, income generation, which display the components of value added, in the place of exogenous variables (second quadrant), because it is from here where income distribution starts. Accounts 4 and 5 describe different intermediate income flows between the three sectors of households, corporations and government so they are treated as first quadrant. Accounts 6 contain the balances of disposable income as well as outflows of income to the rest of the world, and reflect the final or “personal” income remaining with sectors after all processes of distribution and redistribution have been completed.

Table 3 Distribution of national income in Canada, 2000 (billion dollars)

	4a	**4b**	**4c**	**5a**	**5b**	**5c**	**3a**	**3b**	**3c**	**3d**	**10**	**Sum**
4a	0	106	5				545	66	54	0	4	780
4b	38	51	52				0	0	262	0	25	428
4c	0	37	5				0	0	20	128	1	191
5a	742	0	0	0	2	110					2	856
5b	0	192	0	0	0	0					0	192
5c	0	0	114	201	48	0					4	367
6a				653	0	0						653
6b				0	142	0						142
6c				0	0	254						254
10	0	42	15	2	0	3						62
Sum	780	428	191	856	192	367	545	66	336	128	36	1111

Account 3: Generation of income (a: Compensation of employees, b: Mixed income, gross, c: Operating surplus, gross, d: taxes less subsidies on production)
Account 4: Allocation of primary income, Account 5: Secondary distribution of income, Account 6: Disposable income, Account 10: Rest of the world.
Codes for accounts 4, 5, 6, 10. a: Households and NPISHs, b: Corporations, c: Government.
Source: Statistics Canada

In order to compare this macroeconomic view to its microeconomic counterpart, table 4 reconstructs the income/outlay account of households with rows 4a, 5a, and 6a of table 3 forming the side of receivables, and columns 4a, and 5a describing the corresponding payables.

Table 4 Income and outlay account of households

	Payables	Receivables
3a: Compensation of employees		545
3b: Mixed income, gross		66
3c: Operating surplus, gross		54
4: Property income	38	111
5: Taxes on income, social contributions,	201	
Social benefits		112
10: Rest of the World	2	6
6: Disposable income (balance)	653	
Total	894	894

Source: Table 3

The account defines what is called "disposable" income in the national accounts.[1] It is called "personal" or "net" income in household studies, and forms the basis of all indexes of inequality applied there. The perspective of households accounts, alone, is insufficient in two ways. First, in isolating the concept of disposable (or personal) income all memories of the physical and mental effort required to earn the income, or of social status conveyed by it, have been defined away. Income is considered under one aspect, only, as a means of buying goods and services. This reduction in meaning is insufficient in so far as a comparison of welfare cannot ignore such aspects of human, and social life. Second, and more relevant in our context, the simple income/outlay account registers all flows as if they were independent of each other, each coming from a different source. Wages are earned, taxes are paid, interest is paid and received, all appear as original flows determining the final balance of disposable income. The view is adequate for a single individual household, but it is not correct for the sector as a whole (Atkinson 1983).

A social accounting matrix exhibits the multiple processes of transformation and interconnectedness income flows undergo in their circulation through the economy. Wages are paid to households from which interest is paid to banks, which again pay interest to government from which households receive social benefits and so on, through many different channels. The macroeconomic perspective on income distribution reflected in a social accounting matrix allows to put some order into this network of flows. By means of the same input-output technique as is applied to analysing the circuit of products, such as equations 1 – 3, we are able to pursue the flow of value added to income distributed as follows: A matrix of intermediate flows $\boldsymbol{A}$ may be derived from table 3:

(4)
$$\boldsymbol{A} = \begin{pmatrix} 0 & .248 & .026 & 0 & 0 & 0 \\ .049 & .119 & .272 & 0 & 0 & 0 \\ 0 & .086 & .026 & 0 & 0 & 0 \\ .951 & 0 & 0 & 0 & 0 & .300 \\ 0 & .449 & 0 & 0 & 0 & 0 \\ 0 & 0 & .597 & .235 & .250 & 0 \end{pmatrix} .$$

The corresponding matrix $\boldsymbol{B}$ of coefficients of disposable income is shown in equation 5,

[1] The term is somewhat misleading, because it includes outlays that are hardly disposable such as rents for housing, and includes payments more disposable than those such as voluntary contributions to private organisations. A more appropriate term would be "distributed income", because it is the income that remains after all processes of distribution and redistribution have been completed.

