COSTS, PRICES AND MARK-UP INDICATORS IN THE ITALIAN NATIONAL ACCOUNTS SYSTEM

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Abstract

This paper discusses the Italian method of estimating quarterly costs, input-output prices and mark-up indicators by industry. The methodology refers to the ESA95 National Accounts System, furnishing a consistent framework for the various flows underlying the indicators. ISTAT has particular experience in the gross computation of such measures where intra-sector transactions are taken into account. A net computation has never been considered to date because a system for the annual revision of the input-output tables has only recently been developed. Such revision has been made possible by considering the information available on external and commercial trade statistics for flows with the rest of the world, and the output estimates for the intermediate uses table. These tables are computed at both current and constant prices, at the same time allowing evaluation of deflators and intermediate unit costs for both domestic and foreign components. Finally, the quarterly measures are obtained by distributing the annual flows through application of the Chow-Lin methodology using price and current indicators derived by the quarterly system of accounts.

Keywords: National Accounts, price indexes, input-output tables, net measures, intra-sector transactions, unit costs, mark-up, productivity measures, temporal disaggregation.

1. Introduction

Costs, input-output prices and mark-up are key economic indicators in most countries. Accordingly, methodological advance in their computation is one of the main goals pursued by national accountants. This paper outlines the procedure employed in Italy to set up these indicators, a procedure that has traditionally relied on application of methods and sources based on National Accounts systems. In this regard, all the various aspects related to annual and quarterly estimates of the new procedure will be taken into account.

A wide range of approaches can be used to measure costs, input-output prices and mark-up. The procedure recently developed by ISTAT (Pisani, 2001) is based on the net computation of output, which represents the output of the vertically integrated economic sectors as defined by Pasinetti (1973). For the purposes of net computation, the expenditures on intermediate inputs within the same sector of economic activity are not taken into account. It therefore becomes a measure of production, which lies conceptually between gross output and value added.

Net output differs from gross *output* because it excludes the intermediate input purchases within the same sector of economic activity (intra-sector input). Moreover, it also differs from value added because it includes the intermediate inputs purchased outside the sector (extra-sector input).

Measurement of net output depends on the definition of economic sector used, and it is liable to change according to the different boundaries drawn among sectors. For example, if the total economy is considered to be a unitary sector of economic activity, net output includes only the intermediate inputs represented by imports.

The system for decomposing prices allows evaluation of prices for net output, and consequently the deflator of extra-sector inputs. This is crucial for the purposes of economic analysis, since it shows whether inflation pressure has originated within the same sector of economic activity or has been caused by an external one.

Although its importance has been widely recognized (cf., for example, IMF, 2002), net computation, mainly for prices costs and productivity indicators, has been implemented only by the US Bureau of Labour Statistics (1997) and the UK Office for National Statistics. However, to encourage adoption of this procedure, the statistics office of the European Community (Eurostat, 2001) has recently suggested that all member Countries should introduce input-output price indicators with large detail for origin and destination markets.

Input prices measure the prices of products that are purchased for use in the production process, whereas output prices measure the price of products as sold to subsequent links in the production chain (e.g. to another production enterprise). In the Italian system, both input and output prices are split into domestic and foreign components: the former are divided between prices for imports used in the production process (e.g. imported crude oil) and prices for the intermediate

consumption of domestic commodities; the latter between prices for sales to the domestic market and prices for exports. All these indicators are net measures, since intra-sector transactions have been removed from them.

Output prices measure the price change that takes place in a country, providing a direct measure of inflation. At the same time, since it is also an input through the production process, this indicator can be taken as a measure of potential inflation in subsequent stages of production. Input prices measure potential inflation by capturing the price pressures on producers.

Input prices are among the components of non-labor expenditure which producers must undertake, the most important of them being labor costs. In this regard, we shall briefly discuss the problems related to the unit measure of these expenditures and how to obtain the mark-up indicator.

The paper is organized as follows: in section 2 we give a overview of the Italian National Accounts System; section 3 describes the procedure followed to split-up input-output matrices. Section 4 presents the notation for net computation. Section 5 explains sources and methods for quarterly estimates, section 6 reports the main indicators realized. Finally, some concluding remarks are made in section 7.

