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HEALTH SERVICES AS A KEY SECTOR FOR INCOME AND EMPLOYMENT CHANGE

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Abstract: *The analysis of health commodity typically focuses on the efficiency and equity of its market or on the quality of its production and often on the sustainability of its approach to financing. The paper aims to emphasize the importance of health commodity in the process of creation and distribution of income. The methodology is based on the construction of the Social Accounting Matrix with particular attention to health output. We first perform the dispersion analysis in order to evaluate the backward and forward linkages of the health production and then, we simulate different key policies favourable to health commodity aiming to quantify their impacts on the main macroeconomic aggregates.*

Key words: *Health Structural Change, Linkages Analysis, SAM.*

1. Introduction

The increase in health care expenditure emphasizes the relevance of health sector in world production and confirms the importance of health commodity within national economy (Works, 2003). The health commodity and its relative production process is characterised by the absorption and creation of a complex set of goods and services (Harris *et al*., 2004). The territorial distribution of health commodity production and the social-economic weight connected with its financial system, require a detailed analysis of connections among health and the other commodities. This analysis should be done in terms of backward and forward linkages (McNamara and Hancock, 2003) and in terms of linkages with institutional sectors (Households, Firms, Government) which partially express the health demand (McNamara e Hancock, 2003).

Economic literature on this subject typically focuses on theoretical reasons allowing public involvement in production and supply of health commodity. Even if the main criticism related to health commodity is represented by the efficiency in its production and the equity in its distribution among people, this type of analysis normally does not take into account the production aspect and its impact on income and employment (Hughes e Walker, 2003). Since health commodity interacts with the other commodities and institutional sectors, it is crucial to verify whether the health good is able to affect the most important

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macroeconomic aggregates (Clair et al., 2005).

This type of analysis should be performed through the extended multisectoral model based on the Social Accounting Matrix (SAM) that is able to represent the health flows within the phases of value added generation and primary and secondary distribution of income (Bodeen e Shaffer, 1998). Such type of data base can put into evidence the linkages among all production processes and agents in the economy. This is possible by means of the Input-Output table (I-O table) where the flows of health commodity are included in a unique commodity named "*Health and social work services"*, according to the NACE.REV.1 classification (EUROSTAT, 1996).

We decided to put into evidence each part of the "*Health and social work services"* commodity within the economy. For this purpose, according to the structure of the Italian health system, we split all flows related to this commodity into three different categories: i) *Hospital Firm Services* (HFS); ii) *Local Health Unit Services* (LHUS); iii) *Other Health and Social Services* (OHSS). The final result is represented by an I-O table for the year 2000, with symmetric structure (*Commodity* by *Commodity*), in which a set of rows and columns are headed to three different categories of health commodity. After that it is crucial to integrate the data in the I-O table with information deriving from the income accounts in order to obtain a Social Accounting Matrix (SAM) able to describe the Income Circular Flow.

The extended multisector model allows obtaining the structural matrix of the economy which describes the intersector linkages of the health commodity (when it is considered both as a seller to other activities and a purchaser of intermediate goods). Moreover, the model allows identifying the economic relations between institutional sectors and health care expenditure and the linkages analysis is able to determine the relative incidence of the health commodity within the economy (Rasmussen, 1956). Then the inverse matrix of the model can also be considered as a suitable tool to evaluate the impacts of a general or specific policy since it takes into account the direct and indirect effects on output and on employment.

The second section of the paper describes the health care expenditure (in order to put into evidence its main components), the structure of the I-O table and the SAM. The third section describes the extended multisector model and the dispersion analysis approach in order to determine the relevance and the role of health care commodity in the economy. Section fourth shows the main results of both dispersion analysis and policies scenarios.

2. Health Services and Income Circular Flow

The health product consists of a plurality of heterogeneous goods and services and its production process is characterized by a complex organization structure.

This feature forces the attempt to define within the health system the expenditure in each macro area that identifies a hypothetical center of cost associated with production and supply of different types of health good. In this respect we identify a sub articulation of health production: HFS, LHUS, OHSS. This classification, even if not in accordance with NACE.REV.1, is suitable for any level of analysis of health production, both national and regional level, since it identifies two centers of cost with their own budget. [1].

In order to identify the three different centers of cost for the health expenditure we manage the official accounting flows of Hospital Firm Services and Local Health Unit Services. The data are collected annually by each Italian Region according to the official schemes adopted by the Health Information System (SIS) (Ministry of Health, 2000). This procedure aims to establish the production cost able to link the total health product to both the flow of primary factors (labor and capital) and the flow of intermediate goods absorbed by the health production process.

