Convenient policy for Health care expenditure in a multisectoral extended model

Maurizio Ciaschini, Rosita Pretaroli, Claudio Socci[a*]

[a] *University of Macerata, Department of Economic Development Study*
University of Macerata, Italy

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As well as a policy variable that has the potential to affect economic development, a reform of health care expenditure involves the change of GDP because of its role played inside the processes of generation and distribution of income. In this paper an effort is made to verify, through the Macro Multipliers approach, the possibility to design a convenient policy for health care expenses. Such a policy permits to rule the incidence of health's expenses with respect to total output and without neglecting the effects that it originates on the main macroeconomic variables like as GDP. The empirical analysis is built on an SAM framework developed for the United States economic system. The convenient policy differs from selective policy for health sector. The first one implies a complex redistribution of the resources in order to achieve the best result in terms of reduction of the ratio between health expenditure and GDP but without depressing total industrial output and income generation.

Keywords: Health care expenditure, Macro Multipliers, Multisectoral extended model.
JEL classification: C67, D31, D57, R15.

1 Introduction

Debate on U.S. health policy focuses on limiting the growth of health spending that is now around 18 percent of GDP and its public share accounts for almost half of the total[1]. In this debate many of the important questions related to rising health expenses involve the institutional arrangements that preside over its financing and often empirical researches give advice on how to depress public demand for healthcare. Nevertheless the attempt to develop an understanding on better public policies that have to beare able either to ensure society's efficient consumption of health and prevent increasing expenditures should take into account the driving force of health care services in determining the total output of U.S. economy.

Rising health care spending is a topic of absolutely general concern also emerged after the passage of the "Affordable Care Act", but unlike the past increasingly literature focus on the

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*Corresponding author. email: University of Macerata, Dipartimento di Studi sullo Sviluppo Economico, Piazza Oberdan 3, 62100 Macerata-Italy; Phone +39 0733 258 2560, socci_claudio@unimc.it.

[1] From 5.2 percent in 1960 to 16.2 percent in 2008 and the expectation that the share will increase to more than 19 percent by 2019 (BEA 2009).

positive relation between health demand, income growth and better health interventions (Hall and Jones, 2007). This viewpoint consider the Health sector as a leading activity whose expenditure has the potential to pull forward a wide array of other industries including the traditional sector of manufacturing, education, financial services, communications, and construction[2]. These typologies of analysis suggest a fundamental repositioning of the debate about health care from how governments can limit spending to how to obtain economic positive direct and indirect effects from health spending that is undertaken.

The U.S. Health system has more than a few peculiarities. They are directly consequences of a series of incremental reforms not always inspired by public authorities. These modifications impacted from time to time on partial aspects of the Health care system improving contradictions. The U.S. Health care system is considered a very expensive system showing the higher fraction of GDP devoted to health care services. More than a few international report assign to U.S. Health system the worst performance in health between industrialized countries but nevertheless it is undoubtedly the most advanced system in the field of biomedical research and innovation. It is probably because of its paradoxes that is often considered a "non-system", especially for the lack of central national strategy concerning the approach to financing.

But the size and the scope of the recently passed "Patient Protection and Affordable Care Act" demonstrate the economic importance of Health care spending in U.S. economy and perhaps a new thought on this direction. There is no doubt that the Health expenditures are able to stimulate, as for the public and the private share, an articulated production process where various types of market and nonmarket inputs are consumed. While many questions were raised by Economists around the issue of rising costs of U.S. health care system and its financing method, none study conducted a preliminary analysis about the role of health care in the income generation.

This paper offers a first look at this large question by focusing and further developing the issue of economic relevance related to U.S. Health product inside the processes of generation, distribution and redistribution of national income. The effort is made in order to evaluate the potential economic impact of health among all component of total output in a multisectoral framework (Ciaschini et al., 2010). The new perspective of researches on health care services that this paper aims to enhance should be founded on the quantification of the relative force of the health sector in driving total output. Rather than being considered erroneously an indefinitely "squeezable" sector of public expenditure the economic analysis can gains insights into the economic consequences of health sector and its role into public policy design[3].

We develops the Macro Multipliers analysis in order to study the macroeconomic relevance of Health product either as a policy variable and a policy target (Ciaschini et al. 2011). This type of methodology allows to verify the prominence of health output inside the key policy structures that are underlie by the extended circular flow of income that inspire the SAM scheme (Ciaschini and Socci 2007). All key policy structures, as for policy variable and for policy target, are revealed by the decomposition of the reduced form of the multisectoral extended model that is implemented on the U.S. Social Accounting matrix (SAM)which describes all phases of income generation. Of

[2]"*Just as electricity and manufacturing were the industries that stimulated the growth of the rest of the economy at the beginning of the 20th century, healthcare is the growth industry of the 21st century.*" (Fogel, 2008).

[3]The Multisectoral analysis is an appropriate tool in order to analyse the articulated description of the income/value added generation process which, starting from the final demand of goods and services, takes account of the contribution of each producing sector to the income formation (Leontief 1965).

particular importance is the analysis develop on the reduced form of the model that is suitable for policy simulation with the innovative approach of Macro Multiplier (MM) (Ciaschini et al. 2009).

In particular the analysis of MM focuses on the inner composition, or key-structures, determined by the structural matrix, of the policy control (exogenous final demand) and of the policy objective (total output), as the compositions that rule the magnitude of the policy effect. The relevance of health within these key structures reveals the weight of health product as value-added generator and as total-output stimulator with respect to all other outputs. Income generation, technologic and labour-force stimulus are, in fact, the threefold features of the design a policy of reform[4]. Once determined all key structures are scheduled according the value of the key index for the health product, the health-key-index. In this respect we are able to compare the relevance of the U.S. health product both in terms of policy variable and policy object.

For this purpose the second section of this paper describes some characteristics of the institutional framework of U.S. Health care system. The third section shows the multisectoral extended model and the SAM framework. The fourth section shows the results of the traditional dispersion analysis performed on the structural matrix. The fifth section describes the Macro Multipliers approach and the health-key-indices of key structures that the decomposition reveals. The last section presents the major results stressing the role played by the U.S. Health product as an economic policy variable.

2 Multisectoral extended model and SAM

2.1 *Multisectoral extended model*

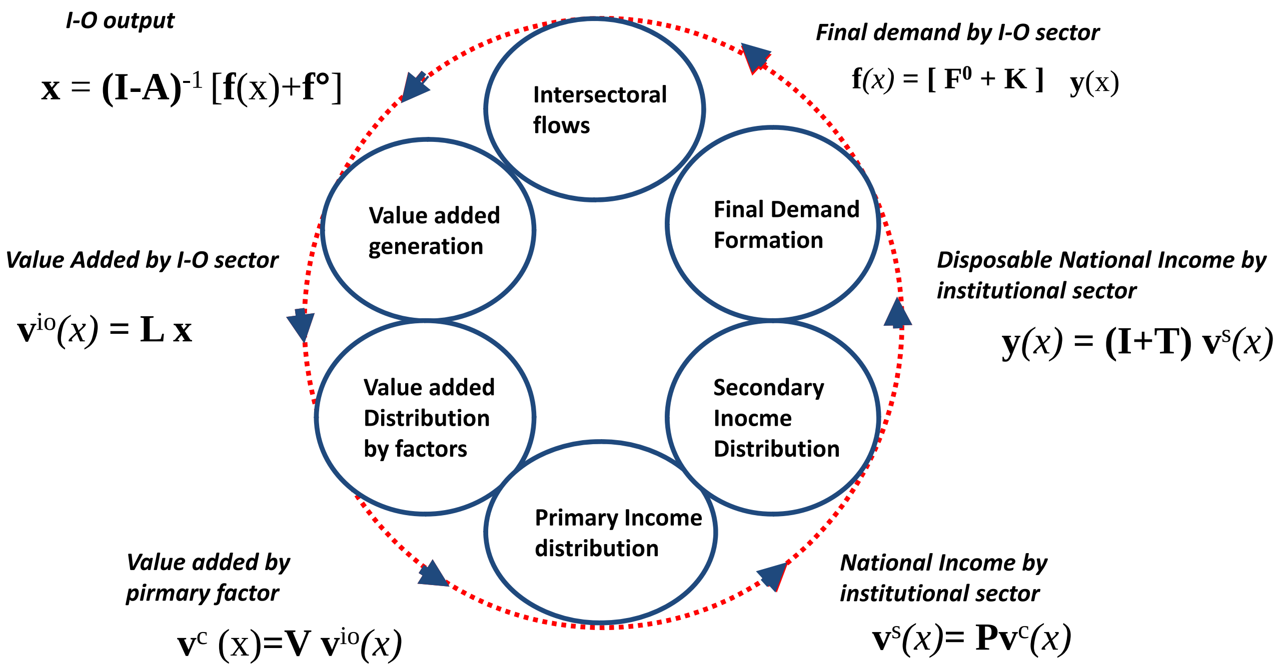
In our analysis we will use a multi-industry, multi-factor and multi-sector model following a Miyazawa approach (Miyazawa 1976, Ciaschini 1988), but in our case using extended income circular flow based on SAM scheme (Ciaschini and Socci 2007, 2003). For the extended income-output model we adopt fixed prices and constant all coefficients and shares.

In fact, the results attained in social accounting encourage the attempt to build an extended version of the income circular flow where the interactions between industries and institutions could be specified and evaluated.

Figure 1 shows a diagram where the fundamental mechanism of production and distribution is shown in terms of interaction between industries, institutional sectors and primary factors (value added components). In figure each arrow identifies an expenditure flow while each box a matrix transformation of a flow variable into another. In the upper part the inter industry demand loop in figure can be recognized. The extended output-income loop emerging in figure allows for an extension of the study of the propagation. We can choose, in fact, on which flow variable to act with a unit shock and on which variable to observe the effects. For each flow variable we need to specify an order of magnitude, such as the scale and a composition, or the structure. If we want to impose a unit shock on final demand and observe its propagation on domestic output we need

[4]Although the traditional tools of multisectoral analysis can reveal the relevance of a commodity in the production process it cannot face the problem concerning the composition of the shock to be conveyed as policy control on final demand (Skolka 1986).

Figure 1. Extended income-output model



to refer to equation 14, but other arrangements of structural matrices are easily found if we need to impose a shock on, say, income redistribution and observe it on value added by factor.

As shown in figure 1, with the dotted arrow, the income distribution process creates a feedback loop between industry output and final demand. This loop is built through various logical phases (UNSO 1994). The production process, that takes place at industry level, generates total output, $\mathbf{x}$, and gross value added by the m I-O industries, $\mathbf{v}(x)$, (Gross value added generation). Value added by I-O industry is then allocated to the c value added components (factors), $\mathbf{v}^c(x)$ (Gross value added allocation). Value added by components is then allocated to the s institutional sub-sectors, $\mathbf{v}^s(x)$ (Primary distribution of income). Value added by institutional sectors is then redistributed among them through taxation to generate disposable incomes by the s institutional sub-sectors, $\mathbf{y}(x)$ (Secondary distribution of income). Finally disposable income will generate final demand by institutional sub-sectors which will be transformed into final demand by I-O industries, $\mathbf{f}(x)$ (Final demand formation).

The extended I-O model starts from following fundamental equation

$$\mathbf{x} + \mathbf{m} = \mathbf{B} \cdot \mathbf{i} + \mathbf{f} \tag{1}$$

where $\mathbf{x}$ is the output vector by industry, $\mathbf{m}$ is imports vector, matrix $\mathbf{B}$ is intermediates consumption and $\mathbf{f}$ finally is final demand vector. Our extended I-O model have a great part of final demand endogenous. For this raison we will determinate the our distributive structural matrices and this is topic for endogenous final demand analysis.

Gross value added generation(by I-O sectors)

$$\mathbf{v}(x) = \mathbf{L} \cdot \mathbf{x} \tag{2}$$

where $\mathbf{L}[m{,}m]$ gives the shares value added by industry starting from the output vector and technical coefficients matrix.

Gross value added allocation(by VA components)

$$\mathbf{v}^c(x) = \mathbf{V} \cdot \mathbf{v}(x) \tag{3}$$

where $\mathbf{V}[c{,}m]$ represents the distribution of value added to the factors (components).

Primary distribution of income(by Institutional sectors)

$$\mathbf{v}^s(x) = \mathbf{P} \cdot \mathbf{v}^c(x) \tag{4}$$

where $\mathbf{P}[s{,}c]$ represents the distribution factors' value added income to the sectors.

Secondary distribution of income(by Institutional sectors)

$$\mathbf{y}(x) = (\mathbf{I} + \mathbf{T}) \cdot \mathbf{v}^s(x) \tag{5}$$

where $\mathbf{T}[s{,}s]$ represents net income transfers among sectors.

Final demand formation(by I-O sectors)

$$\mathbf{f}(x) = \mathbf{F}^0 \cdot \mathbf{y}(x) + \mathbf{K} \cdot \mathbf{y}(x) + \mathbf{f}^0 \tag{6}$$

where $\mathbf{F}^0$ provide the consumption demand structure by industry and is given by the product of two matrices, $\mathbf{F}^0 = \mathbf{F}^1 \cdot \mathbf{C}$, where $\mathbf{F}^1$ $[m{,}s]$ transforms the consumption expenditure by institutional sector into consumption by industry and $\mathbf{C}[s{,}s]$ represents the consumption propensities by institutional sector.

The matrix $\mathbf{K}$ represents the investment demand shares and is given by $\mathbf{K} = \mathbf{K}^1 \cdot s \cdot (\mathbf{I} - \mathbf{C})$ where $\mathbf{K}^1[m{,}s]$ represents the investment demands to I-O industry and scalar s represents the share of private savings which is transformed into investment i.e. "active savings"; $\mathbf{f}^0$ is a vector of m elements which represents exogenous demand (exports).