2. The Italian National Accounts System

The most recent revision of the Italian National Accounts has followed the European System of National Accounts ESA95, which in turn extends the System of National Accounts SNA93. It is based on the input-output table for the year 1992, which represents the benchmark for all the new estimates. This matrix has been constructed at a very detailed level, distinguishing 101 industries.

For 1992 a new calculation of the aggregates was carried out using all the available sources, census included. Both the demand- and the supply-side estimates were based on independent approaches, balanced in a symmetric input-output matrix to gain coherence among all the estimates (Mantegazza and Pisani 2000). The estimate of compensation of employees was based on the income-side estimates that, however, is not fully independent from the demand and supply-side approaches.

Briefly, the flows of an input-output table can be represented by the following identities:

$$USES_i = IU_i + FC_i + INV_i + EXP_i + CHI_i, \quad (1)$$

$$RES_j = CO_j + VA_j + MG_j + IMP_j, \quad (2)$$

$$USES_i = RES_j, \quad \text{for } i = j \quad (3)$$

where, for the *i-th* or *j-th* industry, $i, j = 1,..., n$, *RES* denotes the total resources, *CO* the total non-labor costs, *VA* the value added, *MG* the trade and transport margins and *IMP* the imports. In equation (2) the *USES* are given by the sum of total intermediate uses *IU*, final consumption *FC* (households, non-profit institutions serving households NPISHs and General Government), investments *INV*, exports *EXP* and changes of inventories *CHI*. Equation (3) represents the identity between resources and uses for each industry. Note that with this notation the output denoted hereafter by *PR* is given by $CO + VA$.

In other terms, symmetric input-output tables can be represented by three sections: in the first section, intermediate uses are organized within a square matrix where all the inputs are linked with each other and describe the overall circular flow of goods and services within the production process. We denote this $(n \times n)$ matrix as *INT*, i.e. table of intermediate input, with its generic element given by INT_{ij}, for $i,j = 1,..., n$.

From a row-perspective, the entries of the matrix *INT* represent the flows of goods and services from the production industry to the uses within the accounting period. By column, the same flows represent the costs of purchasing commodities produced by all the industries and consumed in the production process of the given column.

The definitions for total intermediate uses *IU* and total inputs *CO* considered in equations (1) and (2) can be derived directly by aggregating the flows of *INT* by row and column respectively, so that:

$$CO = \sum_j INT_{ij}, \quad (4)$$

$$IU = \sum_i INT_{ij}. \quad (5)$$

The second section of the input-output matrix of equation (1) shows the final uses of products within the economy, illustrating direct links between the products and final demand categories: final consumption (*FC*), fixed capital formation (*INV*), exports and change in inventories. Finally, the primary costs of equation (2) are considered in the third section, i.e. the matrix of primary inputs.

In the benchmark year, a full set of input-output tables was implemented, including the split of the matrix of intermediate uses into domestic and import flows. These matrices are denoted here as *INTdom* and *INTimp* respectively, and their sum gives the matrix *INT* as follows:

$$INT = INTdom + INTimp. \quad (6)$$

Statistical sources for the input-output table are the business survey for estimating costs, value added and investments; external trade statistics and balance of payment for imports and exports; households budget survey for final consumption and balance sheets of the public sector for general government expenditure. Moreover, for 1992, a special survey on non-labor costs by product within the enterprise system was carried out by ISTAT: these data allowed estimation of intermediate uses as a whole.

The same system of input-output tables was used to distinguish domestic market output from exports output. In this respect the following equation holds for each industry:

$$PR = PRdom + PRexp \quad (7)$$

where *PRdom* defines the vector of domestic output by industry and *PRexp* the correspondent exports output.