(5)
$$\boldsymbol{B} = \begin{pmatrix} 0 & 0 & 0 & .763 & 0 & 0 \\ 0 & 0 & 0 & 0 & .740 & 0 \\ 0 & 0 & 0 & 0 & 0 & .692 \\ 0 & .089 & .079 & .002 & 0 & .008 \end{pmatrix}$$

and finally, the matrix ***F*** of final demand of products figuring in equation 3 is now replaced by a matrix ***Y*** of income generated from value added, and is given by the second quandrant in table 3. Inserting these data into formula 3 leads to the desired mapping of income generated into income distributed as shown in table 5:

Table 5 Final (direct and indirect) distribution of gross value added in Canada, 2000

(billion dollars)

		$B(I-A)^{-1}Y$					
		3a	3b	3c	3d	10	Disp. Inc.
HH	6a	433	52	122	32	13	653
Corp	6b	10	1	106	14	10	142
GG	6c	96	12	71	66	9	254
ROW	10	6	1	36	16	3	62
Genera ted inc.		545	66	336	128	36	1111

For explanation of categories see table 3.

Source: Table 3 and own calculations

Read vertically, table 5 shows that a total of 545 billion dollars is paid out as compensation of employees directly. After distribution and redistribution, 433 billion dollars remain with households, 96 billion dollars end up in government, 10 at corporations and 6 flow abroad (column 3a). Read the other, horizontal way table 5 says that of a disposable income of households of 653 billion dollars, 433 originate in employee compensation, 52 in self-employment, 122 stem from operating surplus, 32 from taxes on products, and 13 from abroad (row 6a), similary for disposable income of the other sectors. Operating surplus is interesting (column 3c). Of a total of 336 billion dollars, 262 have been earned by corporations, originally (see table 3). But only a value of 106 billion dollars remains there while 122 billion dollars have been alloted to households, directly and indirectly, through other channels.

4 Financial sector and property income: the case of Germany

The Canadian SAM serves as a plain introduction to an analysis of the macroeconmic distribution process, a thorough analysis, however, requires more detail. The German SAM separates financial from non-financial corporations, permitting to study the particular role this sector assumes in the process of income distribution. The German table differs from the Canadian table in that value added is registered net, instead of gross[2], and in the ordering of sectors (table 6).

Table 6 Distribution of national income in Germany, 2000 (billion euros)

	4. Primary distribution				5. Secondary distribution				3. Income generation				ROW	
	4a	4b	4c	4d	5a	5b	5c	5d	3a	3b	3c	3d	10	Sum
4a	11	19	3	0					0	0	226	0	27	286
4b	76	158	39	98					0	0	-49	0	66	388
4c	4	10	0	1					0	0	-3	218	-7	223
4d	185	108	5	1					1099	181	57	0	9	1645
5a	-11				0	6	3	25	0	0	0	0	0	23
5b		30			6	1	5	70	0	0	0	0	1	113
5c			154		32	8	151	600	0	0	0	0	5	950
5d				1545	12	68	389	1	0	0	0	0	3	2018
6a					-28									-28
6b						29								29
6c							385							385
6d								1310						1310
10	21	63	22	0	1	1	17	12						137
Sum	286	388	223	1645	23	113	950	2018	1099	181	231	218	104	1833

Account 3: Generation of income (a: Compensation of employees, b: Mixed income, net, c: Operating surplus, net, d: taxes less subsidies on products).

Account 4: Allocation of primary income, Account 5: Secondary distribution of income, Account 6: Disposable income, Account 10: Rest of the world.

