A new index of production for the construction sector based on input data

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Abstract

The need for a complete set of timely short-term business statistics has urged Istat to build new indicators, above all for market services and construction. In this paper we develop a new methodology for compiling the monthly production index for the construction sector based on administrative sources and information already available from Istat survey. Given the well-known difficulties in measuring the output of this sector an indirect approach has been followed estimating the production as a linear combination of inputs. The ordinary hours worked are drawn from Cassa Edile register whereas raw materials index is obtained as a composite indicator aggregating turnover of building products. The weights are calculated estimating a production function on a cross-section of balance sheets micro-data. This methodology represents a substantial improvement in terms of timeliness, without increasing the statistical burden on enterprises. Moreover, the combination of short-term information coming from different sources guarantees more stable estimates and a better coverage of all construction activities, including maintenance and repair works.

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Riassunto

L'esigenza di migliorare la tempestività ed il grado di copertura delle statistiche congiunturali, ha spinto l'Istat allo studio di nuovi indicatori, soprattutto per il settore dei servizi e delle costruzioni. In questo lavoro viene sviluppata una metodologia per il calcolo di un indice mensile della produzione nel settore delle costruzioni basato su dati amministrativi ed informazioni disponibili da altre indagini Istat. Date le difficoltà di misurazione diretta dell'output delle costruzioni si propone la sua stima indiretta attraverso una combinazione lineare degli input del settore. Le fonti utilizzate per l'aggiornamento degli input sono l'archivio Casse Edili per le ore lavorate ordinarie e l'indagine mensile Istat sul fatturato per il calcolo di un indicatore sintetico dei prodotti afferenti il settore delle costruzioni quali proxy dell'acquisto di materie prime. I pesi sono ottenuti dalla stima di una funzione di produzione utilizzando i microdati relativi ai bilanci di un campione di imprese delle costruzioni. Questa metodologia consente un netto miglioramento nella tempestività delle informazioni congiunturali non aumentando al contempo il carico statistico sulle imprese. Inoltre, la combinazione di informazioni congiunturali provenienti da fonti diverse garantisce una maggiore stabilità delle stime della produzione ed una migliore copertura dell'output del settore, incluse le attività di ristrutturazione.

Keywords:

short-term statistics, production function estimation, administrative data.

1 Introduction

After the establishment of the monetary union, growing attention has been paid by economic Institutions and policy makers to the availability, comparability and timeliness of European short-term business statistics. This had implied a harmonization process for short term indicators within the EU countries.

For nearly 20 years business statistics concerning the construction sector have been based on the Council Directive 78/166/EEC of 13 February 1978. In May 1998 this Directive was revised substantially by the 'Council Regulation n.1165/98 for short term statistics' (henceforth STS Regulation). Two years later the European Commission, in cooperation with the European Central Bank, prepared the 'Action Plan on Emu statistical Requirements', which contains a more demanding agenda in this field for Member States. The main changes are the reduction of derogations to the implementation of the STS regulation and a substantial improvement in terms of data coverage and timeliness. For the construction sector, in particular, the Action Plan envisages the release of the quarterly production index with a delay of 60 days starting from the IVth quarter of 2001.

At present, the Italian index is estimated on the basis of public works and building permits and is released 180 days after the reference quarter. Therefore, excessive delay and incomplete coverage (in fact, maintenance is excluded) are the main limitations of the current index.

In order to meet the Action Plan requirements a new methodology has been explored: more precisely an indirect estimation of the monthly production index has been performed through a linear combination of hours worked by manual workers and turnover of products used as input in the production process of the construction sector. The weights are calculated estimating a production function on cross-section data taken from Istat 'System of the Enterprises Accounts' an Annual Survey about all Italian enterprises.

In the context of current approaches to the compilation of European short-term business statistics[1] this methodology generalizes the use of input indicators as a proxy for the output and provide empirical evidence for the micro-foundation of this relationship. Moreover, input data need not be collected organizing a new survey, as they can be taken from administra-

[1]See Eurostat, 'Short-Term Business Statistics, National methodologies for the construction sector'.

tive sources (Casse edili register) or from other information already available (current survey on industrial turnover and national accounts). Therefore this framework does not imply additional statistical burden on enterprises.

The new indicator of production (NIPC) refers to the whole activity of the construction sector. The release time is 60 days from the reference quarter, according with the request of the Action Plan. Moreover, once the new methodology will be fully implemented, it will be possible to disseminate the NIPC on a monthly basis.

The remainder of this paper is organized as follows. In section 2 the methodology is described in detail, with regard both to the estimation procedures of the production function (paragraph 2.1) and to the input indicator characteristics (paragraph 2.2). In section 3 the new index is calculated together with the working day adjusted and seasonally adjusted series; moreover, a comparison is carried out with the current production index. The final section contains some concluding remarks.