3. Splitting up input-output matrices

From the benchmark onwards, the practice for current estimates consists in extrapolating the flows of the input-output table referred to that year. The most reliable sources enable direct estimation of the flows for final uses and primary inputs only, whereas detailed data on intermediate inputs are generally not available. However, national accounts estimates for total non-labor inputs by industry are in fact computed through the data of the business survey. This allows the indirect extrapolation of all the flows related to the matrix of intermediate uses by applying the changes in non-labor costs to the columns of *INT*. Of course, this procedure is significant under the hypothesis that current estimates for intermediate inputs maintain the structure defined for the benchmark over time.

The extrapolation is carried out by industry, and the first estimates for all the aggregates from the supply and the demand sides are subsequently balanced into an input-output table by applying the usual Stone procedure (Stone, 1990). As a result, a current estimate for all the intermediate inputs of the matrix *INT* is obtained indirectly. This estimate is coherent with both primary inputs and final uses for which a direct source was available. The advantage is that both direct and indirect estimates are fully integrated within the same accounting system.

For current estimates of both import and domestic components of intermediate inputs an ex-post procedure is applied. The first component, i.e. *INTimp*, is evaluated using the information from the external trade statistics. In particular the procedure updates the flows of each row of *INTimp* referred to the benchmark through the statistics on current imports. On the other hand, the rows of the domestic component *INTdom* are extrapolated by applying the changes of a composite indicator derived from the national accounts aggregates. This is obtained by multiplying the quantity index derived from the output at constant prices by the domestic output deflator. Finally, in order to gain coherence among estimates, the resulting components *INTimp* and *INTdom* are balanced with the totals of *INT* following a proportional criterion.

Constant estimates for the intermediate uses table *INT* are made by separate deflation of its domestic and import components: the domestic input matrix *INTdom* is deflated through the same producer price index previously adopted for current extrapolation, whereas the import matrix *INTimp* is deflated through the import price index derived from the external trade statistics.

Current estimates for both domestic and export components of output, *PRdom* and *PRexp* respectively, follow an ex-post procedure. In particular, the benchmark related to *PRexp* is extrapolated for each industry through the indicators on current exports provided by the external trade statistics and the flows of commodities with the rest of the world. On the other hand, the estimates for the domestic market output *PRdom* are obtained by subtracting *PRexp* from the total output *PR*.

The resulting series for the output components at current prices are deflated separately by considering the same price indexes for domestic and export output as the total output deflator.

4. Net computation for annual figures

Many advantages derive from the input-output environment as defined in previous sections. In fact, a full set of aggregates at current and constant prices has been available for the last 10 years. Moreover, considering that the implementation has been carried out for a large set of industries, it is possible to set up several measures for unit costs, input-output prices and mark-up.

As regards the net computation of non-labor expenditures, i.e. the measures for which intra-sector inputs *COdis* are removed from total domestic inputs *COdom*, we have the following identity:

$$COdom = COdis + COdes, \quad (8)$$

where the remaining part *COdes* consists in the extra-sector component for domestic inputs.

Like the intermediate uses of equation (6), the domestic inputs *COdom* are related to the totals *CO* by:

$$CO = COdom + COimp, \quad (9)$$

where *COimp* represents the costs due to the imports. The net measure of total costs is thus:

$$COes = COdes + COimp. \quad (10)$$

The net computation of the output concerns the domestic component, for which the net measure, i.e. *PRdes*, is defined by subtracting the intra-sector costs *COdis* from the gross measure *PRdom*:

$$PRdes = PRdom - COdis \quad (11)$$

Therefore, the net measure of total output, here denoted by *PRnet*, is given by summing *PRdes* to the exported component *PRexp*:

$$PRnet = PRdes + PRexp \quad (12)$$

5. Quarterly estimates

Net computations of costs, input-output prices and mark-up at quarterly frequency are fully integrated with quarterly national accounts (QNA). On the supply side, QNA are computed for gross estimates of output, intermediate consumption and value added at both current and constant prices. A breakdown for 33 industries and 5 types of producers is available; both seasonally adjusted and unadjusted measures are available as well.