Codes for accounts 4, 5, 6, 10. a: Non-financial corporations, b: Financial corporations, c: Government, d: Households and NPISHs.

Source: Federal Statistical Office, Germany.

The financial sector may now be identified in its role of distributing property income within the economy. 158 billion euros of interest and dividends circulate within the sector itself, 108 are paid to households while an almost equal amount of 98 billion euros is raised from them. Here, clearly, some disaggregation of the housheold sector is warranted in order to recognise the social effect of this distribution of value added. Non-financial corporations are also distributing much of their operating surplus to households, namely 185 billion euros. It is so

[2] Gross is preferable to net in that is more in line with the transactor/transaction principle of national accounting, as figures for consumption of fixed capital are not observed by survey, but computed by statistical offices, and imputed to the data, afterwards.

much that deducting the imputed consumption of fixed capital leads to a negative disposable income for non-financial corporations, which result is not very plausible to hold for the sector as a whole. But we accept it here as the official starting point of our calculation. Applying equations 1 –3 as before yields table 7.

Table 7 Final (direct and indirect) distribution of net value added in Germany, 2000

(billion euros)

Sector	Income generation					
	3a	3b	3c	3d	10	Disp. inc.
5a Non-fin. Cpt.	-26	-4	6	-3	-1	-28
5b Financial cpt	16	3	3	3	4	29
5c Government	208	34	33	94	16	385
5d Households	862	142	161	85	60	1310
10 ROW	39	6	28	39	25	137
Genera ted inc.	1099	181	231	218	104	1833

For explanation of codes see table 6
Source: Table 6 and own calculations

The structure of national distribution appears to be similar to the Canadian case, at the given level of aggregation, except for the difference between gross and net recording of operating surplus. We may facilitate the comparison by normalising both structures to a GDP of 1000 (table 8) where the German figures have been changed to gross recording, in order to improve comparability. The observed structures are surprisingly similar. Compensation of employees is roughly half of GDP (49.1 vs. 51.5 percent) and what is retained by household after all distribution is also similar (39.0 and 39.6 percent, respectively). However, the share of households' disposable income is higher in Germany than in Canada (65.5 vs. 58.8 percent) and lower for the corporate sector (84 vs. 128 percent). Flows of income to and from abroad are equal in relative size; Germany pays more labor (16 as against 5 percent), while Canada looses more operating surplus (33 as against 20 percent of gross value added).

Table 8 Comparison of national distribution circuits in Canada and Germany, 2000

Canada

	Generated income, gross					
Sector	**3a**	**3b**	**3c**	**3d**	**10**	**Disp.inc.**
Corporatns	9	1	96	13	9	128
Governmt.	86	10	64	59	8	229
Househds.	390	47	110	29	12	588
ROW	5	1	33	14	3	56
Gentd. inc.	491	59	302	115	32	1000

Germany

	Generated income, gross					
Sector	**3a**	**3b**	**3c**	**3d**	**10**	**Disp.inc.**
Nonfin. Cp.	7	1	53	2	5	67
Fin. Cpts.	8	1	4	2	2	17
Governmt.	88	14	41	46	7	196
Househds.	396	65	132	37	25	655
ROW	16	3	20	16	10	64
Gentd. Inc.	515	85	250	102	49	1000

For explanation of codes see table 3.

Source: Tables 3 and 6 and own calculations

5 Distribution among households and labor heterogeneity: the case of Portugal

Portugal, of the three countries considered here, prepares the most elaborate social accounting matrix (Santos 20003, 2009). Disaggregating labor input by sex and by education, separating NPISHs from households, and dividing the latter into four groups of different socio-economic characteristics, the resulting table actually justifies its name as a "social" accounting scheme. Containing thus over a hundred rows and columns the matrix is to large to be eproduced here. Table 9 extracts the circuit of income. Its first part (a) describes gross flows of income between sectors, its second part (b) shows how income has been generated from value added, and the last part (c) explains the corresponding classification. Labor input is disaggregated by level of education and by sex.