If we put $\mathbf{F} = [\mathbf{F}^0 + \mathbf{K}]$ equation 6 becomes

$$\mathbf{f}(x) = \mathbf{F} \cdot \mathbf{y}(x) + \mathbf{f}^0 \tag{7}$$

substituting through the equations 1-6 in 7 we get

$$\mathbf{f}(x) = \mathbf{F} \cdot [\mathbf{I} + \mathbf{T}] \cdot \mathbf{P} \cdot \mathbf{V} \cdot \mathbf{L} \cdot \mathbf{x} + \mathbf{f}^0 \tag{8}$$

We now turn to the output generation process shown in equation 1. *Output generation*

$$\mathbf{x} + \mathbf{m} = \mathbf{A} \cdot \mathbf{x} + \mathbf{f}(x) \tag{9}$$

where $\mathbf{m}$ represents imports, $\mathbf{A}$ the technical coefficients matrix, $\mathbf{f}(x)$ represents the demand vector.

Substituting the equations 8 in 12 we finally get:

$$\mathbf{x} = [\mathbf{I} - \mathbf{A} - (\mathbf{F}) \cdot (\mathbf{I} + \mathbf{T}) \cdot \mathbf{P} \cdot \mathbf{V} \cdot \mathbf{L}]^{-1} \cdot (\mathbf{f}^0 - \mathbf{m}) \tag{10}$$

2.2 *USA Social Accounting Matrix*

The basic organization of the data base that has been built, is inspired by the SAM scheme and follows the matrix presentation of national T-Accounts (Socci 2004). The income circular flow is quantified and connects data on the production process (final demand, total output and value added generation) gathered by activities which play the role of industries, with data on the distribution process (factor allocation of value added, primary and secondary distribution of incomes) collected by institutional sectors.

The Social Accounting Matrix for the United States, year 2009 and market price[5], is obtained through link between the IO table and the national accounts by institutional sectors (BEA 2009).

The matrix can be broken up into quadrants which can be further divided into blocks. A brief sketch of blocks in each of the six sub matrices, as shown in table 4, can be easily described as follows:

- quadrant I - production and final demand formation;
- quadrant II - primary allocation;
- quadrant III - secondary distribution and capital formation blocks;
- quadrant IV - operations with the rest of the world block.

Accounts are given in rows and columns corresponding to eight denominations namely Output, Compensation of employees, Other Incomes, Households, Business, Capital formation, Government and Rest of the World.

Each Quadrant in Table 4, then, gives account of the national flows and their allocation in different blocks in order to describe the whole circular flow. Table 4 gathers data from 67 Input-Output sectors, 5 institutional sectors[6], 3 value added components [Compensation of employees, Taxes on production and imports, less subsidies, Gross operating surplus], Last Quadrants (V and VI) describe flows between regions and the public administration and the rest of the world.

[5]The flows are expressed in Million of dollars.
[6]The Households, Business, Federal Government, State and Local Government and Rest of the World

Figure 2. SAM for the USA economy, year 2009 (million of dollars)

Code		Farms	Forestry, fishing, and related activities	Oil and gas extraction	Mining, except oil and gas	Support activities for mining	Utilities	Construction	Wood products
		1	2	3	4	5	6	7	8
1	Farms	35942	779	0	0	0	2	899	2
2	Forestry, fishing, and related activities	19295	5640	0	0	0	3	0	11163
3	Oil and gas extraction	0	0	9516	114	120	56481	0	20
4	Mining, except oil and gas	1163	22	91	5482	360	14719	9972	14
5	Support activities for mining	0	0	3006	1770	608	0	7	0
6	Utilities	6880	204	773	2490	1056	2647	4855	2510
7	Construction	1758	146	6317	16	113	15428	1166	643
8	Wood products	575	245	0	6	135	268	31892	14560
9	Nonmetallic mineral products	24	15	115	294	1319	1102	47699	895
10	Primary metals	65	2	561	539	3343	250	5751	266
11	Fabricated metal products	1731	248	1263	589	1939	2645	67346	1854
12	Machinery	2568	313	824	1091	2249	1137	20978	427
13	Computer and electronic products	18	7	0	35	63	762	3587	516
14	Electrical equipment, appliances, and components	188	177	4	26	124	1158	24770	466
15	Motor vehicles, bodies and trailers, and parts	688	139	181	266	482	628	5478	249
16	Other transportation equipment	0	81	0	14	0	25	5	3
17	Furniture and related products	1	0	0	0	0	123	9852	199
18	Miscellaneous manufacturing	104	12	38	19	269	62	675	23
19	Food and beverage and tobacco products	26685	693	0	1	0	187	0	25
20	Textile mills and textile product mills	160	56	0	9	0	6	1318	445
21	Apparel and leather and allied products	48	7	0	0	0	35	0	0
22	Paper products	343	23	87	107	519	134	3115	436
23	Printing and related support activities	48	19	0	1	0	91	21	16
24	Petroleum and coal products	15334	870	367	765	1482	7372	43027	536
25	Chemical products	18503	1932	1291	192	3240	1094	9811	1987
26	Plastics and rubber products	1175	141	236	666	720	1109	19571	645
27	Wholesale trade	15046	1298	635	764	1759	2084	30657	5267
28	Retail trade	490	13	111	90	119	42	42005	53
29	Air transportation	186	14	8	15	107	409	1190	191
30	Rail transportation	1174	49	133	2713	427	9572	990	351
31	Water transportation	394	9	25	32	18	99	205	2
32	Truck transportation	4478	258	130	1228	1014	1286	12980	2020
33	Transit and ground passenger transportation	1	11	0	3	22	208	234	45
34	Pipeline transportation	7	2	533	9	20	9502	149	2
35	Other transportation and support activities	0	39	4	164	3	950	35	928
36	Warehousing and storage	1086	24	0	3	1	26	0	315
37	Publishing industries (includes software)	2	10	0	0	0	139	0	1
38	Motion picture and sound recording industries	0	1	0	0	0	9	0	0
39	Broadcasting and telecommunications	292	52	76	90	242	648	7622	277
40	Information and data processing services	33	25	11	15	29	809	1461	381
41	Federal Reserve banks, credit intermediation, and related activities	17011	552	272	488	1084	8988	10526	449
42	Securities, commodity contracts, and investments	642	92	65	582	1000	1402	2370	123
43	Insurance carriers and related activities	2420	74	38	83	138	166	6	0
44	Funds, trusts, and other financial vehicles	0	0	0	0	0	0	0	0
45	Real estate	5978	356	280	171	1013	5377	8532	1169
46	Rental and leasing services and lessors of intangible assets	2573	142	7669	1552	2318	816	19362	867
47	Legal services	945	206	311	436	1550	3198	12716	379
48	Computer systems design and related services	524	113	549	499	229	1242	4178	216
49	Miscellaneous professional, scientific, and technical services	1540	921	1222	1436	5243	14793	79654	2655
50	Management of companies and enterprises	0	0	1828	1652	2651	0	2710	2166
51	Administrative and support services	515	144	147	298	604	4752	11799	1080
52	Waste management and remediation services	25	40	31	70	221	1996	1960	176
53	Educational services	783	708	0	0	0	172	95	0
54	Ambulatory health care services	1	4	0	0	0	2	0	0
55	Hospitals and nursing and residential care facilities	0	3	0	0	0	1	0	0
56	Social assistance	1	5	0	0	0	2	0	0
57	Performing arts, spectator sports, museums, and related activities	76	55	1	2	10	91	368	83
58	Amusements, gambling, and recreation industries	49	4	0	1	12	45	131	24
59	Accommodation	15	4	1	14	104	352	1152	214
60	Food services and drinking places	152	25	2	13	105	2257	1482	328
61	Other services, except government	984	215	52	80	310	1428	17013	698
62	Federal general government	0	0	0	0	0	0	0	0
63	Federal government enterprises	67	11	0	7	1	188	52	0
64	State and local general government	0	0	0	0	0	0	0	0
65	State and local government enterprises	1	16	0	0	0	1204	0	37
66	Scrap, used and secondhand goods	-15	1	0	-13	34	12	75	0
67	Noncomparable imports and rest-of-the-world adjustment	63	10	351	151	332	370	168	29
68	Compensation of employees	27243	18828	23237	16071	23006	103366	407826	17399
69	Taxes on production and imports, less subsidies	-4520	1236	23923	4642	2087	49043	7618	823
70	Gross operating surplus	79199	13230	81432	26906	27072	157457	156170	2542
71	**Households and istitutions**	0	0	0	0	0	0	0	0
72	**Business**	0	0	0	0	0	0	0	0
73	**Federal Government**	0	0	0	0	0	0	0	0
74	**State and Local Government Current**	0	0	0	0	0	0	0	0
75	**Private investment**	0	0	0	0	0	0	0	0
76	**National Gross investment**	0	0	0	0	0	0	0	0
77	**State and local government gross investment**	0	0	0	0	0	0	0	0
78		0	0	0	0	0	0	0	0
79	**Rest of Word**	23568	13518	218014	637	0	2110	0	10239
	Total	**316326**	**64087**	**385762**	**75396**	**91023**	**494083**	**1155285**	**89430**
	Domestic Total Output	292758	50569	167748	74759	91023	491973	1155285	79191

Code		Nonmetallic mineral products	Primary metals	Fabricated metal products	Machinery	Computer and electronic products	Electrical equipment, appliances, and components	Motor vehicles, bodies and trailers, and parts	Other transportation equipment
		9	10	11	12	13	14	15	16
1	Farms	0	1	2	2	3	0	10	0
2	Forestry, fishing, and related activities	21	4	68	14	3	11	9	2
3	Oil and gas extraction	138	933	8	34	11	2	9	3
4	Mining, except oil and gas	5752	9871	303	129	150	215	1725	465
5	Support activities for mining	12	3	0	0	0	0	0	0
6	Utilities	4927	8865	5333	2407	2047	1097	3649	1882
7	Construction	721	1709	1290	756	481	231	783	509
8	Wood products	470	351	310	479	180	191	1878	151
9	Nonmetallic mineral products	9291	1804	1148	1272	712	917	3247	334
10	Primary metals	978	56630	55185	21427	5884	12282	23928	8094
11	Fabricated metal products	2098	4697	33287	25980	8067	4387	30736	14681
12	Machinery	230	1897	2955	18772	842	840	11923	3062
13	Computer and electronic products	975	2837	3572	5101	41917	3017	9057	22495
14	Electrical equipment, appliances, and components	82	1737	1605	7813	3468	5239	2815	1906
15	Motor vehicles, bodies and trailers, and parts	191	391	1071	4245	863	292	99814	2247
16	Other transportation equipment	0	1	210	620	320	85	258	40125
17	Furniture and related products	11	2	37	170	408	13	200	34
18	Miscellaneous manufacturing	156	89	369	1747	79	216	975	173
19	Food and beverage and tobacco products	41	3	2	3	5	0	1	0
20	Textile mills and textile product mills	235	13	74	549	36	24	2206	340
21	Apparel and leather and allied products	2	1	8	8	9	1	1426	1
22	Paper products	1602	1238	1721	1223	924	856	1452	660
23	Printing and related support activities	0	0	3	12	1	5	3	0
24	Petroleum and coal products	585	897	551	797	249	500	271	247
25	Chemical products	2830	2067	7201	3219	4454	2975	5513	1880
26	Plastics and rubber products	888	630	1914	5719	2998	2527	11782	2566
27	Wholesale trade	2763	7695	10213	12487	15756	5020	17196	7023
28	Retail trade	54	26	115	703	190	149	1418	568
29	Air transportation	181	237	661	411	383	77	378	508
30	Rail transportation	1270	4726	807	331	169	196	581	226
31	Water transportation	35	113	44	12	5	10	18	17
32	Truck transportation	3783	2959	2841	2351	1288	788	3811	1946
33	Transit and ground passenger transportation	41	41	143	87	52	11	49	59
34	Pipeline transportation	2	16	2	6	2	2	1	1
35	Other transportation and support activities	533	97	73	15	4	4	14	3
36	Warehousing and storage	306	460	1048	755	814	203	617	917
37	Publishing industries (includes software)	8	14	19	116	9246	137	426	907
38	Motion picture and sound recording industries	0	0	0	0	0	0	0	0
39	Broadcasting and telecommunications	260	263	915	604	468	119	282	328
40	Information and data processing services	343	349	1053	793	733	157	348	678
41	Federal Reserve banks, credit intermediation, and related activities	924	1017	2457	1247	480	251	644	1111
42	Securities, commodity contracts, and investments	159	1920	3686	2294	826	505	1477	2098
43	Insurance carriers and related activities	11	14	29	134	7	39	10	9
44	Funds, trusts, and other financial vehicles	0	0	0	0	0	0	0	0
45	Real estate	676	635	3253	1631	1175	372	871	1007
46	Rental and leasing services and lessors of intangible assets	1175	1527	4451	2748	4320	890	2464	3487
47	Legal services	393	702	1782	1148	1351	242	518	1616
48	Computer systems design and related services	178	268	2220	984	1835	87	301	1547
49	Miscellaneous professional, scientific, and technical services	2775	3742	10380	6597	12557	1878	5579	10945
50	Management of companies and enterprises	2924	3967	5239	7172	11449	2448	11710	12411
51	Administrative and support services	1236	2551	5292	2238	2761	491	1509	4511
52	Waste management and remediation services	176	521	466	192	105	53	255	187
53	Educational services	1	1	3	1	4	0	2	3
54	Ambulatory health care services	0	0	0	0	0	0	0	0
55	Hospitals and nursing and residential care facilities	0	0	0	0	0	0	0	0
56	Social assistance	0	0	0	0	0	0	0	0
57	Performing arts, spectator sports, museums, and related activities	61	90	186	119	51	21	69	91
58	Amusements, gambling, and recreation industries	22	22	77	45	27	5	26	31
59	Accommodation	195	191	681	414	249	54	232	283
60	Food services and drinking places	275	338	892	564	284	87	312	392
61	Other services, except government	789	1649	1613	869	533	239	807	693
62	Federal general government	0	0	0	0	0	0	0	0
63	Federal government enterprises	0	26	54	290	12	126	4	2
64	State and local general government	0	0	0	0	0	0	0	0
65	State and local government enterprises	46	179	96	43	29	14	78	37
66	Scrap, used and secondhand goods	32	4809	108	12	2	16	1	0
67	Noncomparable imports and rest-of-the-world adjustment	233	223	257	1153	1868	1054	3600	219
68	Compensation of employees	23371	27894	74785	70261	109527	26841	52192	61905
69	Taxes on production and imports, less subsidies	1356	2420	2913	3437	5442	1052	2493	2122
70	Gross operating surplus	12549	14803	38548	34219	73548	20949	23884	22104
71	**Households and istitutions**	0	0	0	0	0	0	0	0
72	**Business**	0	0	0	0	0	0	0	0
73	**Federal Government**	0	0	0	0	0	0	0	0
74	**State and Local Government Current**	0	0	0	0	0	0	0	0
75	**Private investment**	0	0	0	0	0	0	0	0
76	**National Gross investment**	0	0	0	0	0	0	0	0
77	**State and local government gross investment**	0	0	0	0	0	0	0	0
78		0	0	0	0	0	0	0	0
79	**Rest of Word**	14747	47415	38359	85744	234614	55537	142156	33622
	Total	**106120**	**230592**	**333987**	**344724**	**566281**	**156049**	**490005**	**275469**
	Domestic Total Output	91373	183177	295628	258980	331667	100512	347849	241847