The classification of costs and revenues provided by the Health Information System needs to be consistent with the classification of commodities included in the I-O table. We begin unbundling the intermediate costs from that one for primary factors in order to emphasize both the value added and the expenses for intermediate goods. In particular, we impute the intermediate expenditure to each typology of commodities absorbed by the production process of health. The major part of the intermediate costs of Hospital Firm Services is represented by chemical/pharmaceutical commodities and medical equipment, 16%. Otherwise the major part of the intermediate costs of Local Health Unit Services is represented by the costs of intermediate services purchased from other public and private sanitary structures, 28.7%. In general we can observe that third of the total expenses of Local Health Unit Services and Hospital Firm Services is generated by intermediate expenditure and the rest is represented by value added.

The health commodity can be represented through the integration of the production and the income national accounts (Round, 2003) in order to evaluate how relevant is its contribution to the value added generation by each commodity, to the primary income allocation to the primary factors and to the institutional sectors. The integration can be realized following different phases:

i) the arrangement of the Input-Output (IO) accounts by commodity;
ii) the primary income allocation to primary factors and institutional sectors;
iii) secondary income distribution for institutional sector.

The I-O table can be differently structured (Bulmer-Thomas, 1982) in order to put in evidence the linkages among the commodity production processes including the health care commodity. The I-O table in fact, registers the intermediate goods and primary factors flows that are necessary to realize the production process and satisfy the intermediate and final demand for goods and services. The intensity of the linkages, deriving from the I-O data, shows how the production process of each commodity (health care in our case), is integrated within the economy and then suggests the relevance of the good. Hence the health care commodity might be considered as a “key” sector able to generate economic change directly or indirectly by stimulating the production of other commodities.

The health care services in the original symmetric I-O table (Commodity by Commodity) [2] (Mantegazza et al., 2004) for the year 2000 for the Italian system is embodied in the commodity “*Health and social work services*” which includes hospital services, medical centres services, dental clinic services and other health care services. The opportunity to disaggregate the health commodity in different commodities allows to operate on a specific aspect of the health care sector according to the exigencies of the research. The classification we define above requests the integration of I-O data with information obtained from the HFA (Health For All, 2004) database and the HFS and LHUS economic accounts for the year 2000 (Ministry of Health, 2000). In particular, from the LHUS accounts, it is possible to obtain information on the costs for all health services and from the HFS accounts the costs for hospital services with this juridical structure. By means of the connection matrix between the classification of the economic accounts and the I-O classification, it is possible to organize all the data in order to determine the cost function for the production process of HFS and LHUS, the demand of intermediate goods and services and the value added. Then we proceed to the disaggregation of the initial good in the I-O table (column 53) in 3 commodities: i) HFS (column 53), ii) LHUS (column 54) and iii) OHSS for the residual.

The disaggregation of the initial I-O row is relatively simple since there are many zeros. On the contrary, the final demand flows are separated following this scheme: i) the final consumption of the Households for the two categories of health commodities are obtained following the structure of Empam data base; ii) the final consumption of the Government is the balance of the rows.

The closure of the production flows requires the construction of the imports table in order to complete the I-O table and determine the amount of health commodity imports for intermediate and final consumption. After the identification of the principal intermediate goods that can be imported by the health commodity, the structure of the imports of the health care services obtained by the original I-O table has been extended to the two commodities (HFS and LHUS). The column OHSS contains the residuals imports while the final demand is not affected by the imports of any health care services.

Figures 1 and 2 show the absorption of intermediate goods (unit of product) by HFS e LHUS.