2 The methodology

The delay in the publication of the quarterly production index of the construction sector cannot be significantly reduced in the framework of the current survey, even with a closer monitoring of the data collection system. Therefore the need of a timely indicator has urged Istat to find a new methodology. The well-known difficulties in organizing a new survey, linked to the peculiar features of the sector (high proportion of small size companies, high birth and death rate of firms, substantial share of them operating in the 'black economy', wide heterogeneity of products made and frequent use of subcontracting), and the availability of short-term indicators of the input used in the production process, have pushed towards the exploration of an indirect estimation procedure of output.

The first step in the calculation of the new index of production in construction (NIPC) is the estimation of a production function between input indicators (hours worked, raw materials purchased and technical fixed assets) and output. The parameters of this relationship are estimated using data from Istat 'System of the Enterprises accounts' referring to 1997 for a sample of construction firms.

In the second step, the estimated coefficients are used to weight the dynamics of the monthly input indicators. Following this procedure a quarterly

time series of the NIPC, starting from the first quarter of 1995, has been obtained. The sources and the variables used in this work are the following:

- Casse edili register, for monthly data on ordinary hours worked by manual workers and trainees;
- Istat monthly survey on turnover and orders, for a composite indicator of raw materials used in the construction sector;
- The national accounts, for the estimate of the capital stocks.

2.1 The estimation of the production function

2.1.1 Data Source

Annually Istat collects data on the balance sheets of private companies by means of two surveys: the survey on the account system of firms (SCI) and the survey on small and medium size firms (PI). In 1997 the former was based on a census of the businesses with 20 employees or more and the latter on a sample collection of the firms with less than 20 employees[2].

Table 1: Distribution of SCI and PI firms according to NACE group

NACE		Surveyed		Selected	
Code	Description	Number	%	Number	%
45.1	Site preparation	172	2.9	105	3.1
45.2	Building of compl...; c. eng.	3,700	63,1	2,319	67.6
45.3	Building installation	988	16.9	745	21.7
45.4	Building completion	963	16.4	256	7.5
45.5	Renting of constr. or demolition,...	38	0.6	6	0.2
Total		5,861	100	3,431	100

In particular, the two surveys gathered information on $5,861$ firms belonging to the construction sector. The distribution of these companies according to the kind of business (Table 1) and to the size (Table 2) shows a large majority of small and medium size firms and a high proportion of them belonging to the sector of 'Building of Complete Constructions or Parts Thereof; civil engineering'.

[2]In 1998 the threshold between the two surveys has changed from 20 to 100 employees.

Table 2: Distribution of SCI and PI firms according to number of employees

Class of employed	Surveyed		Selected	
	Number	Percentage	Number	Percentage
≤ 1	1,610	27.4	-	-
$2 \leq$ employees ≤ 19	1,998	34.1	1,287	37.5
$20 \leq$ employees ≤ 49	1,648	28.1	1,557	45.4
$50 \leq$ employees ≤ 99	402	6.9	393	11.5
$100 \leq$ employees ≤ 249	141	2.4	135	3.9
employees $\geqslant 250$	62	1.1	59	1.7
Total	5,861	100	3,431	100

In estimating the production function, however, it was not possible to use the information on all the 5,861 firms. A large part of them (27.4%) has only one person employed (the owner) and consequently the PI survey does not provide any information on the amount of hours worked.

Moreover, as the production equation is estimated considering a logarithmic transformation, it is not possible to use data of firms for which one of the relevant variables (value added, purchase of raw materials, etc.) is equal or less than one unit.

Table 3 shows in detail the selection procedure. The distributions of the selected enterprises by business type and size are shown in the last two columns of Table 1 and 2. With respect to the original sample, the selected group of enterprises contains a bigger proportion of medium size firms and a higher share of companies belonging to NACE groups 45.2 and 45.3.

Table 3: Selection procedure of the enterprises

Surveyed enterprises	5,861
Enterprises with employed ≤ 1	1,610
Hours worked ≤ 1	547
Value added ≤ 1	47
Turnover ≤ 1	7
Raw materials ≤ 1	105
Net capital≤ 1	114
Selected enterprises	3,431

2.1.2 Functional form and output variables

The estimation of the production function has been performed through a Cobb-Douglas type specification calculated in logarithms:

$$\log Y_i = \beta_0 + \beta_1 \log H_i + \beta_2 \log K_i + \beta_3 \log M_i + \epsilon_i \quad (1)$$

where H is the amount of worked hours, K the value of tangible fixed assets and M the value of intermediate inputs of materials. The inclusion of M in the equation has a direct consequence on the choice of the output variable Y that obviously cannot be represented by the value added.

In particular, it is possible to consider three different definitions of the output variable analysing the single items of profit and loss accounts (Table 4).