Table 9 Distribution of national income in Portugal, 2000 (million euros)

(a) Intermediate flows and disposable income

	4a	4b	4c	4d-1	4d-2	4d-3	4d-4	4e	5a	5b	5c	5d-1	5d-2	5d-3	5d-4	5e
4a	983	905	26	0	1	0	0	0								
4b	5,359	3,083	1,279	2,574	466	127	48	40								
4c	289	486	17	4	0	0	0	5								
4d-1	122	1,375	168	1	2	0	0	0								
4d-2	875	1,921	336	10	25	5	1	0								
4d-3	34	839	150	2	5	1	0	0								
4d-4	12	670	27	0	0	0	0	0								
4e	126	243	0	0	0	0	0	0								
5a	3,222								74	874	5	1.312	61	40	13	0
5b		2,410							816	51	6	2,410	144	138	313	22
5c			12,203						4,450	529	12,384	18,211	1,497	1,025	211	27
5d-1				61,484					296	607	3.073	189	40	18	4	3
5d-2					15,421				66	115	674	57	8	3	1	1
5d-3						3,838			989	1,177	9,876	37	30	4	1	11
5d-4							1,440		75	354	855	156	31	15	3	1
5e								13	549	40	1,295	446	81	43	9	3
6a									-1,847							
6b										2,571						
6c											22,218					
6d-1												44,339				
6d-2													14,631			
6d-3														14,930		
6d-4															4,044	
6e																2,410
10	2,871	2,943	1,766	0	7	0	0	0	212	56	851	435	72	40	8	0
FISIM	-1,302	1,940	-15	-1,429	-259	-71	-27	-20								
Sum	12,591	16,816	15,957	62,646	15,667	3,900	1,463	38	5,679	6,374	51,237	67,591	16,595	16,256	4,605	2,477

(b) Income generated from net value added, by kind and direct receivers

	3a-1	3a-2	3a-3	3a-4	3a-5	3a-6	3b-1	3b-2	3b-3	3b-4	3b-5	3b-6	3c	3d	10	FISIM	Total
4a	0	0	0	0	0	0	0	0	0	0	0	0	9,691	0	642	342	10,675
4b	0	0	0	0	0	0	0	0	0	0	0	0	2,764	0	4,157	-3,083	3,838
4c	0	0	0	0	0	0	0	0	0	0	0	0	-70	14,972	186	68	15,156
4d-1	25,800	4,915	6,951	10,312	3,180	6,010	443	100	196	509	42	33	2,189	0	1	297	60,978
4d-2	478	150	80	574	183	286	1,982	214	218	744	53	93	6,841	0	6	594	12,495
4d-3	671	148	71	501	158	97	82	17	0	119	1	6	734	0	0	265	2,869
4d-4	164	70	7	151	72	54	23	0	2	51	0	0	113	0	0	47	755
4e	0	0	0	0	0	0	0	0	0	0	0	0	-349	0	0	17	-331
Total	27,113	5,283	7,109	11,537	3,594	6,448	2,530	331	416	1,423	96	132	21,913	14,972	9,931	-1,453	111,374

(c) Classification

3. Generation of income	Compensation of employees	Male	Primary/lower secondary (ISCED 1-2)	**3a-1**
			Upper or post secondary (ISCED 3-4)	**3a-2**
			Tertiary (ISCED 5-6)	**3a-3**
		Female	Primary/lower secondary (ISCED 1-2)	**3a-4**
			Upper or post secondary (ISCED 3-4)	**3a-5**
			Tertiary (ISCED 5-6)	**3a-6**
	Mixed income (compensation of employees)	Male	Primary/lower secondary (ISCED 1-2)	**3b-1**
			Upper or post secondary (ISCED 3-4)	**3b-2**
			Tertiary (ISCED 5-6)	**3b-3**
		Female	Primary/lower secondary (ISCED 1-2)	**3b-4**
			Upper or post secondary (ISCED 3-4)	**3b-5**
			Tertiary (ISCED 5-6)	**3b-6**
	Net operating surplus/mixed income (capital)			**3c**
	Other taxes less subsidies on production			**3d**
4. Allocation of primary income	Non-Financial corporations			**4a**
	Financial corporations			**4b**
	General Government			**4c**
	Households classified by main source of income	Wages and salaries		**4d-1**
		Mixed income (including property income)		**4d-2**
		Income in connection with old age (retirement)		**4d-3**
		Other transfers income (including other households)		**4d-4**
	NPISH			**4e**
5. Secondary distribution	Sectors as above			**5a – e**
6. Use of income	Sectors as above			**6a – e**