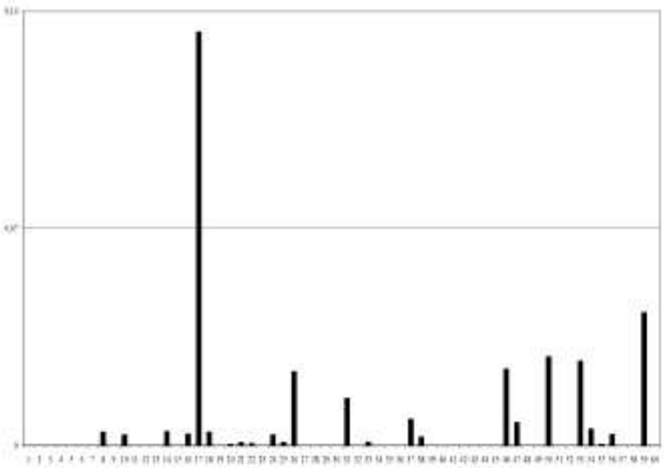

Fig. 1. *Hospital Firm Services (HFS) absorption (unit of product)*

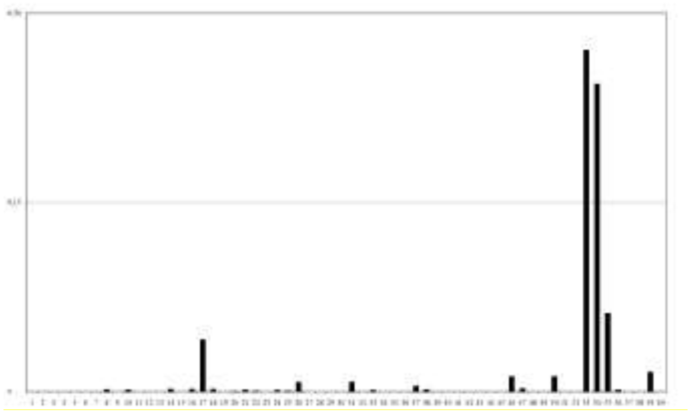

Fig. 2. *Local Health Unit Services (LHUS) absorption (unit of product)*

The final result of this procedure is a *60x60* symmetric I-O table (*Commodity by Commodity*), in which the commodity "*Health and social work services*" have been replaced by three different commodities. The I-O table is composed of three blocks: the intermediate goods, the final demand and the value added. The final demand is divided into Institutional Sectors consumption (Households, Private Social Institution and Government), gross fixed investment, inventories changes and exports. The value added is slipped into value added at factor costs and net indirect taxes. The closure of the table is represented by the imports by product. The integration of production and income accounts requests the identification of the flows related to the components of the value added.

The value added generated by the production of HFS corresponds to the 63% of the total output and is characterized by a quota of 95% of employment income. On the other side, the value added generated by the production of LHUS corresponding to the 59% of the total output, has a quota of 97% of employment income. The secondary distribution of income contributes to the formation of the disposable income of the institutional sectors. The determination of the disposable income allows calculating the gross savings of the institutional sectors. The final consumption expenditure by institutional sectors has been connected to I-O final demand by means of the connecting matrix of consumption shares. This way it is possible to highlight the final consumption of health care commodity from households and firms. Finally the net position of the economy with the Rest of the world (foreign savings) is defined from the accounts of the capital formation and rest of the world.

3. Extended Multisectoral Model and Linkages Analysis

In our analysis we will use a multi-industry, multi-factor and multi-sector model following and extending the approach suggested by Miyazawa (Miyazawa, 1976). The extended multisectoral model we use (Ciaschini and Socci, 2006) is a Social Accounting Matrix (SAM) model that allows to quantify the policies modelled on each target variable (Commodities output, Primary Factors Income and Institutional Sectors demand) in every phases of the income circular flow. This will be done in a way that the definition of the macroeconomic variables implied is made perfectly consistent with the definition adopted in SAM (Pyatt, 2001), which will become the data base of the model. The main assumptions of the extended income-output model, that we adopt, are the assumption fixed prices and the assumption of constant coefficients and shares.

The production process, that takes place at industry level, generates total output, x, and gross value added by the *m* I-O industries, **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 h institutional sub-sectors, $\mathbf{v}^{si}$(x) (Primary distribution of income). Value added by institutional sectors is then redistributed among them through taxation to generate disposable incomes by the s sectors, **y**(x) (Secondary distribution of income). Finally disposable income will generate final demand by sectors which will be transformed into final demand by I-O industries, **f**(x) (final demand formation).