The first one is the gross turnover (**turnover**) that provides a straightforward measure of the enterprises output. Moreover, it is possible to identify two other different measures to account for variations of the stocks (total value of production, **tvp**) and the expenses for the sub-forniture (**tvpn**). In principle, given the high share of subcontracted works on gross turnover in the building sector (29% for the enterprises with more than 20 employees), the last variable seems to be a proxy closest to the right definition.

Table 4: Production function: dependent variable selection

Total value of production (tvp)
+ gross turnover (**Turnover**)
+ increase of fixed assets for internal works
+/- variations of the stocks of finished products
+/- variations of the stocks of under processing products
+/- var. of the stocks of products bought by third parties and resold without transformation
Tvpn
+ total value of production (tvp)
- expenses for sub-furniture

Equation 1 has been estimated using the three alternative output variables previously described. The results, contained in Table 5, confirm prior ideas about the correct specification: in fact the best goodness of fit, measured by the R^2, is shown by the model with TVPN as the dependent variable.[3] The specification used in our study is therefore:

[3]Translog specifications were estimated too, but the models showed a poor fit to data.

Table 5: Estimation results

Variable	Turnover		TVP		TVPN	
	estimate	SE	estimate	SE	estimate	SE
Intercept	3.14	0.04	3.10	0.03	3.18	0.03
H	0.51	0.01	0.48	0.01	0.46	0.01
K	0.14	0.01	0.13	0.01	0.12	0.01
M	0.37	0.01	0.41	0.01	0.39	0.01
R-square	0.827		0.891		0.905	

$$\log TVPN_i = 3.18 + 0.46 \log H_i + 0.12 \log K_i + 0.39 \log M_i + \epsilon_i \qquad (2)$$

The sum of coefficient values is 0.97, quite close to the case of constant returns of scale (even if according to the F test this sum is significantly different from 1). The elasticity of output is slightly higher for worked hours (0.46) than for intermediate goods (0.39), while K play only a minor role. Equation 2 has been estimated also for each Nace group. The results in table 6 show that the sum of the coefficients for H and M is stable across the groups. Moreover, as expected, the "building installation" and the "building completion" are more labour intensive compared to "building of complete construction; civil engineering".

Table 6: Estimation results for NACE group

Variable	452		453		454-5	
	estimate	SE	estimate	SE	estimate	SE
Intercept	3.05	0.04	3.40	0.07	3.34	0.09
H	0.42	0.01	0.51	0.02	0.51	0.03
K	0.11	0.01	0.11	0.01	0.09	0.02
M	0.43	0.01	0.32	0.01	0.34	0.02
R-square	0.91		0.85		0.89	

The equation 2 could be seen as an extension of an equation including only hours worked and tangible assets as inputs. With this simplified specification, considering value-added as output, the estimated coefficient for hours worked is equal to 0.82. This is quite close to the sum of coefficient of H and M (0.85) in equation 2. So, when H and M exhibit a similar path, equation 2

reproduces the same results obtained in the equation without raw materials as input.

The advantages of having included inputs of building materials into the final equation are twofold: on the one hand, the combination of the dynamics of more than one input variable yields more stable estimates, preserving from the influence of possible outliers; on the other hand, the change in the level of activity performed by firms with no employees or operating in the "black economy" (for example in maintenance activity) are better taken into account.

2.2 Input indicators

2.2.1 Hours worked

The best cyclical indicator for labour input is the total amount of hours worked in the reference period[4].

Data on hours worked are drawn from the Casse Edili register (henceforth C.E.). C.E is a local organization, formed by trade unions and employer organizations that in each province[5] manage the allocation of employers' contributions to pay their employees for holidays and year-end bonus[6]. In order to pursue its institutional duties each local C.E. collects information every month[7] on the number of manual workers employed in their area and on the total amount of ordinary hours worked by them. Overtime hours are not collected. All the firms that have at least one construction site open in each single province have to provide monthly data on labour input to the local C.E., which gathers this kind of information together with the code of the firms. This allows the C.E. register to be matched with the ISTAT one (ASIA) in order to check for the coverage and the bias of the administrative source[8].

[4]See for example the methodology used in Germany for the IPC (Eurostat, 2002).

[5]Local C.E. are distributed according to the old administrative subdivision in 98 Italian provinces, apart from the province of Isernia for which there is no local C.E.. The firms with construction sites in Lecco and Lodi send information respectively to the Cassa Edile of Como and Milano; the firms in Crotone and Vibo Valentia provinces to the Cassa Edile of Catanzaro.

[6]See CNCE, Contratto Collettivo Nazionale di Lavoro per i dipendenti delle imprese edili ed affini , 1995

[7]Only 11% of CE collects data on a quarterly basis

[8]In Bacchini, Gennari e Iannaccone, 2001, we provide first results of this comparison.