QNA are compiled using an indirect approach. In fact, QNA unknown series are mostly derived by applying to the (known) quarterly stochastic and/or deterministic indicators the estimated coefficients of the annual econometric relationships between the (known) values of the series to be disaggregated and the historical indicators. The methodology adopted is based on the work by Chow and Lin (1971) and it is the one currently used for distribution, interpolation and extrapolation (i.e. for quarters subsequent to the last known value of the annual series) of the base series.

5.1 The quarterly input-output price indicators

The double deflation approach is used to estimate value added at constant prices. In this regard a quarterly system of input-output price indicators (IOP) is implemented using sources from relevant monthly price-indexes compiled by Istat. This system largely follows the same rules as the annual IOP system (Picozzi, 1990), with minor adjustments when fewer sources are available at short term.

The IOP system at time *t* consists in 4 basic price-indexes: the vector of domestic producer price index by industry $Pprd_t$, the corresponding index for intermediate uses $Pint_t$ and the vectors of import and export price indexes by industry $Pexp_t$ and $Pimp_t$ respectively. These indexes are used to compute the gross output price indicator, which for the *ith*-industry at time *t* is:

$$PO_{it} = (PRdom_i/PR_i)\cdot Pprd_{it} + (PRexp_i/PR_i)\cdot Pexp_{it}; \quad (13)$$

and the indicator by industry of gross input price PI_t, which is given by:

$$PI_t = diag(CO)^{-1}\,(INTdom'\cdot Pint_t + INTimp'\cdot Pimp_t), \quad (14)$$

where standard matrix notation has been considered in equation (14).

Note that when the initial breakdown of *n* industries must be aggregated into *m* sectors, with $m<n$, equation (14) can still be applied to evaluate the input price indicator. In this respect the flows of *INTdom* and *INTimp* are aggregated by column, i.e. considering the flows of *m* intermediate inputs by the original *n* industries; the resulting rectangular matrices are pre-multiplied by the inverse of the sectoral costs *CO*, which are obtained by aggregating the original costs by industry into the given sectors.

Both the gross domestic and import components of the input price indicator by industry, $PIdom_t$ and $PIimp_t$ respectively, can be obtained by:

$$PIdom_t = diag(COdom)^{-1}\,INTdom'\cdot Pint_t \quad (15)$$

$$PIimp_t = diag(COimp)^{-1}\,INTimp'\cdot Pimp_t \quad (16)$$

where the same exceptions as considered for the indicator of the total input price apply when a sectoral measure is required. On the other hand, domestic and export components of the output price by industry correspond to $Pprd_t$ and $Pexp_t$ respectively, whereas their sectoral counterparts are obtained by a simple weighted average.

Net computation of input-output prices requires a measure of the effect of intra-sector transactions on the domestic component of the input price. When basic information on prices is available at a level of *n* industries, the intra-sector effect on *m* sectors, $m<n$, can be evaluated by the following expression:

$$PIdis_t = diag(COdis)^{-1}\,INTdis'\cdot Pint_t \quad (17)$$

where *INTdis* is a block diagonal matrix of the same dimension of *INT* but with positive values only in the

intra-sector blocks; all the other terms of *INTdis* are zeros.

5.2 The net estimates at current and constant prices

The indexes PO_t and PI_t are closely related to the implicit annual deflators because the sources and definitions used for their compilation are mostly the same. Hence, the two quarterly indicators can be significantly used in the procedure for temporal disaggregation of the annual input and output deflators.

In order to obtain net input-output measures at current and constant prices use is made of both the gross QNA figures and the indicators from the IOP system, after these have been seasonally adjusted. The strategy followed considers firstly the disaggregation of current aggregates and then deflators.

With respect to current output estimates, the relevant gross QNA figures (*PR*) have been used to obtain both the net output (*PRnet*) and its domestic component (*PRdom*). In order to disaggregate the current gross domestic input (*COdom*), the QNA estimates of input (*CO*) have been considered. Note that the indirect approach followed for these aggregates derives from the close correlation between the annual figures implied in the disaggregation procedure.