The extended output-income loop emerging allows for an extension of the study of the propagation phenomena in the field of policy modelling. We can choose, in fact, on which flow variable to act with a shock, recognizing the role policy instrument, and on which variable to observe the effects, recognizing to this variable the role of objective. The direct, indirect and income induced changes in total output, $\Delta\mathbf{x}$, the policy objective, generated by change in final demand, $\Delta\mathbf{f}$**,** the policy control, will be given by (Ciaschini and Socci, 2006):

$$\Delta\mathbf{x} = \mathbf{R}\cdot\Delta\mathbf{f} \tag{1}$$

with

$$\mathbf{R} = [\mathbf{I} - (\mathbf{A} - \mathbf{A}^m) - (\mathbf{F} - \mathbf{F}^m)\cdot(\mathbf{I} + \mathbf{T})\cdot\mathbf{P}\cdot\mathbf{V}\cdot\mathbf{L}]^{-1} \tag{2}$$

where **A** is intermediate coefficients domestic matrix and $\mathbf{A}^m$ intermediate coefficients imports matrix; **L** is a diagonal matrix whose elements give the constant residual shares of value added by industry; **V** is the structural matrix of value added components; **P** is a matrix constant shares of value added by factor attributed to the institutional sectors; **T** represents a matrix of the net income transfers shares among institutional sub-sector.

F and $\mathbf{F}^m$ are two matrices (domestic and import) of the constant shares for final demand formation, obtained as $\mathbf{F}=\mathbf{F}^0+\mathbf{K}$, where $\mathbf{F}^0= \mathbf{F}^1\cdot\mathbf{C}$ and $\mathbf{F}^1$ represents the consumption demand of the commodity produced by each industry as a constant share of the consumption expenditure of the institutional sectors; diagonal matrix C represents the consumption propensities by institutional sector that transforms the consumption expenditure by institutional sectors into consumption by industries. Finally matrix **K** represents the investment demand and is given by $\mathbf{K}=\mathbf{K}1\cdot s\cdot(\mathbf{I}-\mathbf{C})$ where **K**1 represents the investment demands to I-O industry as a share of investment expenditures by institutional sectors, scalar s represents the share of private savings which is transformed into investment i.e. “active savings”.

The **R** matrix, equation 2, provides a set of disaggregated multipliers that are recognized to be the most precise and sensitive for studies of detailed economic impacts. These multipliers recognize the evidence that total impact on output will vary depending on which industries are affected by changes in final demand. The i^{th} total output multiplier measures the sum of direct and indirect input requirements needed to satisfy a unit final demand for goods produced by industry *i* (Bulmer-Thomas, 1982). Research on linkage analysis dates back to the definitions elaborated by Rasmussen of "summary measures for the inverse matrix". He noted that the sum of column elements corresponds to the total increase in output from the whole system of industries needed to match an increase in the final demand for the product of industry *j* by one unit, called backward dispersion index. Similarly the sum of row elements gives the increase in output of industry *i* required to meet a unit increase in final demand for the product of each industry. We can take the average, which represents an estimate of the (direct and indirect) increase in output to be supplied by an industry chosen at random if final demand for the products of industry *j* expands by one unit (Rasmussen, 1956). Similarly can be regarded as the average increase in output to be supplied by industry *i* if the final demand for the products of an industry chosen at random is increased by one unit, called forward dispersion index.

4. Linkages Analysis and Policies Scenario

Matrix **R** allows performing the dispersion analysis, which is able to assess the relevance of health commodity in terms of its power in activating the production of other goods and its contribution in other production processes. [3]

The results are presented in the table 2 in the appendix. The commodities 53, 54 and 55 respectively represent HFS LHUS OHSS commodities. From the backward analysis we observe that the index values in all the instances are greater than 1, respectively, 1.02 for HFS, 1.07 for LHUS and 1.06 for OHSS. This first result leads to consider three types commodity as a “key commodities” for the economy since they have a high value of backward linkage. Observing the coefficient of variation associated to the backward index, it is also possible to identify the dispersion effect for all types of commodities. In particular it is possible to observe a coefficient of 2.26 for HFS, 2.60 for LHUS and 2.46 for OHSS. This result suggests that LHUS is a commodity that activates only few other goods and then is less important than the HFS and the OHSS.

As for the forward analysis, the values of the indexes showed in the table 2 suggest that the HFS does not appear to be relevant in this case (only 0.46). On the other side, both LHUS and OHSS have an index greater than one - 1.68 and 1.18 respectively - but looking at the associated coefficient of variation it is possible to observe that LHUS have a forward effect concentrated in a few commodities.