At present, not all the 98 local C.E. are able to send to Istat the information collected within 50 days of delay from the reference period. On the basis of a previous feasibility study that checked the collaboration attitude of C.E.[9] and their relative importance, a panel of 28 C.E. was selected. According to the C.E. Census of 1996, this panel represents the 49.6% of total employment (more precisely, 268.113 manual workers and trainees out of a total number of 540.464) and the $45,6\%$ of the firms (43.332 units). Table 7 contains the 28 C.E selected and Table 8 compares the geographical distribution of the panel with the one of the universe, in terms of number of employed.

Table 7: Geographical distribution of selected C.E

North-West	North-East	Center	South	Isles
Cuneo	Bolzano	Firenze	Avellino	Messina
Asti	Pordenone	Lucca	Napoli	Palermo
Torino	Padova	Viterbo	Salerno	Sassari
Genova	Venezia	Roma	Bari	
Bergamo	Bologna		Foggia	
Brescia	Parma		Lecce	
Milano			Potenza	
			L'Aquila	

The sample coverage for the macro-area is quite satisfactory: in fact, considering North-west and North-east together, the two distributions are quite similar.

Table 8: Manual workers distribution: universe and panel

	Universe		Panel	
Area	Number	Percentage	Number	Percentage
North-west	147,245	27.2	91,281	34.0
North-east	109,303	20.2	45,245	16.9
Center	95,241	17.6	40,584	15.1
South	114,145	21.2	62,755	23.5
Isles	74,530	13.8	28,248	10.5
Total	540,464	100	268,113	100

The principal result is that small firms whose activity is related to "Building installation" are less present in the C.E. register

[9]See Bacchini e Iannaccone, 2001

Monthly time series of the hours worked for the selected C.E. have been calculated from January 1995. However, for the period January 1995 - December 1997, only 19 C.E. provided the data requested. For the period from January 1998 to June 2001, that is the period in which data are available for both subsets, the two series of index numbers for the 19 and the 28 C.E have been calculated. The correlation between both the year to year and month to month growth rate of the two indices is quite high (respectively 0,90 and 0,99). The index of the worked hours for the 28 C.E. has been then reconstructed for the period from January 1995 to December 1997 according to the evolution of the series for the 19 C.E..

Data received from each C.E. within 50 days from the reference period are just provisional because of the delay in data transmission by firms. Revisions can be provided by each C.E. in the following months, but usually after 150 days data can be considered as final. This procedure of data collection has some implications on the revision policy of the index of production (see paragraph 3.4).

The index of hours worked for the 28 C.E. from January 1995 to September 2001 with basis 1995 is shown in Figure 1.

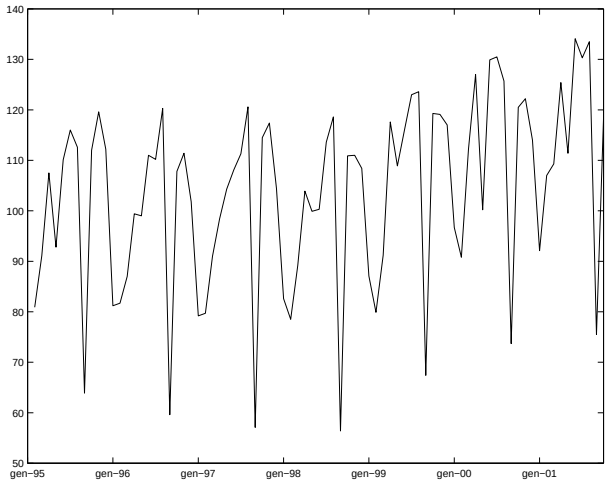

Figure 1: *Worked hours index jan.95-sept.01 - Casse edili source*

The index presents very large seasonal fluctuations with annual troughs in August and at the beginning of winter (December and January).

2.2.2 Building materials

As data on the use of raw materials in the construction process are not collected on a monthly basis, it has been necessary to identify a proxy indicator of this variable. A natural candidate is the turnover of industrial enterprises that produce and sell the typical building materials used in the construction industry. This choice implies that: i) the input material purchased are immediately used in the production process; ii) the share of imports for the goods selected is not significant. The first hypothesis seems to hold in the construction sector, where the number of small size firms is very large and the quote of maintenance works on total turnover is substantial. Moreover the share of imports for the sector selected is negligible.