Coefficients ***A*** and ***B*** of equations 1 –3 are derived from table 9a, the first by dividing entries of accounts 4 and 5 into their corresponding column sums, and the second by performing the same operation on accounts 6. The exogenous value added matrix ***Y*** is supplied by table 9b, where the columns show what kind of income has been generated from value added, and the rows show how much of this income every institutional sector, and group of households, in particular, have received, directly. In order to find out where this original income ends up after all processes of distribution and redistribution following (and described in table 9a) have been completed we a pply equations 1 – 3 to tables 9 (a - c), which yields table 10.

Table 10 Final (direct and indirect) distribution of net value added in Portugal, 2000

(million euros)

	3a-1	3a-2	3a-3	3a-4	3a-5	3a-6	3b-1	3b-2	3b-3	3b-4	3b-5	3b-6	3c	3d	10	FISIM	Disp. income
6a	-241	-46	-64	-98	-30	-56	-9	-1	-2	-7	-1	-1	-1071	-40	-192	13	-1847
6b	541	105	143	223	70	127	24	4	6	18	1	1	877	148	509	-225	2571
6c	4649	892	1243	1895	586	1092	202	31	48	142	11	12	2975	7026	1487	-71	22218
6d-1	17271	3292	4651	6910	2131	4025	318	69	133	350	29	23	2531	859	1794	-47	44339
6d-2	743	194	156	635	201	325	1742	189	193	659	47	82	7735	641	947	142	14631
6d-3	2934	581	686	1404	438	635	180	32	24	181	6	11	3260	3155	1462	-59	14930
6d-4	481	126	96	270	106	127	38	3	6	56	1	1	708	341	1803	-118	4044
6e	531	102	142	218	67	125	28	4	6	18	1	2	536	442	210	-23	2410
10	677	131	180	280	87	160	43	6	8	26	2	2	4590	2273	1428	-634	9260
FISIM	-474	-92	-125	-199	-62	-112	-35	-5	-6	-21	-1	-2	-229	126	484	-430	-1183
Gener. income	27113	5283	7109	11537	3594	6448	2530	331	416	1423	96	132	21913	14972	9931	-1453	111374

For explanation of codes see table 9c

Source: Tables 9 and own calculation

Male labour of primary or lower secondary education (3a-1) is paid 27,113 million euros of wages, altogether (last row of tables 9b and 10). Households whose main source of income are wages and salaries (d-1) are paid 25,800 million euros of this sum, directly (table 9b); they retain 17,271 million euros, or 67 percent of this amount, in their disposable income of 44,339 million euros (last column of table 10), after social distribution and redistribution have been performed. Female labour of the same qualification (3a-4) is paid 11,537 million euros altogether (last row, column 3a-4, in table 10) of which a sum of 10,312 million euros goes to workers' households (d-1, table 9b), directly, and 6,910 million euros, or 67 percent are retained there after distribution. Male and female labour are not treated differently in the distribution process (whether they are paid on equal terms, originally, cannot be ascertained in this analysis, as the hours of work are not given).

In contrast, entrepreneurial or "mixed income" earned by male self-employed workers of primary or lower secondary education (3b-1) amounts to 2,530 million euros altogether (last row, column 3b-1 in table 10), of which 1,989 million euros flow to households, directly, where this income is prevalent (row 4d-2, table 9b), and 1742 million euros, or 88 percent are retained within disposable income of these same households after distribution. We arrive at a first important finding: Labor income and capital income do not undergo the same distribution process, in Portugal.