The same type of analysis has been carried out considering the inverse in terms of labour units without distinguishing between employees and self employment. [4] The structural matrix obtained in this case expresses the direct, indirect and induced effects in terms of labour units when a change in final demand happens. From the linkages analysis applied to this matrix, table 3 in the appendix, changes in HFS and OHSS production activate significantly the level of employment. The backward indexes in fact, are equal to 1.42 and 1.13. The further observation of the coefficient of variation suggests that the incidence is less dispersed in the case the HFS: the coefficient of variation is in fact equal to 0.07 on a *range* from 0.01 to 0.14. The coefficient of OHSS on the other side measure a greater dispersion as it is equal to 0.04 on the same *range*. For the forward index the HFS and OHSS have an index greater than one - 2.03 and 1.91 respectively. Looking at the associated coefficient of variation it can be seen that the OHSS have a high effect on the employment level, balanced in the distribution with respect to all other goods.

Besides the dispersion analysis, we decide to simulate four policies on the demand for health commodity. The results could provide some indications on the economic aspects of health good, which in many territorial contexts may be relevant.

The first policy (scenario 1) focuses on the external acquisition (in particular from private health) of the entire flow of intermediate goods that the LHUS presents as absorption from them. This operation involves a dual effect: first it causes an increase in the production of private health (+11.49%) and secondly it generates a reduction in the production of the LHUS

(-9.32%) and of the HFS (3.43%). Furthermore, the direct and indirect effects on the whole system consist of a reduction in total production (0.004%). In table 4 in appendix effects on each 60 commodities output are showed.

The second policy (scenario 2 or S_2) considers an increase of 2% of final demand from health good (HFS, LHUS and OHSS) made by the government. This increase generates direct and indirect effects on the whole system. At first, ignoring the problems of its coverage, this policy (column S2a of table 5 in appendix) we show that the increase in final demand determines an increased of production and value added of the HFS and LHUS respectively 3.89% and 3.03%. The positive effect is extended to all other commodity, particularly for those who have strong links with health good. In the second column (called in the table 5 S2b in the appendix) is considered a possible policy that includes coverage by reducing final consumption of public good, "Public Administration, defence and compulsory social security" (commodity 51). The effects in this case show a smaller increase of total production of health which is associated with a redistribution to support products related to health, the Gross Domestic Product is unchanged. The increase due to the stimulus of final demand for health services is almost entirely counterbalanced by the reduction of public spending.

In the third column (S2c) of table 5 in appendix, the total amount of resources for increasing the demand for health care is covered by reducing the disposable income of Households. In this case the effect on production is broader compared to coverage made by cutting expenditure for final consumption. In addition a positive effect on GDP (+0.08%) is observed.

5. Conclusions

The paper proposes a different approach to analyse the impact of the health commodity on the main macroeconomic aggregates within the economy as a whole. By means of the I-O table for the year 2000 for the Italian economy and Social Accounting Matrix we implement the multisectoral extended model in order to evaluate how the health care commodity is connected with the production of other commodities and the institutional sectors (Households, Firms, Government). Since the supply of the health care services is widespread in the national area, the multisector model, in fact, is able to emphasise the contribution of these commodities to the value added generation by each commodity, to the primary factors remuneration, to the income of each Institutional Sectors and to the level of employment. The linkages analysis shows that the backward indexes for the three categories of health commodity are significant and thus greater than 1- 1.02 for HFS, 1.07 for LHUS and 1.06 for OHSS. These preliminary results show that these categories of health commodity represent "key commodities" for the economy since they have strong linkage with the backward production process. The coefficients of variation for backward indexes - 2.26 for HFS, 2.60 FOR LHUS and 2.46 for OHSS - suggest a major relevance of the LHUS on the other activity production since it has the highest coefficient. This means than LHUS production concentrate only on a small number of commodities. A different conclusion can be achieved by observing the forward indexes. These suggest that HFS are not significantly activated by the other productions instead of the LHUS and OHSS that show higher indexes (greater than 1). In this case, the LHUS manifests a forward effect on the production of few commodities. Furthermore, the extended multisector model allows verifying the impact on the economy of two policies oriented to health care services. The first considers a variation of the production structure of LHUS. The intermediate goods absorbed on the LHUS production process moved to the production of OHSS. The second policy proposes an increase on final demand of health commodity without any public or private coverage, in order to determine the effects on the income.

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Notes:

[1] The classification we propose is consistent with the existing organization in the Italian system.

[2] The initial symmetric IO table (Commodity by Commodity) has a disaggregation of 58 commodities. The IO classification as shows in table 1 in appendix.

[3] The inverse matrix of the model can be asked to the authors.

[4] The matrix R has been pre-multiplied by a diagonal matrix which has on the principal diagonal the requirements of labour per unit of product.