Using the finest breakdown available for turnover indices (3 digit of NACE classification), at first a list of 11 groups of products was identified (table 9). In order to elaborate a composite index of the industrial turnover as a proxy

Table 9: Intermediate and capital good industries linked to construction sector: selection criteria

Branch	Group	Description	share	coeff
19	203	Man. of builders carpentry and joinery	100,0	0,0276
30	262	Man. of non-refractory ceramic goods....	46,8	0,0406
30	263	Man. of ceramic tiles and flags	100,0	0,0406
30	264	Man. of bricks, tiles and construction products	100,0	0,0406
31	265	Man. of cement, lime and plaster	100,0	0,0900
31	266	Man. of articles of concrete, plaster and cement	100,0	0,0900
34	281	Man. of structural metal products	100,0	0,0426
34	282	Man. of tanks, reservoirs and containers...	44,2	0,0426
35	286	Man. of cutlery, tools and general hardware	3,1	0,0466
35	287	Man. of other fabricated metal products	21,4	0,0466
41	313	Man. of insulated wire and cable	83,0	0,0229

of the value of raw materials used in the construction sector these steps have been carried out:

- choice of the groups among those reported in table 9;
- deflating indices of industrial turnover;
- identification of a proper weighting system in order to aggregate the selected groups.

The criteria adopted to choose the groups takes into account two types of information: activation coefficients of the input/output matrix of the Italian economy in 1992 (column *coeff* of Table 9) and the share of products in each group used exclusively in the construction sector[10] (column *share* of Table 9). The production of cement, concrete and plaster and the making of cement, concrete and plaster products are the most important inputs of the construction sector (the value of the "coeff" is for both sectors 0,0900[11] and is the highest one). Moreover, the products of these two groups are only used in the construction sector (100% in the column "share").

Similar remarks can be made for "Manufactures of ceramic tiles and flags" (263), for "Manufactures of bricks, tiles and construction products" (264), for "Manufactures of structural metal products" (281) and to some extent for "Building carpentry and joinery" (203). These six groups have all been selected to calculate the composite index. For the other groups either the activation coefficient had low values or the prevailing use of products belonging to the group was not strictly linked to the construction industry.

The quote of import for the six groups selected has been measured using the data from input/output matrix of the Italian economy in 1992. The ratio between the value of imports and the total intermediate inputs used in the construction sector is equal at most at 4.5% (for the branch "Manufactures of ceramic products").

The indices of the groups selected to compile the composite index are considered starting from January 1995 with basis 1995; they have all been deflated through the indices of the output prices.

The composite index has been calculated using two different weighting systems: for each branch, different groups have been aggregated using their weights on national turnover; different branches then, have been aggregated through the activation coefficient, standardized to 1. In Figure 2 the calculated composite index is presented; it shows very large seasonal fluctuations with troughs in August and January.

[10] According to the weights for the products used by the industrial production survey with basis 1995.

[11] Both the groups 265 and 266 have the same coefficient because they belong to the same branch and the input/output matrix adopts a less disaggregated breakdown.

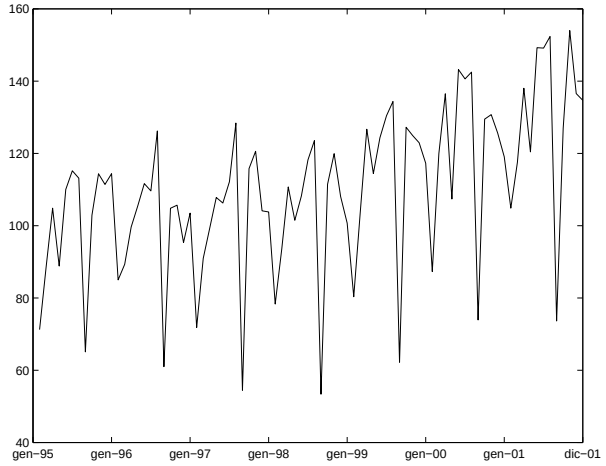

Figure 2: *Composite turnover index jan.95-dec.01 - national turnover source*

2.2.3 Capital stock

In estimating the production function, the proxy for capital input was given by the value of tangible fixed assets, gross of amortizations. Total gross capital by branch is estimated on an annual basis within the system of National Accounts: the annual growth rate of this aggregate for the period 1994-2000 (the year 2000, published in July 2001, is the latest data currently available) is presented in Table 10. Indeed, quarterly or monthly series are not available. In order to use this information to update the value of fixed as-

Table 10: Total gross capital value in the construction sector 1995 basis, billions lire

Year	Values	Var. %
1994	140,883	
1995	140,095	-0.6
1996	140,709	0.4
1997	141,685	0.7
1998	143,681	1.4
1999	146,323	1.8
2000	149,907	2.4

sets is necessary to disaggregate at a monthly frequency the annual growth

rate. The simplest hypothesis to calculate monthly data is to assume uniform growth within each year, therefore splitting up linearly over the 12 months the annual variation estimated by the National Accounts. Trends for the latest months are extrapolated from the growth rate recorded in the previous year[12]. Following this procedure the index of fixed assets with basis 1995 = 100 has been estimated (Figure 3).