Institutional sectors also receive income from value added, directly: Taxes on production go to government, and operating surplus remains with the corporate sector, in part (9,691 million euros), although a significant amount of 6,841 million euros is also paid out to entrepreneurial households (d-2), column 3-c in table 9), directly. Payments are so high, in fact, that they turn net disposable income of the corporate sector into the negative (cell 6a, 5a in table 9a), entrepreneurial households and, surprisingly, foreign owners retaining major portions of it in their disposable income (7,735 and 4,590 million euros, column 3-c of table 10). Taxes on production (column 3-d), go to government alone, in the first place, but after distribution, only half of this generated income is retained in government's disposable income (7026 million euros), the other half flowing into disposable income of pensioner households (3155 million euros), and foreigners again (2273 million euros).

Table 10 determines the final destination of a certain income generated in production. It extends traditional distribution analysis by considering not only one, the direct act of distribution but also all indirect effects following thereafter. For example, government may collect a tax in wage income, using it to finance other wage income. The net effect of this double distribution is caught in table 10. Table 11 gives an idea of the difference. Its first four rows show the direct tax rate as calculated by dividing row 5c into column sums 5d-1 to 5d-4 of table 9. Thus households whose main income are wages and salaries pay 26.9percent of their income to government, directly. If the indirect distribution is accounted for, in addition, one can follow the distribution circuit upstream to wages and salaries and finds that 17.0 percent of this factor income ends up in government as its disposable income (row 6c divided into column sums 3a and 3b of table 10). Households whose main income is mixed income pay 9.0 percent directly, and the same rate applies to the pure factor income. In the first case, mixed income of 16,595 million Euros includes property income, wh9ich is not yet included ate the level of income generation of 4,928 million Euros.

Table 11 Comparing direct and indirect tax rates in Portugal, 2000

Code	Type of households according to main income	Total income (million Euros)	Tax (million Euros)	Tax rate (percent of income)
5d-1	Wages and salaries	67,591	18,211	26.9
5d-2	Mixed income	16,595	1,497	9.0
5d-3	Retirement	16,256	1,025	6.3
5d-4	Other transfers	4,605	211	4.6
	Type of factor income			
3a-1 to -6	Compensation of employees	61,084	10,357	17.0
3b-1 to –6	Mixed income	4,928	446	9.1

Table 12 compares the distribution circuit of Portugal to that Germany, aggregating data of the first to the level of the latter. Both circuits have been normalised to a total of net value added (NDP) of 1000. In relative terms, it appears, disposable income of households is of similar size in Portugal as in Germany (72.1 as against 71.5 percent) although the labor share in GDP is smaller (54.8 against 60.0 percent). But sources from which households' disposable income stems differ; compensation of employees contributes more (47.0 vs. 44.5 percent), and operating surplus less (8.8 vs. 13.3 percent) to it in Germany than in Portugal.

Table 12 Comparing distribution circuits of Portugal and Germany, year 2000

Germany Sector	**3a**	**3b**	**3c**	**3d**	**10**	**Disp. inc.**
Nonfin. Corporations	-14	-2	3	-2	0	-15
Fin. Corporations	9	1	2	2	2	16
Government	113	19	18	51	9	210
Households	**470**	77	**88**	46	33	**715**
ROW	21	3	15	21	14	75
Generated Income (net)	**600**	99	126	119	57	1000

Portugal Sector	**3a**	**3b**	**3c**	**3d**	**10**	**Disp. inc.**
Nonfin. Corporations	-5	0	-10	0	-2	-17
Fin. Corporations	11	0	8	1	3	23
Government	93	4	27	63	13	199
Households	**445**	40	**133**	49	55	**721**
ROW	4	0	39	22	8	73
Generated Income	**548**	44	197	134	76	1000

(net)

For explanation of codes see table 3

Source: Tables 6 and 9, and own calculations.