Code		Furniture and related products	Miscellaneous manufacturing	Food and beverage and tobacco products	Textile mills and textile product mills	Apparel and leather and allied products	Paper products	Printing and related support activities
		17	18	19	20	21	22	23
1	Farms	7	15	166343	755	5	5	1
2	Forestry, fishing, and related activities	103	109	4298	25	10	2625	37
3	Oil and gas extraction	3	5	54	14	0	23	3
4	Mining, except oil and gas	30	163	928	41	0	993	5
5	Support activities for mining	0	0	0	0	0	0	0
6	Utilities	802	1205	19211	1242	142	8508	1752
7	Construction	297	357	2483	119	17	1068	510
8	Wood products	4842	1128	326	119	1	3011	21
9	Nonmetallic mineral products	225	470	2853	55	0	140	5
10	Primary metals	2167	6433	4850	121	1	295	45
11	Fabricated metal products	2400	5492	11588	381	73	2797	822
12	Machinery	76	1873	2179	35	2	787	688
13	Computer and electronic products	599	1856	1880	364	25	1691	854
14	Electrical equipment, appliances, and components	53	646	1001	36	4	225	67
15	Motor vehicles, bodies and trailers, and parts	117	143	1187	40	1	224	62
16	Other transportation equipment	0	0	0	2	0	0	0
17	Furniture and related products	2233	236	0	3	0	7	1
18	Miscellaneous manufacturing	20	7018	76	90	77	10	21
19	Food and beverage and tobacco products	1	10	142337	33	527	498	260
20	Textile mills and textile product mills	1993	1342	252	6123	1747	2160	276
21	Apparel and leather and allied products	10	56	20	1087	1198	18	1035
22	Paper products	774	1726	25153	511	37	31678	10224
23	Printing and related support activities	0	24	340	1	24	20	1383
24	Petroleum and coal products	98	184	2107	128	11	1765	461
25	Chemical products	1359	5849	8077	8752	232	11100	2475
26	Plastics and rubber products	3549	4220	17006	215	111	2479	794
27	Wholesale trade	2935	5119	45412	2078	687	7947	2963
28	Retail trade	469	385	733	16	7	37	20
29	Air transportation	157	276	1099	71	15	229	367
30	Rail transportation	118	137	4475	60	6	1682	106
31	Water transportation	2	5	838	2	0	20	2
32	Truck transportation	991	1495	16243	645	160	2671	682
33	Transit and ground passenger transportation	35	74	147	8	2	42	90
34	Pipeline transportation	0	1	6	17	0	7	0
35	Other transportation and support activities	397	154	660	66	1	389	488
36	Warehousing and storage	220	498	1258	85	31	369	433
37	Publishing industries (includes software)	5	64	0	7	0	7	9
38	Motion picture and sound recording industries	0	0	0	0	0	0	0
39	Broadcasting and telecommunications	273	480	825	68	27	237	417
40	Information and data processing services	343	475	1170	82	26	372	318
41	Federal Reserve banks, credit intermediation, and related activities	553	1004	3732	227	71	456	1468
42	Securities, commodity contracts, and investments	806	1505	567	41	12	110	185
43	Insurance carriers and related activities	12	15	56	2	1	2	130
44	Funds, trusts, and other financial vehicles	0	0	0	0	0	0	0
45	Real estate	1141	1428	5166	220	87	935	1505
46	Rental and leasing services and lessors of intangible assets	459	2379	7318	249	143	1520	1575
47	Legal services	210	964	1548	104	58	400	611
48	Computer systems design and related services	251	397	852	63	18	239	506
49	Miscellaneous professional, scientific, and technical services	2668	5730	14996	760	437	2685	3523
50	Management of companies and enterprises	868	2704	29664	617	243	4026	2032
51	Administrative and support services	602	1017	4840	240	218	1477	2319
52	Waste management and remediation services	175	152	1202	51	11	302	131
53	Educational services	0	4	4	0	0	3	130
54	Ambulatory health care services	0	0	0	0	0	0	0
55	Hospitals and nursing and residential care facilities	0	0	0	0	0	0	0
56	Social assistance	0	0	0	0	0	0	0
57	Performing arts, spectator sports, museums, and related activities	39	82	289	19	6	81	94
58	Amusements, gambling, and recreation industries	19	38	79	4	1	22	45
59	Accommodation	170	350	703	38	10	198	413
60	Food services and drinking places	206	442	1120	69	21	316	609
61	Other services, except government	344	480	2658	151	23	1062	602
62	Federal general government	0	0	0	0	0	0	0
63	Federal government enterprises	1	24	1	4	0	2	119
64	State and local general government	0	0	0	0	0	0	0
65	State and local government enterprises	38	34	365	14	3	92	34
66	Scrap, used and secondhand goods	1	17	0	24	0	834	4
67	Noncomparable imports and rest-of-the-world adjustment	28	487	1462	73	39	114	23
68	Compensation of employees	17436	42684	87954	10672	8239	29361	21708
69	Taxes on production and imports, less subsidies	442	1341	30523	709	363	1930	756
70	Gross operating surplus	4994	31494	87067	4912	1382	23537	2400
71	**Households and istitutions**	0	0	0	0	0	0	0
72	**Business**	0	0	0	0	0	0	0
73	**Federal Government**	0	0	0	0	0	0	0
74	**State and Local Government Current**	0	0	0	0	0	0	0
75	**Private investment**	0	0	0	0	0	0	0
76	**National Gross investment**	0	0	0	0	0	0	0
77	**State and local government gross investment**	0	0	0	0	0	0	0
78		0	0	0	0	0	0	0
79	**Rest of Word**	22349	70564	61347	20727	108533	18905	2121
	Total	**81515**	**215062**	**830924**	**63511**	**125128**	**174743**	**70739**
	Domestic Total Output	59166	144498	769577	42784	16595	155838	68618