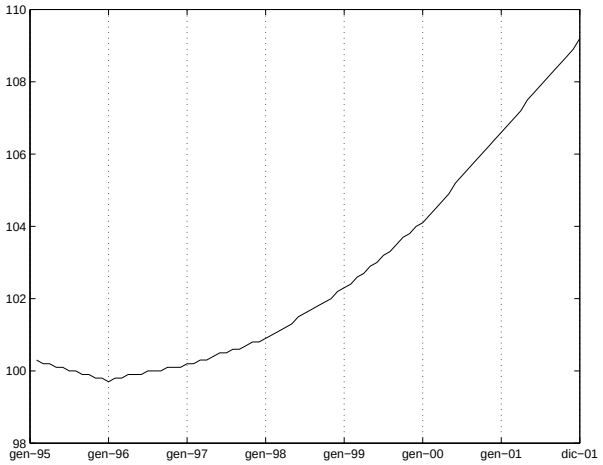

Figure 3: *Index for fixed assets jan.95-dec.01*

3 The new production index

The identification of the input series has allowed to calculate the new production index for the construction sector (NIPC) using the coefficients of the production function previously estimated. Concerning the reference period, the NIPC could be calculated on a monthly basis, as intermediate inputs and hours worked are monthly series and the fixed assets index has been interpolated with a monthly frequency. Nevertheless, if the data available within 60 days from the reference month for intermediate inputs and fixed assets can be considered as final[13], the index of hours worked is provisional as by the

[12]Revision policy of these data according to new information available are reported in paragraph 3.2

[13]The index of fixed assets is revised only when the last annual figure is published.

cut-off date the coverage of C.E. providing worked hours information is partial. At the moment, the input index is not long enough to calculate robust revision coefficients on a monthly basis; therefore only a quarterly index has been estimated.

3.1 Raw index

The data collected up to now for the 28 C.E. show negligible revisions of hours worked only after 150 days from the reference month. In particular, at the end of February 2002, all the 28 C.E. sent data for September 2001, 23 C.E. transmitted data for October 2001 and 22 C.E. sent information on November and December 2001. The index of hours worked and consequently the NIPC index for the third quarter 2001 has been calculated using the information on all the 28 C.E. For October, November and December the month-on-month growth rate of hours worked has been estimated using the best available information for the subset of C.E. that sent data regularly: this means that changes between September and October have been estimated with information dated at 120 days, changes between October and November at 90 days and changes between November and December at 60 days. In this way it is possible to minimize the impact of revisions on the estimation of the NIPC index for the fourth quarter.

In detail, the resulting plot of the NIPC for the period I.95- IV.01 is showed in Figure 4.

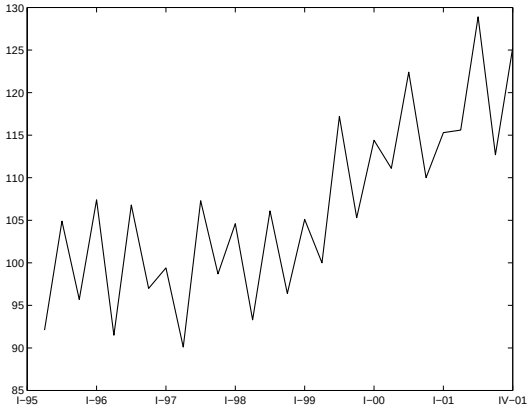

Figure 4: *NIPC, I.95-IV.01*

The annual averages and annual variations are showed in Table 11.

Table 11: NIPC annual averages 1995-2001

Year	Values	Change %
1995	100,0	
1996	98,7	-1,3
1997	100,2	1,5
1998	100,3	0,1
1999	109,2	8,9
2000	114,7	5,0
2001	120,5	5,0

In Figure 5 a comparison is made between the year-on-year growth rate of NIPC and the ones of input indices, respectively hours worked index (H) and the raw materials composite index (M). As expected, there is a strong

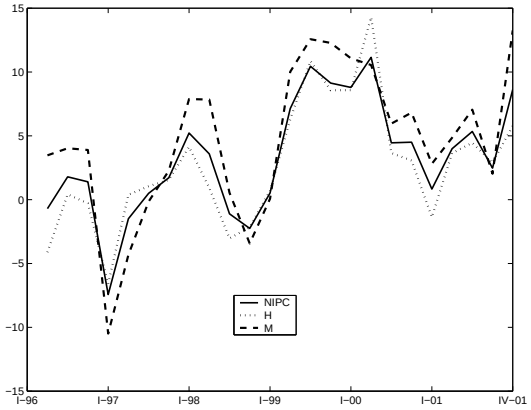

Figure 5: *NIPC, worked hours index and turnover composite index. growth rate I.96-IV.01*

concordance in the growth rates of the two input series. This results seems to confirm the hypothesis that all the raw materials purchased (or at least a constant share of them) are immediately used in the production process: otherwise there would be significant differences with respect to the cyclical evolution of the index of hours worked. Correspondingly, the introduction of raw materials as input in the production index does not produce an evolution very different from the one based only on hours worked.