6 Two simulations: wage increase, and income tax increase

The straight application of equations 1 –3 to a social accounting matrix table is no more than a somewhat sophisticated technique of accounting. But it also standard to use the equations as a thought experiment studying the possible effect of an exogenous variables' change on the endogenous variables. The assumption is made, then, that coefficients remain constant in the change, which is counterfactual in most cases, but nevertheless provides a quick, and cheap overview. In this spirit, we calculate two examples of political interest; the first assumes a wage increase of 1000 which goes fully at the expense of operating surplus, and the second studies the effect of an increased income tax, fully borne by a corresponding reduction of disposable income of employee households.

Table 13 describes the first simulation. 1000 are paid to Portuguese employee households, directly, as earned wages (column 3a) while operating surplus (3c) of non-financial corporations shrinks by the same amount. After distribution, only 669 of this initial rise is retained by employee households while 178 go to government as taxes, 89 to pensioner households, and even financial corporations participate by way of increased interest payments (+20). The corresponding loss in operating surplus is also distributed. Its major impact hits abroad, 394 are borne by foreign capital, 205 are borne by the government sector because of smaller taxes, 142 by entrepreneurial households, by way of smaller withdrawals, and 191 by pensioner households. The net effect of both changes is shown in the last column, for each sector. It proves that distribution may not be neutral to the source of an income, but follow different ways depending on which source an income stems from.

Table 13 Simulation of a wage increase (3a) at the expense of operating surplus (3c) in Portugal, 2000

Y: Income generated	3a	3c	Sum
4a: Non-financial corporations	0	-1000	-1000
4b: Financial corporations	0	0	0
4c: Government	0	0	0
4d-1: Employee households	1000	0	1000
4d-2: Entrepreneurial households	0	0	0
4d-3: Pensioner households	0	0	0
4d-4: Other households	0	0	0
4e: NPISH	0	0	0

$B(I-A)^{-1}Y$: **Income disposable**			
6a: Non-financial corporations	-9	102	93
6b: Financial corporations	20	-59	-39
6c: Government	178	-205	-27
4d-1: Employee households	669	-80	589
4d-2: Entrepreneurial households	12	-142	-130
6d-3: Pensioner households	89	-191	-102
6d-4: Other households	13	-41	-28
6e: NPISH	20	-51	-31
10	26	-394	-368
FISIM	-18	60	42
Total income distributed	1000	-1000	0

Our second thought experiment raises income tax of employee households from 18,211 to 19,211 million euros diminishing their disposable income by the same amount (from 44,339 to 43,339 million euros). Disposable income of government rises, as a result, from 22,218 to 23,218 million euros. Initial value added remains the same as before. Table 14 shows the details of the imagined income shift. Disposable income of government rises by the assumed amount of 1000, the corresponding row (6c) naming the sources, from male labour with primary education (3a-1) to female labour with tertiary education (3a-6). Government itself pays 142 out of taxes on production (3d) for the shift through the indirect effects. The loss in disposable income of employee households is reduced to 870, instead of 1000, the original cut, in the ensuing distribution process: 71 are borne by households of mixed income, 49 by households in retirement, and 10 even by households in retirement.

Table 14 Simulation of a direct tax increase of 1000 for employee households in Portugal

	Types of generated income											
Sectors	**3a-1**	**3a-2**	**3a-3**	**3a-4**	**3a-5**	**3a-6**	**3b**	**3c**	**3d**	**10**	**FISIM**	**Disp. Inc.**
6°: Non-financial corporations	0	0	0	0	0	0	0	0	0	0	0	0
6b: Financial corporations	0	0	0	0	0	0	0	0	-1	0	0	0
6c: General government	297	57	79	121	37	70	29	113	142	56	-2	1000
6d-1: HH of wages and salaries	-331	-63	-89	-132	-41	-77	-17	-51	-32	-36	1	-870
6d-2: HH of mixed income	-1	-1	0	-2	-1	-1	-14	-38	-8	-5	-1	-71
6d-3: HH in retirement	25	5	7	9	3	6	2	-19	-79	-9	1	-49
6d-4: HH of other transfer income	2	0	1	1	0	0	0	-2	-7	-5	0	-10
6e: NPISH	5	1	1	2	1	1	0	-1	-10	-1	0	0
10: Rest of the world	3	1	1	1	0	1	0	-1	-7	0	0	0
FISIM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0