Figure 3. SAM for the USA economy

Petroleum and coal products 24	Chemical products 25	Plastics and rubber products 26	Wholesale trade 27	Retail trade 28	Air transportation 29	Rail transportation 30	Water transportation 31	Truck transportation 32	Transit and ground passenger transportation 33	Pipeline transportation 34	Other transportation and support activities 35	Warehousing and storage 36	Publishing industries (includes software) 37	Motion picture and sound recording industries 38	Broadcasting and telecommunications 39	Information and data processing services 40	Federal Reserve banks, credit intermediation, and related activities 41	Securities, commodity contracts, and investments 42	Insurance carriers and related activities 43	Funds, trusts, and other financial vehicles 44	Real estate 45	Rental and leasing services and lessors of intangible assets 46	Legal services 47	Computer systems design and related services 48	Miscellaneous professional, scientific, and technical services 49	Management of companies and enterprises 50	Administrative and support services 51
14	3563	16	4	118	0	0	0	1	0	0	8	0	0	0	0	1	0	0	0	0	53	0	0	1	325	10	140
9	466	1278	0	176	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	136	5	2
281679	16708	52	169	250	0	3	7	1	327	1354	280	15	10	9	203	20	4	16	18	0	638	182	15	8	443	120	107
357	5397	113	7	68	0	40	19	0	392	0	336	6	256	59	72	69	6	1	0	0	1435	296	1	20	552	11	74
277	25	0	0	0	0	0	0	1	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	66	1	0
3819	19830	4522	3123	9669	66	67	156	725	397	137	608	1047	440	486	2551	410	1888	1170	381	102	13969	4377	418	2418	4005	1476	2006
1778	2494	821	1070	3754	33	3139	24	277	1041	1404	1239	329	387	241	6050	921	11590	2237	206	259	33818	2129	275	233	6493	768	684
9	452	816	921	991	2	750	1	181	23	1	31	51	531	390	367	700	44	5	5	0	3954	1169	3	43	616	3	360
911	1092	1011	179	697	2	11	3	34	133	1	116	26	23	11	738	411	8	3	4	0	1470	227	1	31	1613	49	271
211	1392	1198	333	25	1	1046	1	1	31	0	43	0	312	72	51	128	0	0	1	0	356	457	0	33	1177	16	166
677	6777	4155	1128	1821	530	187	1537	2474	1191	330	388	216	1997	64	3948	967	120	48	26	2	3087	1035	158	643	4446	573	1234
235	2644	1166	605	424	20	172	14	186	108	595	426	280	432	121	617	202	14	13	6	0	1230	515	21	303	1818	273	1972
275	4289	2129	3208	2445	8	12	3	194	74	11	80	53	3035	1162	10396	3710	3707	1113	15	92	375	468	1044	4443	7392	4869	1882
140	813	913	215	553	11	169	9	546	161	11	125	205	5	0	2047	401	135	55	16	0	704	269	551	372	2131	91	770
118	485	285	1785	3263	9	119	3	4579	1604	0	287	399	272	9	258	58	177	119	34	0	120	541	0	36	1143	288	1594
0	63	46	2	3	1996	1139	1805	57	191	0	660	1	0	0	2	0	0	0	1	0	5	4	0	0	270	0	21
0	19	194	194	656	1	0	0	0	14	0	13	0	3	0	89	241	0	0	0	0	3831	145	11	2	164	5	3
20	657	211	490	644	1	4	0	8	13	1	17	66	29	6	186	81	337	134	5	2	95	102	20	22	1454	13	808
56	4138	71	577	171	38	0	18	0	0	0	3	0	102	9	0	17	0	0	14	0	92	0	0	9	1231	24	35
63	637	1972	263	2456	0	0	70	9	1	2	3	1	7	39	6	6	0	1	9	0	75	99	0	1	399	3	132
2	97	17	399	675	0	0	0	0	2	0	1	0	0	9	42	7	12	1	2	0	4	59	0	0	403	7	185
377	4166	3474	2194	1796	67	80	7	271	17	29	113	141	1774	122	546	206	1175	278	84	3	396	1055	325	462	5357	344	1294
17	376	6	2471	3955	1	22	0	86	13	5	32	9	10215	356	271	404	776	1828	4076	0	50	384	545	927	7118	1131	1627
24632	20448	1135	4749	2275	23944	4718	5726	26300	2562	257	10942	668	292	65	1278	315	1124	445	114	19	2173	742	178	285	3421	497	21740
5283	181867	48783	981	920	8	205	10	428	139	9	236	96	1088	85	354	273	146	81	24	42	2515	387	96	166	6505	860	2699
287	9064	10688	3492	4641	14	28	6	1911	164	43	380	153	431	121	1571	319	85	93	156	30	1510	1040	146	256	3022	151	1147
13724	26413	6084	24215	12992	1999	1057	571	4610	412	191	1297	371	5463	132	3183	1174	1375	528	347	33	2414	9284	384	1355	7174	1552	2939
319	2066	107	377	1426	12	35	113	2017	159	32	230	34	44	17	17	58	618	105	18	0	3553	284	66	47	314	5	497
63	695	356	1364	1041	16	27	74	1056	13	3	280	89	1142	326	777	846	5119	1479	301	120	584	1088	594	1712	4084	171	2423
514	4150	759	92	117	37	272	17	2858	11	13	30	8	55	4	165	22	24	8	19	3	188	35	30	33	476	12	200
69	132	6	14	8	73	17	21	81	6	6	33	2	1	0	5	1	3	1	1	0	13	3	0	4	1821	66	54
1254	5989	1536	2449	7356	359	379	251	14226	150	34	625	202	700	181	655	371	147	339	112	6	1162	493	136	210	2700	2004	938
13	65	68	120	112	0	80	0	2	15	1	13	0	284	69	305	279	1903	439	221	30	245	302	233	537	1382	38	846
3859	305	22	29	17	154	45	59	219	58	14	85	5	1	0	1	0	5	1	0	0	103	1	0	0	3	3	14
247	167	298	11657	10962	17278	625	3216	13465	164	91	6470	1057	2742	651	100	1317	706	2360	466	0	161	2531	625	611	6489	54	1917
42	760	461	8410	14665	38	11	159	2588	39	4	703	2661	1039	242	277	524	8	428	64	0	151	589	145	178	1553	6	890
0	45	21	14	633	0	0	0	2	19	0	20	3	5613	36	453	316	457	619	571	71	61	856	570	857	4229	926	2617
0	0	0	18	256	7	2	3	1	0	0	4	1	47	11751	25416	2322	44	14	1	0	89	47	15	90	6151	80	96
75	583	419	3755	5192	480	97	75	1446	109	53	457	287	2474	804	67600	7811	7533	13808	3660	452	2869	3485	3612	11520	17637	4314	7507
37	593	412	1074	3666	74	10	12	132	55	46	57	69	2547	167	2531	1375	5830	12183	816	342	419	1048	969	1701	5772	2375	5105
245	1235	1535	10062	20681	298	3187	42	2202	735	215	757	338	4870	1058	5831	1810	108489	28559	7569	1505	269644	17741	3255	4753	18398	10798	8109
72	258	266	900	1381	73	1543	410	288	229	61	382	45	725	414	848	202	90341	68364	14326	62003	997	6138	910	829	3694	8513	2260
5	20	21	7764	11792	752	13	595	9056	672	300	872	631	1865	773	-1	689	28321	11328	156885	1482	43281	9738	4302	1593	12323	580	8631
0	0	0	0	0	6	3	1	13	0	0	161	0	0	0	0	0	54	3112	5012	0	1	0	245	182	700	3	887
232	1732	1397	12118	51128	1041	173	854	3431	588	196	1584	3342	6225	3657	6552	2791	19291	24028	6008	1572	134441	13885	12685	19807	27165	6022	12263
1177	8118	1478	7560	11908	5823	3347	45	1250	305	2	806	373	5632	991	5426	7110	2862	6190	1472	10	1087	6979	2320	4385	15841	11983	7422
238	1504	575	3632	3395	298	1361	67	673	162	99	325	221	3764	1264	2134	1365	11448	9624	7485	1800	12920	4574	2418	2699	11377	6315	5480
198	730	353	2317	3666	67	850	23	834	118	32	163	238	3243	378	3109	4178	5189	10686	1255	467	2600	2884	2409	4308	12172	6142	5712
1625	33189	4237	34077	46581	657	2054	393	3268	1580	825	2059	1055	21859	10236	31285	9124	56494	42629	14470	2703	14984	20305	7348	16672	84236	38914	27712
1660	27653	3533	15323	7208	275	17	187	2441	167	0	1075	760	6288	730	645	992	13562	6122	1828	108	2471	10486	1920	2441	10903	0	7858
611	3689	1495	18303	22056	1586	1343	469	11842	866	579	3796	2122	17646	2763	7896	5915	21715	15433	10103	477	31412	11010	8330	11654	42426	5079	27567
104	711	327	471	1168	53	79	519	254	539	49	1141	140	51	35	1151	143	21	116	280	0	15461	489	59	99	1209	162	1090
8	3	3	699	5061	12	64	0	0	2	7	5	0	1	0	497	166	172	27	2	0	6	11	0	57	206	0	285
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	4
37	112	116	723	1553	14	287	3	46	18	1	150	97	403	2276	11185	941	3135	1009	123	81	738	582	561	583	5061	1786	1532
7	33	38	157	407	0	1	0	1	2	1	3	0	163	39	128	148	1074	245	47	10	117	157	153	319	712	437	547
61	309	330	387	110	4	11	1	16	16	4	114	58	1370	346	1107	1271	9114	2105	403	160	929	1374	915	2432	5002	291	3210
167	464	476	1482	3064	2394	18	6	162	18	4	325	65	1451	376	1237	1378	14629	2459	582	499	2410	2273	1787	3340	11651	1769	6874
367	2237	902	4899	6237	85	325	75	1707	250	191	525	518	1289	483	3855	2936	15851	4972	1175	306	14906	7322	1101	1202	9933	4541	7086
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83	79	2	5139	6767	58	27	399	6183	46	77	1663	528	1434	365	537	825	4479	2734	193	0	150	1613	449	419	4129	216	1450
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	243	83	124	371	0	2	3	28	166	0	149	53	49	20	473	65	167	98	21	0	789	532	219	108	779	62	560
3	81	65	1	2	-74	2	1	333	0	1	153	0	0	9	0	0	0	0	0	0	0	-1152	0	0	1	1040	0
538	7770	631	7563	426	12181	87	2246	61	13	51	592	23	1467	433	7729	2280	1969	19000	2511	28	77	1649	4	2653	3101	476	627
18334	83103	35237	411521	447012	38167	18121	6136	73769	19554	4954	59131	31045	54992	26294	88791	30570	168009	180911	187078	26481	85649	49517	110212	214717	452765	204921	272490
5098	7029	1935	163285	162795	12908	-1038	770	3293	139	2397	3306	622	1493	3067	25637	2813	12005	6239	22652	3721	204879	17086	10461	3361	12611	11377	6223
102673	120080	18316	218212	156075	13333	12229	7826	40466	8890	4558	26461	7261	46092	30004	175324	45513	271632	20353	207320	38361	1411621	163494	98453	44531	296776	22103	75355
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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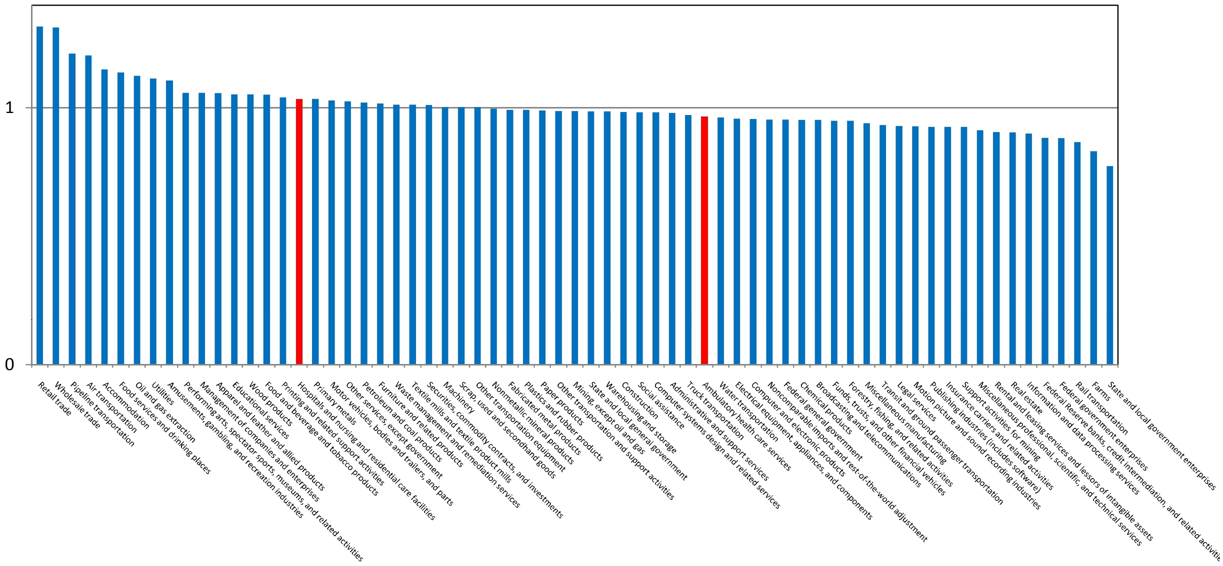
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61628	164668	29475	-23063	0	24187	268	-9195	2486	0	0	-2772	0	2469	4452	0	52	787	0	54801	0	0	1165	2272	17181	50218	0	310
536653	**794972**	**198448**	**985804**	**1071735**	**161480**	**58945**	**25869**	**245078**	**44883**	**19285**	**129615**	**58088**	**228632**	**108281**	**514500**	**149567**	**905929**	**506298**	**715395**	**143383**	**2335546**	**385580**	**283972**	**389897**	**1215086**	**366723**	**558739**
475025	630304	168973	1008867	1071735	137293	58677	35064	242592	44883	19285	132387	58088	226163	103829	514500	149515	905142	506298	660594	143383	2335546	384415	281700	372716	1164868	366723	558429