It should be stressed, however, that the growth rate of the building materials index often shows a higher variability. A possible explanation is that data concerning worked hours includes only ordinary hours: as in Italy the rate of overtime to ordinary hours worked exhibits a strong pro-cyclical behaviour, ignoring overtime means that the relationship between output and labour input is dampened. Furthermore, it is possible that a systematic part of the production is not captured by the hours worked surveyed by the C.E. (e.g. firms operating in the black economy, most of the times in maintenance activity, do not transmit data on hours worked to the local C.E.).

An alternative way to analyse the evolution of input and output series is to look at the effects of the input series contributions to the total change in the raw production index (Table 12). These contributions can be calculated using the following formula:

$$\frac{Y_t - Y_{t-12}}{Y_{t-12}} = \beta_1 \frac{H_t - H_{t-12}}{Y_{t-12}} + \beta_2 \frac{K_t - K_{t-12}}{Y_{t-12}} + \beta_3 \frac{M_t - M_{t-12}}{Y_{t-12}} \qquad (3)$$

where H_t is the index of hours worked, K_t the index of capital stock and M_t the index of purchase of building materials and the betas are the coefficients of the production function. From Table 12 it is possible to observe the small contributions of K to the total growth rate and consequently the limited influence of the hypothesis made on the uniform growth of this input series.

Table 12: Component contributions to NIPC year-on-year growth rate 2000-2001

	NIPC	H	M	K
I 00	11,1	6,5	4,4	0,2
II 00	4,4	1,7	2,5	0,3
III 00	4,5	1,4	2,8	0,3
IV 00	0,8	-0,6	1.2	0,3
I 01	4,0	1,7	2,0	0,3
II 01	5,4	2,1	3,0	0,3
III 01	2,5	1,4	0,9	0,3
IV 01	8,6	2,6	5,8	0,3

3.2 Seasonal adjusted index

Given the methodology used to calculate the raw value of NIPC, two different strategies for seasonal adjustment can be implemented:

- a direct procedure, in which the seasonal component of the raw index is estimated;
- an indirect procedure, in which the NIPC seasonally adjusted is calculated as a weighted sum of the two seasonally adjusted series of hours worked and building materials.

Conforming to the seasonal adjusted policy followed by Istat (Istat, 1999), both strategies are performed applying Tramo-Seats (Gomez and Maravall, 1996).

Table 13: Seasonally adjusted NIPC: Tramo-Seats - 1995-2001

Model	(0,1,1)(0,1,1)
Easter effect	Non significative
Trading day effect	Significative
Holiday effect	Significative
Outliers	None
Parameters value	
MA1	-0,529 (0,11)
MA2	-0,438 (0,12)
Holiday	-0,014 (0,00746)
Trading Day	0,0096 (0,00095)
Test on residuals	
Normality test	0,4158
Skewness	0,1805
Kurtosis	3,12
Durbin-Watson	1,8113
Ljung-Box	17,88
Ljung-Box2	24,40

Applying the indirect procedure, an AIRLINE model has been identified for both input series, with a significant effect of working days. Similar results have been obtained with the direct strategy: that is, an AIRLINE model has been estimated for the output index corrected for the effect of working

days. The two seasonally adjusted series move together very closely: the correlation coefficient between them is equal to 0.999 for year-on-year growth rates and equal to 0.995 for month-on-month variations. Therefore in the current practice the direct strategy will be used.

In Table 13 the specification results and the main diagnostics are presented and in Figure 6 the plot of the NIPC series is shown.

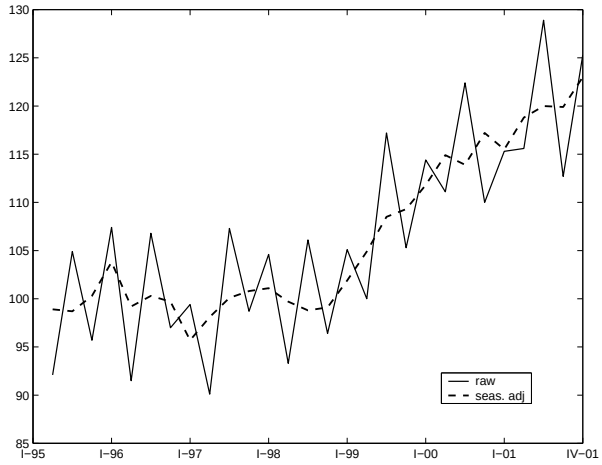

Figure 6: *NIPC: raw index and seasonally adjusted. I.95-IV.01*

3.3 The comparison with the current index of production

The main difference between NIPC and the current index of production (CIPC) is due to the degree of coverage of the construction activity. According to the Classification of Construction (henceforth CC[14]) the total activity can be split into two main groups, **building** and **civil engineering**. Moreover, from another point of view, it is possible to distinguish between **new activity** and **maintenance**.