All the other current estimates are determined by difference. In particular, the difference between gross and net output, i.e. *PR-PRnet*, determines the domestic intra-sector input *Codis*, and the one between gross and domestic output, i.e. *PR-PRdom*, determines the exported output *PRexp*; subtracting the intra-sector input from the domestic estimates of output, *PRdom-COdis*, yields the domestic net estimates of output *PRdes*; the difference between gross and domestic input, *CO-COdom*, gives the import input *COimp*, whereas the difference between gross and intra-sector input, *CO-COdis*, yields the measure of extra-sector input *COes*; finally, the difference between this last measure and import input, *COes-COimp*, gives the domestic extra-sector input *COdes*.

Constant quarterly measures have been computed by deflation of current figures using implicit input-output QNA deflators and 3 indicators from the IOP system. These indexes are given by the export component of output price *Pexp*, the gross domestic input price *PIdom* of equation (15) and its intra-sector *PIdis* component.

Disaggregation of both the annual export output deflator and the domestic intra-sector input deflator by the price indicators *Pexp* and *PIdis* respectively, yields first the quarterly deflators and then the corresponding constant measures of *PRexp* and *COdis*. These measures, together with the gross output *PR* derived by the QNA constant estimates, allow computation of net output (*PRnet*), gross output (*PRdom*) and extra-sector domestic components (*PRdes*) applying the identities for output defined by equations (7), (11) and (12).

6. The realized indicators

The estimates provided in the present paper refer to the overall business sector. Consequently, all non-business activities as well as the rents of owner-occupied dwellings are excluded. Calculations have been obtained for five macro-sectors of economic activity: agriculture, energy, manufacturing, construction, and market services without General Government services. The resulting indicators regard the following series: *1*) both input prices and unit non-labor costs split into domestic and import components; *2*) unit labor costs, making use of the QNA estimates of compensation of employees; *3*) implicit output price deflator, with the distinction between domestic and export components; *4*) some specific components of the input deflator given by the imported energy component and the domestic service market.

We obtain the unit costs (*CU*) and the mark-up (μ) within this set of quarterly measures. The first measure is the ratio of compensation of employees (*COw*) and extra-sector inputs (*COes*) to real net output ($PRnet_k$), i.e. the costs necessary to produce an additional unit:

$$CU=(COw+COes)/PRnet_k \qquad (18)$$

The unit costs by sector of economic activity are important indicators, in order to identify the sources of output price change among the cost components of output (labor and non-labor costs)] for imported or domestic inputs) and to analyze changes in the industry-cost structure.

The mark-up is defined as follows:

$$1+\mu= PRnet_d/CO \qquad (19)$$

where $PRnet_d$ is the net output deflator and *CO* is the unit cost indicator previously defined.

The mark-up highlights the gross margins by sector, which represent the portion of gross margins retained by the sector after paying the variable costs.

In particular, annual series, quarterly series, and related indicators are revised every year in order to incorporate the most recent revisions and the available information. Furthermore, quarterly estimates are revised at the end of the fourth quarter, when the annual estimates become available.

7. Conclusions

Efforts to improve the cost, prices, and mark-up indicators presented in previous sections entail improvements in the measurement of productivity, since these quarterly indicators analyze the short-run relationship among output, employment and compensation of employees.

It should be pointed out that the new indicators used in the Italian national accounts system are *experimental* in nature; they are still being tested, and are not yet published on a regular basis, yet. As a consequence, they must be treated with caution, given that they may be highly volatile, subject to revision and to some extent unreliable for inferring long-run trends.

Significant progress has already been achieved in implementation of these indicators. In effect, efforts to improve the estimation method have resulted in significant improvements in the way that the Italian National Accounts system deals with the measurement of quarterly costs, input-output prices and mark-up indicators at the industry level.

For the first time in Italy a systematic set has been considered for costs, input-output prices and mark-up indicators implying net measures of output.

The approach is original with respect to the method used by BLS and ONS for the US and UK respectively, although it complies with the guidelines recently issued by Eurostat for these indicators.

As this method is based on National Account estimates, it offers the advantage that indicators consistent with the main macroeconomic measures can be performed. Moreover, for the first time a wide range of indicators have been computed taking into account of the decomposition for origin and destination market.

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