Figure 4. SAM for the USA economy

	Waste management and remediation services	Educational services	Ambulatory health care services	Hospitals and nursing and residential care facilities	Social assistance	Performing arts, spectator sports, museums, and related activities	Amusements, gambling, and recreation industries	Accommodation	Food services and drinking places	Other services, except government	Federal general government	Federal government enterprises	State and local general government	State and local government enterprises	Scrap, used and secondhand goods	Noncomparable imports and rest-of-the-world adjustment	Compensation of employees	Taxes on production and imports, less subsidies	Gross operating surplus	Households and institutions	Business	Federal Government	State and Local Government Current	Private investment	National Gross investment	State and local government gross investment		Rest of the world	Total
	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77		79	
	10	184	21	116	2	6	293	21	2481	6	-866	4	1051	0	3	-1	0	0	0	63235	0	0	0	5490	0	0	0	35242	316326
	5	69	11	139	20	4	278	171	4664	49	0	13	528	0	18	0	0	0	0	7769	0	0	0	260	0	0	0	4563	64087
	27	21	86	147	54	39	755	166	396	197	0	431	0	2120	0	0	0	0	0	0	0	0	0	5632	0	0	0	5562	385762
	29	136	349	153	140	71	1102	15	89	365	330	0	1032	2345	55	0	0	0	0	165	0	0	0	-572	0	0	0	7413	75396
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85231	0	0	0	2	91023
	734	12340	3207	9842	1009	811	3084	5039	10893	4806	4308	1717	17524	1691	148	5	0	0	0	251321	0	0	0	0	0	0	0	851	494083
	354	2476	2333	5372	662	393	2852	1688	2428	4565	11441	2467	31688	5940	103	14	0	0	0	0	0	0	0	650521	27801	281495	0	78	1155285
	59	214	198	362	401	11	236	146	2503	406	201	18	2739	135	35	0	0	0	0	3853	0	0	0	689	12	0	0	3654	89430
	113	118	603	499	176	18	366	28	3422	1318	218	0	996	774	28	0	0	0	0	10822	0	0	0	-3359	0	0	0	6966	106120
	148	89	199	72	132	15	225	6	282	987	410	0	151	180	563	1	0	0	0	1817	0	0	0	-14158	0	0	0	23327	230592
	1130	329	594	732	583	29	789	484	6050	4506	3907	233	2401	1617	293	5	0	0	0	15399	0	0	0	1840	4300	527	0	23376	333987
	861	1193	211	579	70	19	248	32	1170	4399	749	50	3355	465	86	1	0	0	0	9834	0	0	0	128650	2362	8670	0	91563	344724
	201	851	3094	2903	124	27	373	368	802	5270	30111	1	2991	402	94	38	0	0	0	63459	0	0	0	142695	38936	20668	0	95161	566281
	330	538	56	279	145	13	312	76	1796	2933	1965	54	1357	656	37	2	0	0	0	35512	0	0	0	18216	1063	2087	0	23591	156049
	894	549	406	754	484	28	140	54	709	23656	3490	1086	6383	226	266	4	0	0	0	149406	0	0	0	93502	3086	7987	0	60312	490005
	18	0	0	0	2	0	9	0	1	226	43818	43	1	14	54	55	0	0	0	22225	0	0	0	27810	45643	1001	0	86510	275469
	0	3	160	58	87	342	180	2	861	226	0	11	5	85	1	0	0	0	0	35006	0	0	0	18584	186	3548	0	3053	81515
	555	564	17568	10846	949	35	105	177	490	1727	1287	0	4226	46	21	2	0	0	0	88924	0	0	0	38372	438	1632	0	29355	215062
	186	5235	519	17070	1963	664	1723	1449	61540	493	1162	874	20357	0	63	1	0	0	0	496766	0	0	0	-4362	0	0	0	47305	830924
	100	34	22	497	49	1	208	59	142	499	519	4	337	4	13	1	0	0	0	28600	0	0	0	-918	19	12	0	7691	63511
	179	275	108	496	1622	89	17	4	3	690	65	99	3824	10	17	0	0	0	0	113368	0	0	0	-7119	0	0	0	4485	125128
	230	682	1397	2475	283	60	358	1337	4013	1057	1844	102	8608	10	111	2	0	0	0	27019	0	0	0	-2414	0	0	0	16868	174743
	127	1527	1225	2029	447	524	222	613	1021	2850	3365	251	9844	24	29	4	0	0	0	6864	0	0	0	-1104	0	0	0	2162	70739
	1273	2410	1429	4819	428	225	1909	996	2827	1792	15365	1532	36373	3561	116	19	0	0	0	168292	0	0	0	7622	0	0	0	46017	536653
	553	1634	24576	21334	723	207	1412	681	924	3616	4943	75	14880	778	146	6	0	0	0	241314	0	0	0	-3436	0	0	0	120286	794972
	206	695	4099	6703	695	36	390	226	5980	5083	2156	106	4515	696	70	3	0	0	0	31163	0	0	0	-6190	72	0	0	19135	198448
	843	4308	7021	10156	1684	265	1547	1151	18790	6621	8643	414	27340	939	238	11	0	0	0	387832	0	0	0	62275	7119	7586	0	96943	985804
	33	131	756	1162	30	276	164	43	2603	2963	12	3	225	1	6	0	0	0	0	962052	0	0	0	40890	0	0	0	0	1071735
	458	520	1440	536	259	123	263	228	1242	1192	5205	761	1940	25	16	7	0	0	0	82268	0	0	0	1778	354	121	0	29731	161480
	33	126	309	463	31	7	49	20	530	155	767	385	1520	70	34	1	0	0	0	4702	0	0	0	444	87	142	0	8616	58945
	5	15	12	38	2	1	9	3	26	6	1173	84	220	11	1	1	0	0	0	12824	0	0	0	23	10	0	0	7053	25869
	429	695	2387	2896	432	146	767	246	3129	1816	5124	404	6461	266	67	6	0	0	0	69777	0	0	0	12158	976	1223	0	24663	245078
	155	452	552	685	62	273	127	64	351	461	208	31	5559	86	17	0	0	0	0	26795	0	0	0	0	0	0	0	0	44883
	10	27	20	51	1	3	121	2	5	16	104	6	436	357	1	0	0	0	0	1171	0	0	0	0	0	0	0	1662	19285
	791	614	1704	971	383	519	388	200	522	3614	45	255	1696	464	15	0	0	0	0	6096	0	0	0	0	0	0	0	19892	129615
	162	268	644	1499	137	201	189	210	615	943	652	0	3638	20	22	1	0	0	0	438	0	0	0	0	0	0	0	2344	58088
	200	2467	569	699	359	144	208	222	965	1582	60	17	5834	110	19	0	0	0	0	75472	0	0	0	74373	2922	4903	0	27384	228632
	5	2919	78	686	1246	274	117	1083	1873	751	2582	46	514	0	2	3	0	0	0	38212	0	0	0	-511	0	0	0	11935	108281
	575	2902	7522	5846	1275	690	1358	2007	7135	6032	8483	1611	21916	117	70	11	0	0	0	250949	0	0	0	7381	0	0	0	5639	514500
	646	1292	1090	2820	164	246	295	288	2111	2989	16119	196	9913	125	41	20	0	0	0	51482	0	0	0	0	0	0	0	307	149567
	685	2105	8864	2821	799	633	2831	1242	4501	22013	798	2222	9535	3485	54	1	0	0	0	232016	0	0	0	0	0	0	0	22392	905929
	157	798	1785	5092	3194	701	509	283	769	24414	1	98	6394	868	50	0	0	0	0	138073	0	0	0	0	0	0	0	34170	506298
	2647	813	23250	18126	2284	2510	2324	2592	8641	7396	2863	3	324	88	27	4	0	0	0	308581	0	0	0	0	0	0	0	15243	715395
	0	0	0	0	0	0	0	0	0	1462	0	0	0	0	0	0	0	0	0	131541	0	0	0	0	0	0	0	0	143383
	1163	22166	32668	85799	9383	4960	6775	3725	28394	33029	4291	949	30942	3433	120	5	0	0	0	1588119	0	0	0	61586	0	0	0	851	2335546
	1718	2180	8321	4618	769	1807	1247	2757	10987	3011	681	143	4985	364	74	1	0	0	0	74835	0	0	0	0	0	0	0	75176	385580
	549	1261	8393	5789	856	1363	3064	1270	3413	4537	3628	488	10085	339	48	5	0	0	0	101896	0	0	0	0	0	0	0	8385	283972
	248	2966	3053	3591	623	168	729	554	1594	2237	47831	565	7608	443	37	60	0	0	0	0	0	0	0	183367	23827	8767	0	10015	389897
	2822	10233	38272	25763	5321	8551	9531	10893	23620	27551	132068	1780	45392	6131	250	167	0	0	0	63987	0	0	0	54579	0	0	0	24886	1215086
	1408	361	9430	21202	1071	1505	4849	3851	15631	3695	0	0	0	0	116	0	0	0	0	0	0	0	0	0	0	0	0	68472	366723
	2770	6166	32790	27912	4879	4262	3643	6075	7824	18830	29097	1440	29689	2611	154	37	0	0	0	39592	0	0	0	0	0	0	0	2142	558739
	10252	1312	1786	2143	555	142	866	1082	1631	1417	773	80	12128	1479	131	1	0	0	0	16104	0	0	0	0	0	0	0	156	86459
	90	1639	246	1103	17	556	147	6	4	2164	4828	147	9806	13	26	6	0	0	0	281909	0	0	0	0	0	0	0	1465	313380
	23	153	17958	15859	4	644	26	1	0	769	1618	0	2487	0	7	2	0	0	0	783734	0	0	0	0	0	0	0	2	823703
	17	111	38	463	3	3	3	1	0	0	2712	0	1808	0	5	3	0	0	0	884167	0	0	0	0	0	0	0	250	889594
	28	187	60	296	5	6	6	2	0	0	29	0	3044	0	8	0	0	0	0	139866	0	0	0	0	0	0	0	0	143552
	139	289	578	446	323	12588	1105	293	2362	2163	1592	51	937	18	6	2	0	0	0	51380	0	0	0	0	0	0	0	202	109612
	76	186	357	198	49	42	31	112	347	191	487	10	1682	10	6	1	0	0	0	139709	0	0	0	0	0	0	0	1	149174
	515	589	1825	389	258	121	210	306	1688	1362	2899	77	1963	50	16	4	0	0	0	86482	0	0	0	0	0	0	0	1	136244
	734	1681	7038	5120	1057	360	732	2735	3958	2720	1020	777	13285	92	50	1	0	0	0	507254	0	0	0	0	0	0	0	550	620814
	1215	3104	7232	9163	1442	1277	2142	1874	5468	13953	5589	950	19007	659	81	7	0	0	0	495570	0	0	0	0	0	0	0	237	697534
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	987138	0	0	0	0	0	0	987138
	311	1152	3029	3614	269	203	884	1745	5850	2830	218	37	2698	17	11	0	0	0	0	7201	0	0	0	0	0	0	0	268	71373
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1424388	0	0	0	0	1	1424389
	228	256	944	575	1509	51	455	396	617	563	926	174	3126	973	12	1	0	0	0	59552	0	0	0	0	0	0	0	0	77907
	0	3	53	0	0	-984	253	0	14	990	-81	0	0	0	23	0	0	0	0	81934	0	0	0	-92653	-6786	584	0	27178	16947
	24	20	0	3	0	58	18	108	134	56	23176	1063	0	1	12	29	0	0	0	-54375	0	0	0	2030	0	0	0	128948	189800
	27637	176331	396283	467562	74168	36036	53197	50181	228349	290456	422583	49060	817056	25648	3153	534	0	0	0	0	0	0	0	0	0	0	0	0	7819518
	2850	7348	8836	15469	1120	5738	9638	10205	41119	22880	0	-4041	0	-5193	71	0	0	0	0	0	0	0	0	0	0	0	0	0	964357
	15437	19973	124038	49103	16279	19122	20770	14352	68515	103365	117546	1917	128028	12006	855	148	0	0	0	0	0	0	0	0	0	0	0	0	5335164
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7808700	0	3203600	0	236400	1604700	470512	0	0	0	0	216200	13540112
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1819564	216782	0	168918	109400	0	0	0	0	239861	2554525
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35500	120100	1821000	339100	0	0	0	0	0	0	14456	2330156
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	928900	191900	384100	195600	484600	0	0	0	0	0	0	2185100
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	950900	1529400	0	0	0	0	0	0	-891098	1589202
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1127400	0	0	0	0	0	1279827	152427
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	180800	0	0	0	0	170153	350953
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	47	1097	0	589	0	354	0	0	0	2612	0	0	0	0	8625	188553	10818	-43	0	166000	254025	212200	0	0	0	0	0	0	2451092
	86459	**313380**	**823703**	**889594**	**143552**	**109612**	**149174**	**136244**	**620814**	**697534**	**987138**	**71373**	**1424389**	**77907**	**16947**	**189800**	**7819518**	**964357**	**5335164**	**13540112**	**2554525**	**2330156**	**2185100**	**1589202**	**152427**	**350953**		**2451092**	
	86412	312283	823703	889005	143552	109258	149174	136244	620814	694922	987138	71373	1424389	77907	8322	1247													

Figure 5. Backward dispersion: Health care services relevance

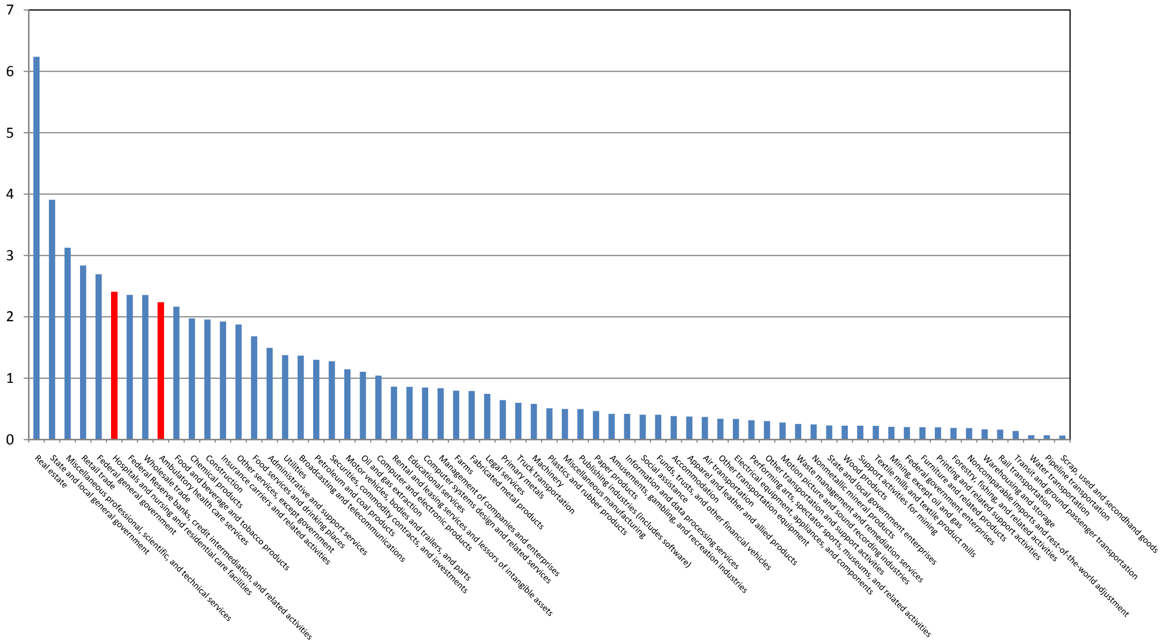


3 Backward and Forward dispersion for Health care services

Inside the phases of creation, distribution and redistribution of income that the SAM for the U.S. economy describe, Health care services can be twice identified. First the Health care services derive from the consumption programmed by Households and Institutions. This part of private Health care output can be generated by two type of activities: "*Ambulatory health care services*" (54) and *Hospitals and nursing and residential care facilities* (55). That amounts are respectively 823.703 and 889.594 million of dollars. The remaining part is qualified as Federal Government production (884.400 million of dollars) and State and Local government (431.200 million of dollars). Matrix R, the reduced form of the model, has the potential to underline the direct and indirect effects on the disaggregated output generated. This is possible performing an exogenous shock trough a predetermined final demand or trough any other macroeconomic variables described in the model. Starting from the reduced form we can build two types of indexes of dispersion that are able to point out the role of any products in terms of backward and forward dispersion. The first type of index can appreciate the relevance of a good to activate the production chain or, to put it better, the index evaluate an increase of a unit final demand shock of the *ith* good in terms of a change of the output of the other commodities. The second type of index evaluate the relevance of a good when a unit final demand shock of all commodities is performed. The inverse matrix allows to build the indexes of dispersion focusing on the good *Ambulatory health care services*" and *Hospitals and nursing and residential care facilities* in order to determine its role as a key commodity. Once determined the Rasmussen dispersion indexes (Rasmussen 1956) it is possible give a rank of all goods in term of power and sensitivity of dispersion. As in figure 5 the two typologies of private Health care services are differently ranked. *Hospitals and nursing and residential care facilities* has a backward index equal to 1.03, is ranked at the 17th position while *Ambulatory health care services*" index is equal to 0.97 (42th position).

The figure 6 shoes the forward index. In this case both goods are ranked in the first positions: *Hospitals and nursing and residential care facilities* is the 6th (2.41) while *Ambulatory health*

Figure 6. Forward dispersion: Health care services relevance



care services" is the 9th (2.23).

4 The health care services as policy objective and policy control

The set of key structures (both for objective variable and control variable) is easily rearranged according the constant absolute change. This phases is needed in order to build two type of index trough which each structure can be measured. In particular, these indexes can be focused on each singular commodity of which can reveal its relative role among all key structures with the specific aspire to quantify its importance both in terms of objective variable and control variable.

As it is for the key objective structures, given matrix $\mathbf{Z}$, it is possible to define the index:

$$\mu_{ij} = \frac{|m_i \cdot z_{ij}|}{\frac{\frac{1}{m}|m_i \cdot z_{.j}|}{\frac{1}{m^2}\sum_{j=1}^{m}|m_i \cdot z_{.j}|}} \tag{11}$$

that quantify the importance of the *ith* good in all the m key objective structures. In particular, the index can reveal the role played by the selected good inside the key objective structures ($\mathbf{z}_i$) when the correspondent Macro Multipliers (m_i) are activated[7]. As for the key control structures, it is possible to define the index starting from matrix $\mathbf{P}$:

$$\gamma_{ij} = \frac{|p|_{ij}}{\frac{\frac{1}{n}|p|_{.j}}{\frac{1}{n^2}\sum \lim its_{j=1}^{n}|p|_{.j}}} \tag{12}$$

The index quantify the importance of the *ith* good in all the n key control structures. In particular,

[7]When the index assume a value smaller than 1 that means the good has a low importance inside both the key objective and control structures.

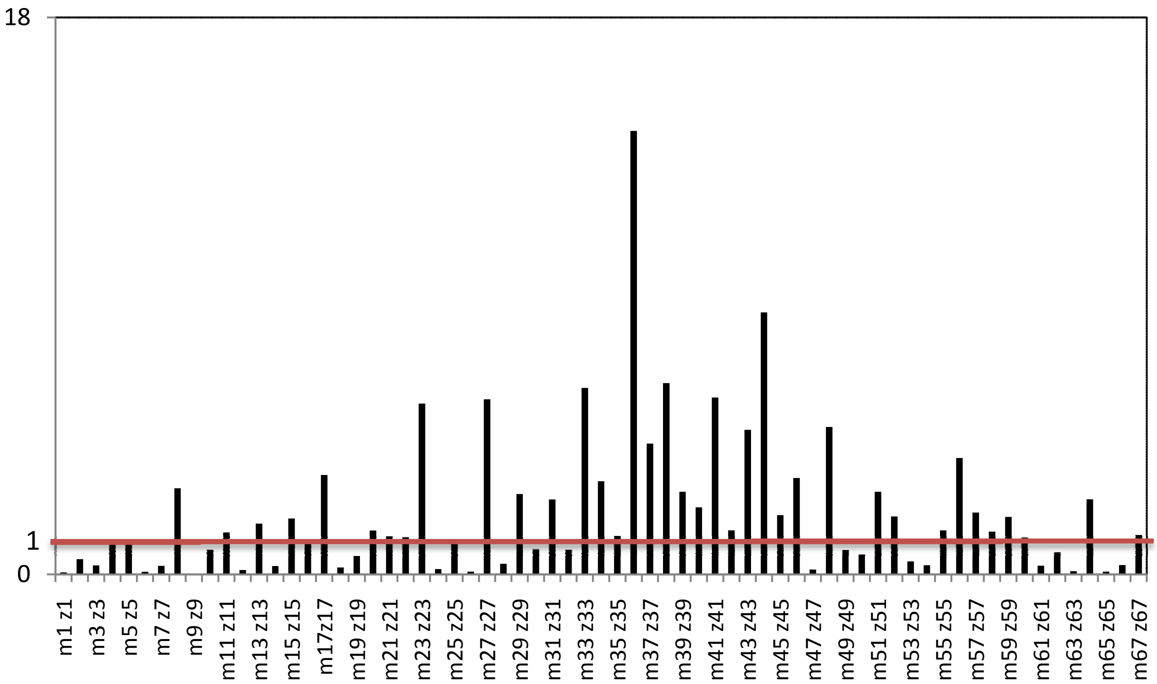
the index can reveal the role played by the selected good inside the key objective structures ($\mathbf{p}_i$).