For explanation of headings see table 9c

Source: Table 9 and own calculations

7 Conclusion

Input-output is known as a technique for analysing economic activity of industries, and division of labour, in an economy. In this paper, we suggest, and probe into, its extension to analysing the social distribution of the income that follows the process of production. Empirical data for such endeavour are provided by a social accounting matrix, which describes how flows of different kinds of income circulate between institutional sectors of an economy.

Three national examples of such matrices have been studied, namely of Canada, Germany, and Portugal. The tables are comparable in concept, but differ in degree of detail, with Portugal providing the most information. But even for the more aggregated tables it could be shown how a certain type of income generated from value added in production is diffused over the members of society by way of the institutionalised distribution process. For example, of the wages and salaries paid to Canadian households directly only 79 percent are retained in their disposable income, after the whole distribution process has been completed (table 5); the corresponding figures are 78 percent for Germany (table 7), and 81 percent for Portugal (table 11). Distribution structures appear to be surprisingly similar, in these three different countries.

Besides developing such accounting studies, input-output technique may also serve as a base for primitive, and cheap modelling of potential variation of the parameters of an economy. Calculating the effect of a wage increase paid out of operating surplus has shown that employee households in Portugal retain 58.9 percent of the increase while entrepreneurial households lose only 13 percent disposable income of theirs. It would be interesting to go further, and to see the results when the secondary effects of the distribution process through production are also included. All the necessary data are available in the SAM, and taking into account the multiplier effect of income being spent on goods, etc., is exactly what makes a SAM analysis interesting.

The approach is new, and this investigation exploratory. It demonstrates, nevertheless, that the traditional division of research fields into production of goods and services, on the one hand, and distribution of the resulting income, on the other, is insufficient in explaining the functioning of an economy. It is an old saying of Adam Smith's that animals differ from humans, not in that they know no division of labour, but in that they do not bargain about it, and conclude contracts it between them. The macroeconomic mechanisms of these social contracts may be studied in the way sketched above.

References

Atkinson, Anthony B., The economics of inequality, Clarendon Press, Oxford 1983

Hicks, J. R. (1960) *The Social Framework. An Introduction into Economics,* Oxford UP.

Miller, Ronald E. and Peter D. Blair, Input-output analysis: foundations and extensions, Cambridge UP, New York 2009.

Peichl, Andreas, Nico Pestl and Hilmar Schneider, "Does Size Matter? The Impact of Changes in Household Structure on Income Distribution in Germany", *The Review of Income and Wealth* (1) **58**, March 2012, 118-141.

Pyatt, Frank Graham and Alan Roe and associates, Social accounting for development planning with special reference to Sri Lanka, Cambridge UP, Cambridge 1977.

Pyatt, Graham and Jeffery I. Round, "Social Accounting Matrices for Development Planning," The Review of Income and Wealth, 23, 1977, 339-364.

Pyatt, G. and J. I.Round (2012) Distributional Invariance and the Design of SAMs. *Economic Systems Research,* 24, 251-274.

Santos, Susana, Macro-SAMs for Modelling Purposes. An application to Portugal in 2003.Working Paper No. 17/2007/Department of Economics/ Research Unit on Complexity and Economics, ISEG-UTL, 2007.

Santos, S. (2009) *From the System of National Accounts (SNA) to a Social Accounting Matrix (SAM) –Based Model. An Application toPortugal*, Coimbra, Editiones Almedina.

Statistisches Bundesamt, Sozialrechnungsmatrix 2000, Wiesbaden 2005.

Stone, Richard, *Foreword*, in: Frank Graham Pyatt, Alan Roes, Social accounting for development planning with special reference to Sri Lanka, Cambridge UP, Cambridge 1977.