4.1 *The key-objective-structures index*

The importance of Health care output that is detected with reference to the economic policy design is quantified among the structures revealed by the MM approach. All indexes to which we refer in the previous section let to stress the relevance of private Health. They allow to quantify how important is private health care output in influencing output change when an exogenous shock is performed on final demand components. If the economic policy will develop through the objected represented by the disaggregated output for the instance of U.S. economy it is necessary to verify the weight of "*Ambulatory health care services*" (54) and *Hospitals and nursing and residential care facilities* (55) inside the composition of the key object variable. More than a few structural differences can be stressed considering the value of the key-objective-structures index following the equation (11) with respect to good "*Ambulatory health care services*" and *Hospitals and nursing and residential care facilities.*

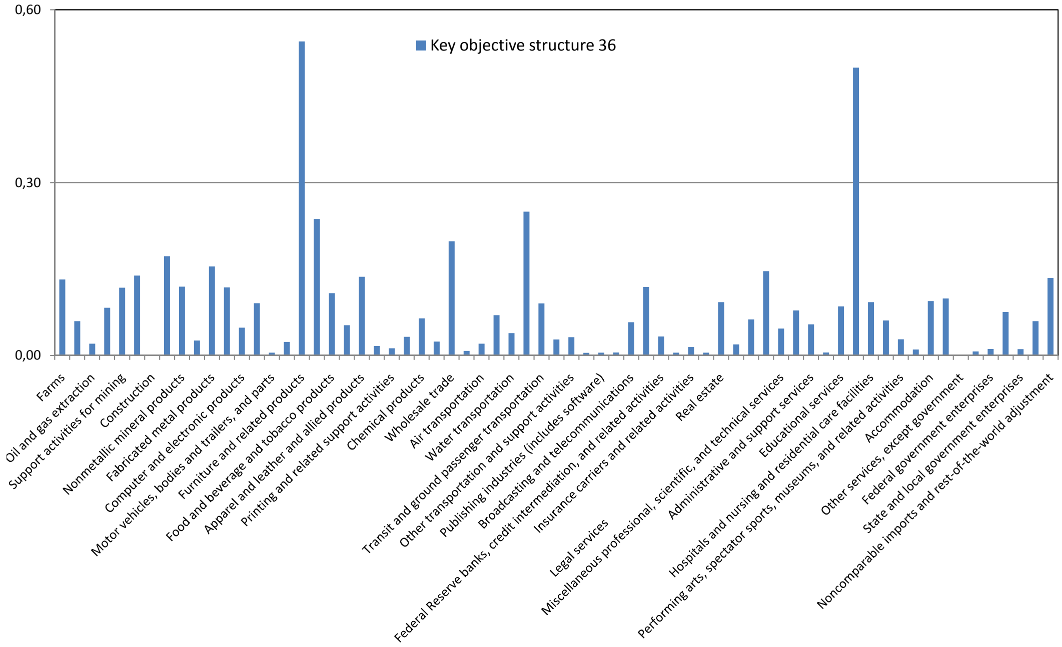
The results regarding the key-objective-structures index for the USA instance are shown in figures 7 and 9. We can see that good "*Ambulatory health care services*" expresses an important influence into 40 key objective structures among 67 ($\mu_{ij} > 1$). From figure 7 it can be seen how good *Ambulatory health care services*" demonstrate the most influence in structure 36.

Figure 7. The index of key policy for the objective variable ("*Ambulatory health care services*")



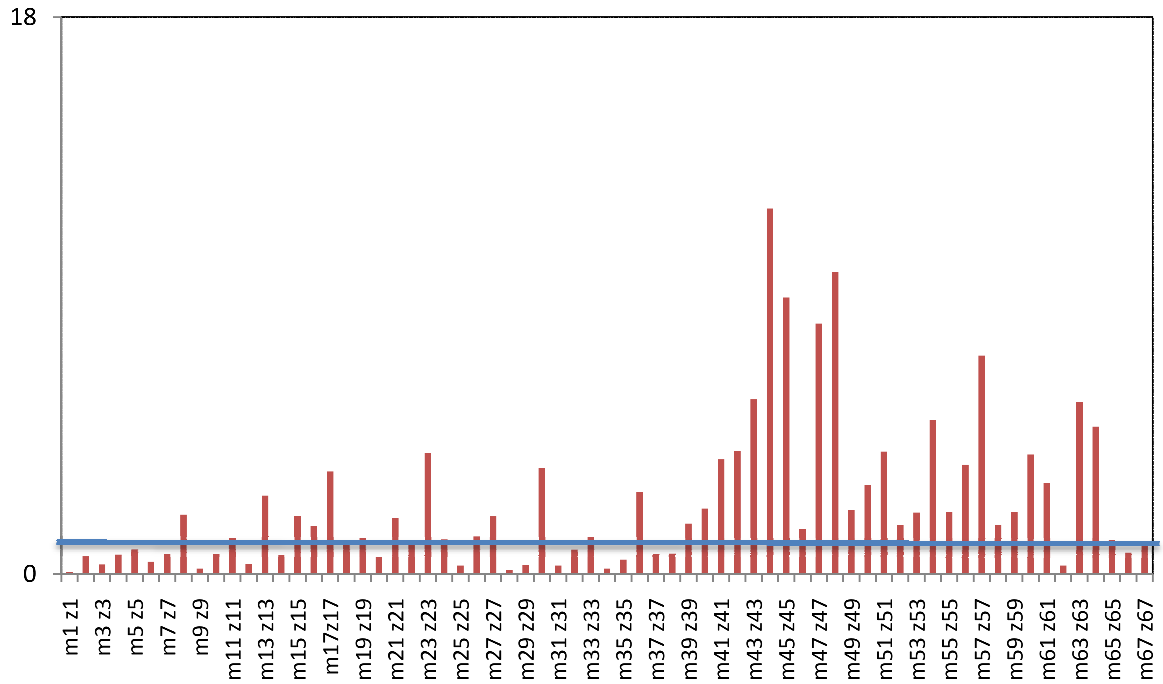
Into detail, structure 36 whose composition is showed in figure 8 manifests an important change of this type of private health output. The structure also enhance the good "Furniture and related products" (17), "Truck transportation" (32) and "Miscellaneous manufacturing" (18). We can see that the good "*Hospitals and nursing and residential care facilities*" (55) has an important

Figure 8. "*Ambulatory health care services*" - Key-objective-structure 36



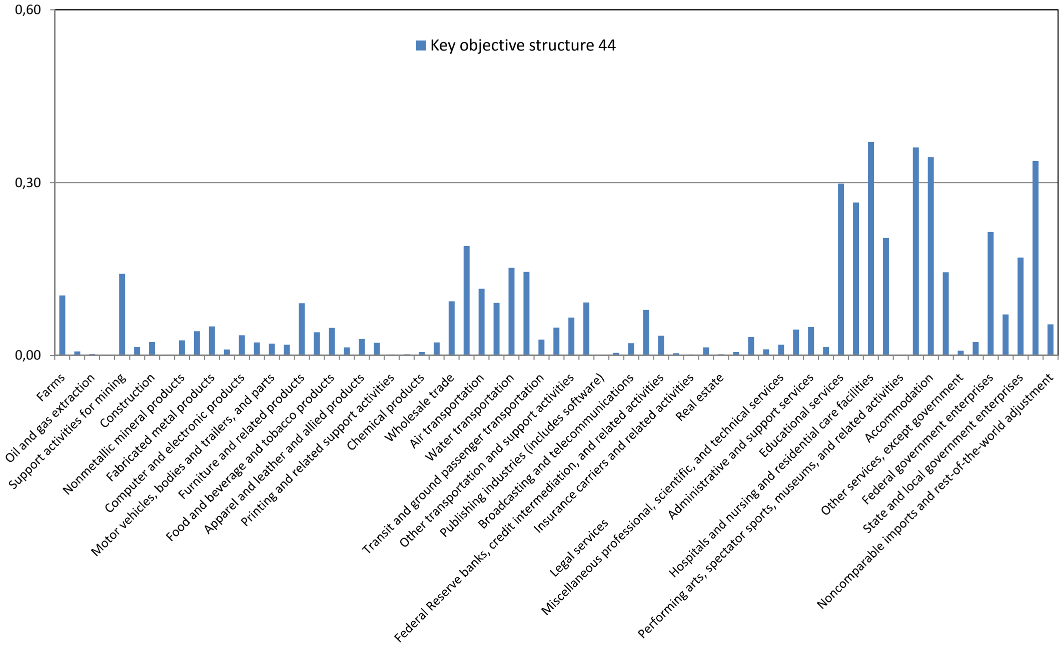
position into structure 43 and 67 ($\mu_{ij} > 1$). From figure 9 it can be stressed the key-objective-structures 44.

Figure 9. The index of key policy for the objective variable ("*Hospitals and nursing and residential care facilities*")



The composition of structure 44 besides enhancing output "*Hospitals and nursing and residen-*

Figure 10. "*Hospitals and nursing and residential care facilities*" - Key-objective-structure 44



tial care facilities" shows the high importance of all health goods [8]. Goods that get the major change are "Amusements, gambling, and recreation" (58), "Accommodation industries" (59), "Scrap, used and secondhand goods" (66) and Educational services (53).

4.2 *The key control structures index*

According to equation 12 it is possible to calculate the index of the key control structures for the good "*Ambulatory health care services*" and "*Hospitals and nursing and residential care facilities*". That indexes allow to identify the key structures of final demand in which the health good plays a significant role. In this respect the key-control-structures index has the potential to reveal which type of good is favoured by the key policies choose according the value of the index.

We can see that the good "*Ambulatory health care services*" (54) get an important role into 22 key-control-structures among 67 structures. Figure 11 shows the value of the index γ_{ij}.

Between the key control structures the structure 36 whose composition is showed in figure 12 is the more interesting. In order to activate this structure is necessary to enhance good "Furniture and related products" (17), "Truck transportation" (32), Wholesale trade (27) and Miscellaneous manufacturing (18).

We can see that good "*Hospitals and nursing and residential care facilities*" (55) get an important role into 25 key-control-structures ($\gamma_{ij} > 1$) among 67 (see figure 13). the Structure 44 is the more interesting among the 25 key-control-structures (its composition is showed in figure 14).

In activating this key policy, the goods "Amusements, gambling, and recreation" (58), "Accommodation industries" (59), "Scrap, used and secondhand goods" (66), Educational services (53), "Social Assistance" (56), "Federal Government" (62) and "State and Local Government"

[8] The composition of structure is showed in figure 10.

Figure 11. The index of key policy for the control variable ("*Ambulatory health care services*")

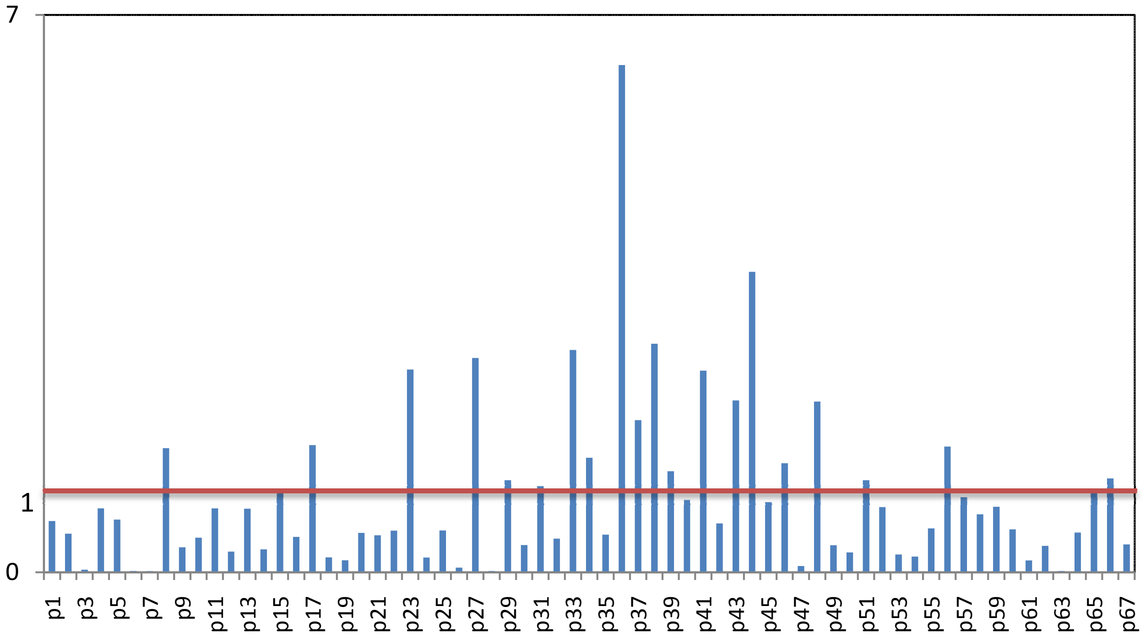
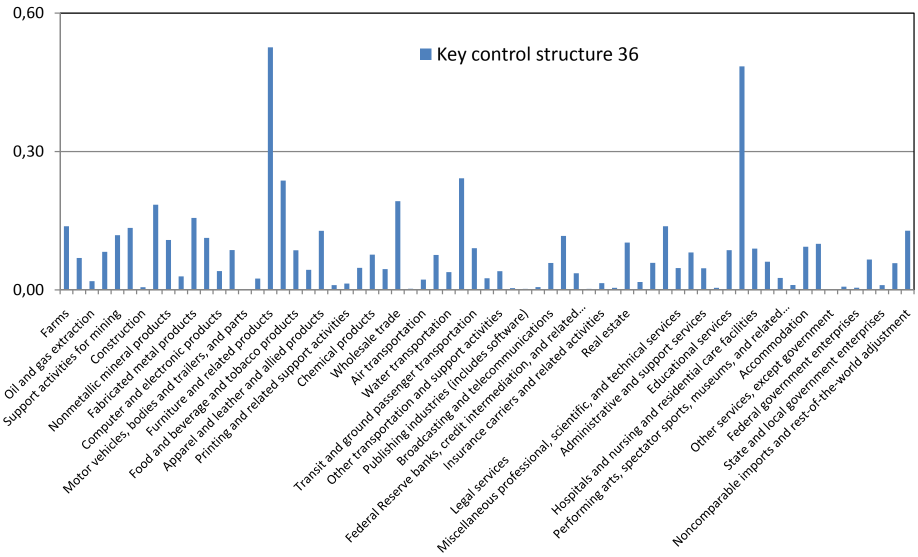


Figure 12. "*Ambulatory health care services*" - Key-control-structure 36



(64) are important to activate the structure.

Figure 13. The index of key policy for the control variable ("*Hospitals and nursing and residential care facilities*")

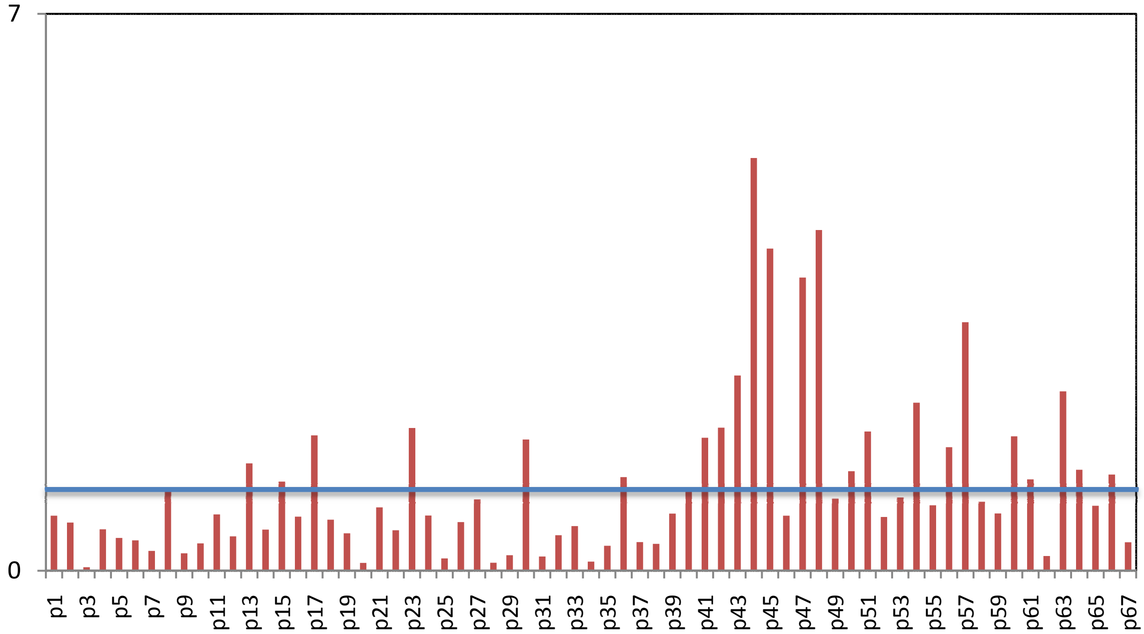
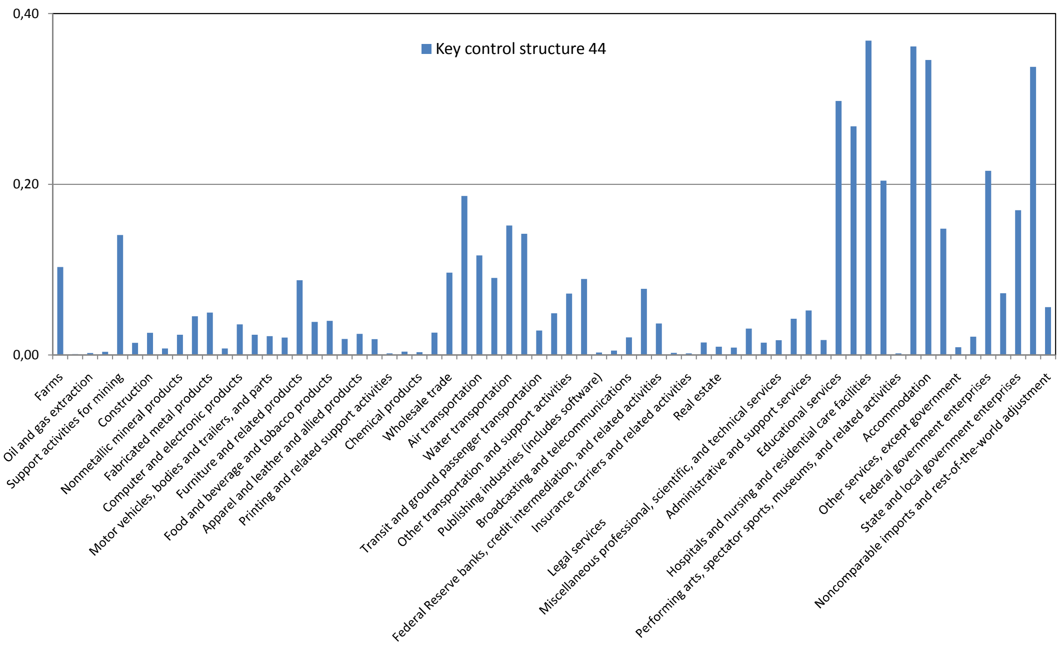


Figure 14. "*Hospitals and nursing and residential care facilities*" - Key-control-structure 44



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Appendix A: Three aggregate measures for a multisectoral economic policy

In order to allocate the policy problem in a multisectoral extended framework to that emerging from the SAM. In these models the macroeconomic variables are defined and evaluated as sectoral flows with lesser attention paid to their aggregate role, which is determined as a summation of the flow over all sectors. The macro variables implied are total output vector $\mathbf{x}$, industry demand vector $\mathbf{b}$, final demand vector $\mathbf{f}$ and, in an ancillary role of accounting check, value added vector $\mathbf{va}$.

The equilibrium relationships that connect intermediate demand expenditure and final demand expenditure to total output value - verified at the industry level- can be written, according the well known formula, as equation 1:

$$\mathbf{x} = [\mathbf{I} - \mathbf{A} - (\mathbf{F}) \cdot (\mathbf{I} + \mathbf{T}) \cdot \mathbf{P} \cdot \mathbf{V} \cdot \mathbf{L}]^{-1} \cdot (\mathbf{f}^0 - \mathbf{m}) \tag{A1}$$

Speaking in terms of policy models, equation A1 represents the structural form of the extended multisectoral model. This model has a corresponding reduced form in which variables that play a strategic role in defining the policy problem are put in evidence. These are the endogenously determined policy target, $\mathbf{z} = [z_1, \ldots, z_n]^T$ on which the effects of the policy control are observed, and the exogenously given policy controls, $\mathbf{p} = [p_1, \ldots, p_n]^T$, which the policy maker has to determine to attained the desired or convenient configuration of the policy targets.

The structural model is then manipulated in order to put the policy targets in direct relationship with the policy controls determining the reduced form of the model:

$$\mathbf{z} = \mathbf{R} \cdot \mathbf{p} \tag{A2}$$

where $\mathbf{R} = [\mathbf{I} - \mathbf{A} - (\mathbf{F}) \cdot (\mathbf{I} + \mathbf{T}) \cdot \mathbf{P} \cdot \mathbf{V} \cdot \mathbf{L}]^{-1}$, $\mathbf{z} = \mathbf{x}$ and $\mathbf{p} = \mathbf{f}$. Notably with the model the target variable, $\mathbf{z}$, is represented by total output, $\mathbf{x}$, and the policy control, $\mathbf{p}$, by final demand, $\mathbf{f}$. This means that the reduced form matrix coincides with the inverse $\mathbf{R}$.

In the extended model the specific policy targets $\mathbf{z}_0$, i.e. changes in total outputs, are linked to the peculiar policy controls $\mathbf{p}_0$, i.e. changes in final demands, through the inverse $\mathbf{R}$. Once determined the solutions of the policy problem, the remaining endogenous variables are then consistently determined:

$$\mathbf{m}_0 = \mathbf{x}_0 - \mathbf{f}_0 \tag{A3}$$

$$y_0 = \sum_i \left[x_{0i} - \sum_j a_{ij} x_{0j} \right] \tag{A4}$$

However a preliminary problem has to be discussed which regards the determination of the aggregate figure to be globally associated to the change in the policy-control vector-variable starting from the observed sectoral changes in the same vector-variable. This discussion will lead us to determine three different aggregation criteria for the same policy-vector each one with a different meaning on the aggregate behaviour of the macro variable.

This aggregation criterion gives the information on the balance of the policy manoeuvre. In this case a first definition of the scale of the policy control vector **p** will be given by:

$$bal(\mathbf{p}) = \sum_i p_i = costant$$

The vectors that show the same net balance will be allocated along the same line. Putting together all the possible policy controls **p** into groups according their balance, a set of lines will be determined and we define then as equal policy-contours with respect to a predetermined balance or, briefly, equal-balance policy contours. An equal-balance policy contour, then, puts together all the policy-control vectors that quantify a policy manoeuvre that has the same net balance.

The family of the equal-balance policy contours orders then all the conceivable policy vectors according their net balances: a map where, for each aggregate balance value of the macro variable chosen as policy control, a set of infinite sectoral compositions of the same variable is shown. In the policy application the zero-balance manoeuvre is of great interest because is represented by the policy control performed without making its original global level. In this case the manoeuvre is realized through changes that compensate each other.

It is however apparent that balance is not sufficient by itself to describe the order of magnitude of the net changes in the role of policy control. In particular net balance does not give information on the order of magnitude of changes involved within the policy control.

A measure more suitable for this aim is given by the sum of absolute values, that we will indicate with the abridged expression of change $Cng(...)$:

$$Cng(\mathbf{p}) = \sum_i |p_i| = constant$$

The change of vector **p** quantifies the order of magnitude of the policy manoeuvre in terms of both the expansion realized and the restraints imposed to sectors. Vectors that show the same absolute change will locate along the same square with diagonal equal twice the change. Grouping all the possible policy controls **p** according their aggregate scale defined as change, a set of squares will be generated that we define as equal-change policy contour.

The change of a vector, according our definition, has also specific properties that the previously defined balance has not. The aggregation rule given by $Cng(...)$ is, in fact, a vector norm. It defines a type of distance between two points, and then the vector's length, in terms of the sum of the (absolute) differences of their coordinates. Sometimes is known as Manhattan norm[9]. The notion of norm of a vector in mathematics is essential in order to define the concept of "distance" or "length" in a linear vector space as that in which the equal policy contour map is defined.

But what is more relevant the norm can give interesting suggestions for the definition of the macroeconomic aggregate value of a multisectoral vector variable. In fact the norm of a vector **p** $\in P^n$ is a mapping that associates a real number to each element in R^n. Whatever type of norm

[9]This name alludes to the grid layout of most streets on the island of Manhattan, which causes the shortest path a car could take between two points in the city to have length equal to the sum of the (absolute) differences of their coordinates rather than the Euclidean distance.

has to fulfil some consistency requirements:
l) the norm of a vector different from zero is positive[10];
2) the norm of the sum of two vectors is not greater then the sum of the norms of the two vectors;
3) scaling a vector by a constant the norm of the vector is scaled by the same constant.

We note that while the change satisfies the requisites to be a norm the balance doesn't satisfy these conditions, even providing valuable economic information. In fact balance can become negative and can be zero also when all his elements are not equal to zero and this is contrary to the requirements for being a norm. Of course it remains the relevance of its economic meaning; that's why *balance* will be used contextually with *change* as two criteria for aggregating our policy control vector.

Since our aim is that of operating on the multidimensional policy target through the use of the multidimensional policy control, we need to answer to a further question. Are the aggregation criteria, that we use for the definition of the policy contours, exploitable to understand something more on the transformation from policy into targets operated by the Leontief reduced form? As it will be shown further on in this paper, a matrix transformation of the vector space - the map of the equal policy contours - takes place through a process that implies three phases: rotation, scaling and counter rotation.

The main question is now whether the morphology of the equal-change policy contour is neutral with respect to the rotation and the counter-rotation phases of the matrix transformation. In these two phases no scale change has to be introduced by a rotation operation so that dimensional changes can remain confined to and completely determined by the scaling phase. In this phase the aggregated Macro Multipliers that rule the matrix transformation are determined.

Each rotation of the axes transforms the coordinates of the vectors. However an axis rotation transforms the length of the policy vector on the equal-change policy contour in a non uniform manner since the length of the policy vector on the contour is not constant. The specific geometrical features of the equal-change policy contour is, then, not neutral with respect to an axes rotation.

We then conclude that even if the two aggregation criteria described, balance and change, are sufficient under the economic profile to synthesize the characteristics of the vectors scale, a further attempt is needed to identify an aggregation criterion that can generate an equal policy contour map neutral with respect to an axes rotation. In this way we will be able to isolate the aggregated Macro Multipliers, implicit in the Leontief reduced form, that can be determined only in the scaling phase of the matrix transformation.

An aggregation criterion that overcomes these drawbacks is that of assigning to the vector's scale the value of its Euclidean norm, the *modulus*:

$$Mod(\mathbf{p}) = \sqrt[2]{\sum_j p_j^2}$$

All the policy vectors that have constant modulus are invariant with respect to rotations of the

[10]The norm is a definite positive function:
$\|\mathbf{p}\| = \mathbf{0}\ \forall\ \mathbf{p} \in \mathbf{P}$ and $\|\mathbf{p}\| = \mathbf{0}$ if and only if p_i=0.
It satisfies the triangular inequality:
$\|\mathbf{p}_1 + \mathbf{p}_2\| \leq \|\mathbf{p}_1\| + \|\mathbf{p}_2\| \quad \mathbf{p}_1, \mathbf{p}_2 \in \mathbf{P}$.
It is homogeneous $\|\lambda \cdot \mathbf{p}\| = |\lambda| \cdot \|\mathbf{p}\|$ for each scalar λ.

axes and describe a circle with radius equal to a constant.

This aggregation criterion is less immediate in its economic interpretation then the two already shown. It is however useful in calculation when, operating with matrices on macroeconomic vector variables, we need to isolate the scale effects from the structure effects of a macroeconomic vector variable on another vector variable. Given the three aggregation criteria, a predetermined vector variable will show three different aggregated values. The three values provide three different indications on the three features of the scale of the variable and the possibility of switching from a value to another, when necessary, through the use of the definitions.

The relationship that exists between change and modulus is of particular interest and can be analyzed concentrating on the unit equal-change and the unit equal-modulus policy-contours.

Appendix B: Macro Multiplier approach

The direct and indirect effects of final demand on total output are then quantified in our multi-sectoral extended model from structural matrix $\mathbf{R}$.

$$\mathbf{R} = [\mathbf{I} - (\mathbf{A} - \mathbf{A}^m) - (\mathbf{F} - \mathbf{F}^m) \cdot (\mathbf{I} + \mathbf{T}) \cdot \mathbf{P} \cdot \mathbf{V} \cdot \mathbf{L}]^{-1} \tag{B1}$$

The structural matrix[11] of our model can be easily decomposed in a sum of m different matrices through the Singular Value Decomposition [?].

The decomposition proposed can be applied both to square and to non-square matrices. Here the general case of square matrix $\mathbf{R}$ will be shown. The non-square matrix case is easily developed along the same lines.

To simplify we consider 2x2 model. Let us consider matrix $\mathbf{W}$ [2,2], for example, the square of matrix $\mathbf{R}$:

$$\mathbf{W} = \mathbf{R}^T \cdot \mathbf{R}$$

Matrix $\mathbf{W}$ has a positive definite or semi definite square root. Given that $\mathbf{W} \geq 0$ by construction, its eigenvalues λ_i for $i = 1, 2$ shall be all real non negative [?].

The nonzero eigenvalues of matrices $\mathbf{W}$ and $\mathbf{W}^T$ coincide. The system of eigenvectors $[\mathbf{u}_i \quad i = 1, 2]$ for $\mathbf{W}$ and $[\mathbf{v}_i \quad i = 1, 2]$ for $\mathbf{W}^T$ are orthonormal basis.

We get then

$$\mathbf{R}^T \cdot \mathbf{z}_i = \sqrt{\lambda_i} \cdot \mathbf{p}_i \qquad i = 1, 2$$

We can construct the two matrices

$$\mathbf{Z} = [\mathbf{z}_1, \mathbf{z}_2] \;\; \mathbf{P} = [\mathbf{p}_1, \mathbf{p}_2]$$

As defined above, the eigenvalues of $\mathbf{W}$ coincide with singular values of $\mathbf{R}$ hence $s_i = \sqrt{\lambda_i}$ and

[11] Its numerical determination is shown in table 1 section 4 $\mathbf{R}$.

we get

$$\mathbf{R}^T \cdot \mathbf{Z} = [s_1 \cdot \mathbf{p}_1, s_2 \cdot \mathbf{p}_2] = \mathbf{P} \cdot \mathbf{M}$$

Structural matrix $\mathbf{R}$ in equation B1 can be then decomposed as

$$\mathbf{x} = \mathbf{Z} \cdot \mathbf{M} \cdot \mathbf{P}^T \cdot \mathbf{f} \tag{B2}$$

$\mathbf{P}$ is an [2,2] unitary matrix whose columns define the 2 reference structures for final demand:

$$\mathbf{p}_1 = \begin{bmatrix} p_{1,1} \; p_{1,2} \end{bmatrix}$$

$$\mathbf{p}_2 = \begin{bmatrix} p_{2,1} \; p_{2,2} \end{bmatrix}$$

$\mathbf{Z}$ is an [2,2] unitary matrix whose columns define 2 reference structures for output:

$$\mathbf{z}_1 = \begin{bmatrix} z_{1,1} \\ z_{2,1} \end{bmatrix}, \mathbf{z}_2 = \begin{bmatrix} z_{1,2} \\ z_{2,2} \end{bmatrix}$$

and $\mathbf{M}$ is an [2,2] diagonal matrix of the type:

$$\mathbf{M} = \begin{bmatrix} \mathbf{m}_1 & 0 \\ 0 & \mathbf{m}_2 \end{bmatrix}$$

Scalars m_i are all real and positive and can be ordered as $m_1 > m_2$. Now we have all the elements to show how this decomposition correctly represents the MM that quantify the aggregate scale effects and the associated structures of the impact of a shock in disposable income on total output. In fact if we express the actual vector $\mathbf{f}$ in terms of the structures identified by matrix $\mathbf{P}$, we obtain final demand vector, $\mathbf{f}^0$, expressed in terms of the structures suggested by the $\mathbf{R}$:

$$\mathbf{f}^0 = \mathbf{P} \cdot \mathbf{f} \tag{B3}$$

On the other hand we can also express total output according the output structures implied by matrix $\mathbf{R}$:

$$\mathbf{x}^0 = \mathbf{Z}^T \cdot \mathbf{x} \tag{B4}$$

Equation B2 then becomes through equations B3 and B3:

$$\mathbf{x}^0 = \mathbf{M} \cdot \mathbf{f}^0 \tag{B5}$$

which implies:

$$\mathbf{x}_i^0 = m_i \cdot \mathbf{f}_i^0 \tag{B6}$$

where $i = 1, 2$. We note that matrix $\mathbf{R}$ hides 2 fundamental combination of the outputs. Each of them is obtain multiplying the corresponding combination of final demand by a predetermined scalar which has in fact the role of aggregated Macro Multiplier.

The complex effect on the output vector of final demand shocks can be reduced to a multiplication by a constant m_i.

The structures we have identified play a fundamental role in determining the potential behavior of the economic system, i.e. the behavior of the system under all possible shocks. We can in fact evaluate which will be the effect on output of all final demand possible structures. This is easily done imposing in equation 16 a vector whose modulus is constant, say equal to one, but whose structure can assume all possible configurations. If vector $\mathbf{f}$ in equation B2 is such that

$$\sqrt{\sum_{\Sigma} j = 1} \tag{B7}$$

then geometrically we mean that the final demand vector describes a sphere of unit radius (the unit circle).

It rotates around the origin assuming all the possible structures, including those implied by the columns of matrix $\mathbf{P}$. Correspondingly the vector of total output will describe an ellipsoid with semi-axes of length $m_1, \ldots, s_m$, oriented according the directions designated by the columns of matrix $\mathbf{Z}$. This ellipsoid is sometimes called the isocost of final demand control.

When final demand vector crosses a structure in $\mathbf{P}$, the vector of total output crosses the corresponding structure in $\mathbf{Z}$ and the ratio between the moduli of the two vectors is given by the corresponding scalar m. Singular values $\mathbf{m}_i$, then, determine the aggregated effect of a final demand shock on output. For this reason we will call them macro multipliers. These MM are aggregated, in the sense that each of them applies on all components of each macroeconomic variables taken into consideration, and are consistent with the multi-industry specification of the model.

In our original [m,m] extended model, we can than say that, given our matrix $\mathbf{R}$, we are able to isolate impacts of different (aggregate) magnitude, since that MM present in matrix $\mathbf{R}$, $\mathbf{m}_i$ can be activated through a shock along the demand structure $\mathbf{p}_i$ and its impact can be observed along the output structure $\mathbf{z}_i$.

Appendix C: Table and figures

Figure C1. I-O commodities, Primary factors, Institutional Sectors and Capital Formation classification

1	Farms	40	Information and data processing services
2	Forestry, fishing, and related activities	41	Federal Reserve banks, credit intermediation, and related activit
3	Oil and gas extraction	42	Securities, commodity contracts, and investments
4	Mining, except oil and gas	43	Insurance carriers and related activities
5	Support activities for mining	44	Funds, trusts, and other financial vehicles
6	Utilities	45	Real estate
7	Construction	46	Rental and leasing services and lessors of intangible assets
8	Wood products	47	Legal services
9	Nonmetallic mineral products	48	Computer systems design and related services
10	Primary metals	49	Miscellaneous professional, scientific, and technical services
11	Fabricated metal products	50	Management of companies and enterprises
12	Machinery	51	Administrative and support services
13	Computer and electronic products	52	Waste management and remediation services
14	Electrical equipment, appliances, and components	53	Educational services
15	Motor vehicles, bodies and trailers, and parts	54	Ambulatory health care services
16	Other transportation equipment	55	Hospitals and nursing and residential care facilities
17	Furniture and related products	56	Social assistance
18	Miscellaneous manufacturing	57	Performing arts, spectator sports, museums, and related activitie
19	Food and beverage and tobacco products	58	Amusements, gambling, and recreation industries
20	Textile mills and textile product mills	59	Accommodation
21	Apparel and leather and allied products	60	Food services and drinking places
22	Paper products	61	Other services, except government
23	Printing and related support activities	62	Federal general government
24	Petroleum and coal products	63	Federal government enterprises
25	Chemical products	64	State and local general government
26	Plastics and rubber products	65	State and local government enterprises
27	Wholesale trade	66	Scrap, used and secondhand goods
28	Retail trade	67	Noncomparable imports and rest-of-the-world adjustment
29	Air transportation	VA1	Compensation of employees
30	Rail transportation	VA2	Taxes on production and imports, less subsidies
31	Water transportation	VA3	Gross operating surplus
32	Truck transportation	I	Households and istitutions
33	Transit and ground passenger transportation	II	Business
34	Pipeline transportation	III	Federal Government
35	Other transportation and support activities	IV	State and Local Government Current
36	Warehousing and storage	V	Rest of Word
37	Publishing industries (includes software)	S1	Private investment
38	Motion picture and sound recording industries	S2	National Gross investment
39	Broadcasting and telecommunications	S3	State and local government gross investment

Figure C2. Key-objective-structures

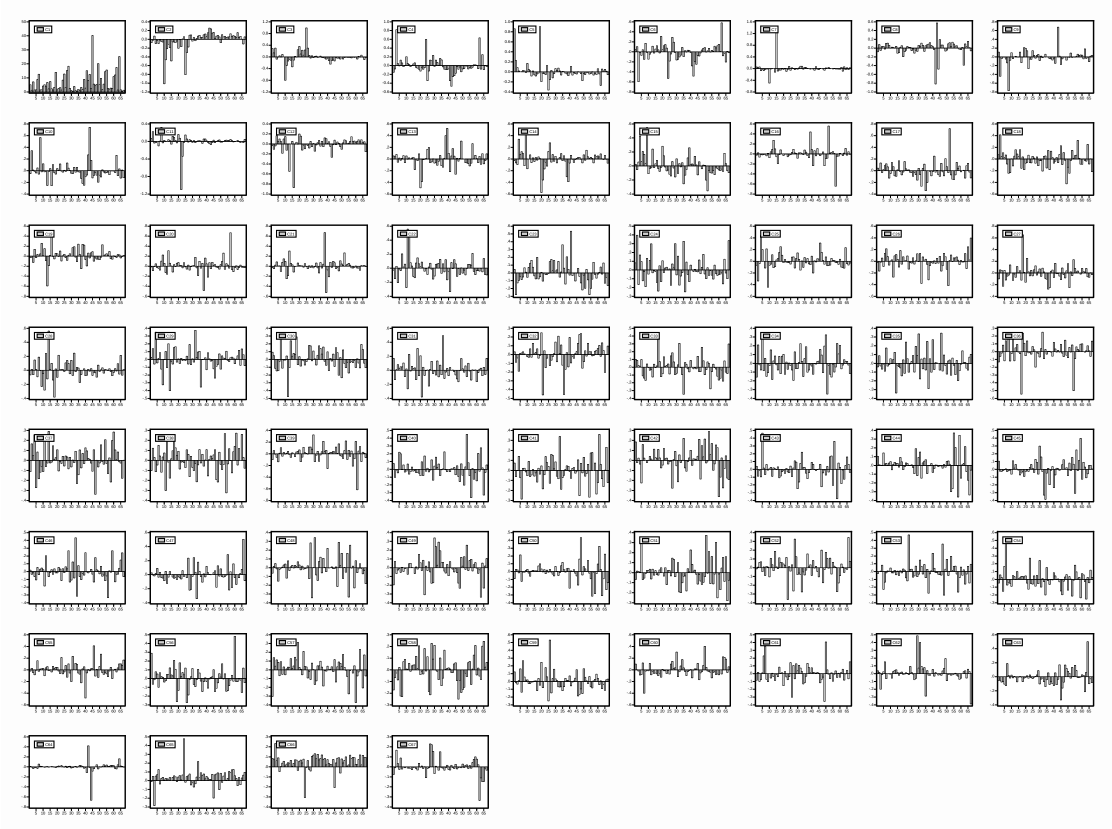

Figure C3. Key-control-structures