At the moment, the NIPC refers to the total activity: in the estimation of the production function the total value of production refers to all the activity performed by a single enterprise; the input indices (worked hours,

[14]Eurostat, 1997

raw materials and stock of capital) are not distinct for building and civil engineering or for new production and maintenance. The CIPC refers only to new activity. According to the Italian national account estimation, in the year 1998 the maintenance activities accounted for 42.3% of the total production in construction.

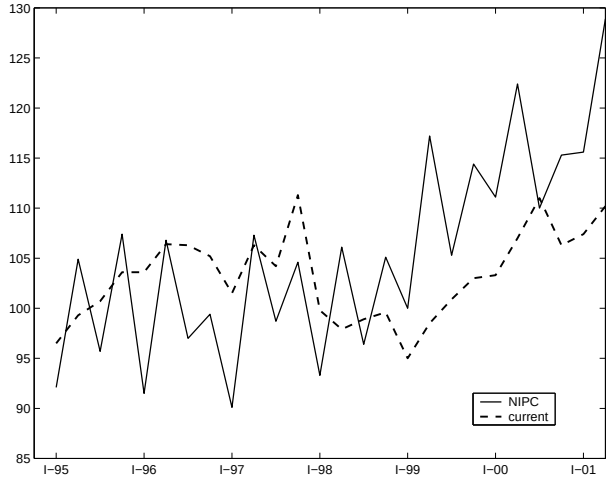

Figure 7: *NIPC and current production index (new activity) I.95-II.01*

A second difference between NIPC and CIPC regards the basic information used in the estimation of the index. Consider, for example, an enterprise constructing a building (residential or non-residential). For a reference period (month, or quarter), NIPC basic information on the construction site consists of the number of ordinary worked hours, the quantity of raw material used (cement, etc.) and the estimation of the capital stock employed. The basic information for CIPC is the building permits accorded to the firms at some earlier stage. The building permits is transformed in production using a table of the plan of production for the specified building typology[15]. Instead, for civil engineering works the elementary information used by CIPC is the amount of work carried-out, realised in the reference period and measured by total payments at current value[16].

[15]In the late '80s a survey collected information on starting and finishing time for different typology of buildings

[16]From Italian national accounts in the 1998 the share of civil engineering was 14% with respect to the total activity

Finally, the release time of NIPC is 60 days from the reference quarter while CIPC is compiled at 180 days.

The argument stressed above are not of immediate use for the interpretation of the difference in the time path between NIPC and CIPC (Figure 7).

NIPC shows a larger seasonal component compared to CIPC: the quarterly average of the building permits, started at different stage, smooths the seasonal effect of the single building permits.

The difference between the two indices is even bigger considering the growth rates (figure 8). The NIPC shows a higher growth rate in 1999, while

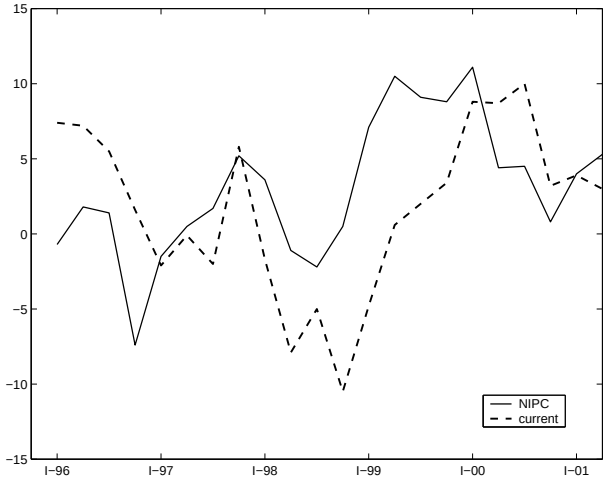

Figure 8: *NIPC and current production index (new activity) Year-on-year growth rate I.96-II.01*

the peak of the CIPC can be found in the year 2000. This evidence could be related to the dynamics of maintenance, included in NIPC but not in CIPC, that showed a growth in the period 1998-2000[17] because of the introduction of fiscal reductions for maintenance expenses undergone by families in 1998[18].

Apart from the empirical difference, the introduction of the NIPC implies a significative increasing in the coverage of the construction activity, in the quality of the basic information used and in the timeliness. However, further

[17]See Ance elaboration on Ministry of finance data, 2001

[18]law n. 449/97

development of NIPC should foresee the estimation of the production index for building and civil engineering. The Action Plan requires the index of production at 60 days only for the whole activity even if the final implementation of the STS Regulation will imply a quarterly production index at 60 days also for building and civil engineering.

3.4 Revision policy

As stressed previously, the most recent release of the new production index is provisional because of non complete coverage of data on hours worked coming from the C.E. More generally, each year the series can be revised when the latest results of SCI and PI annual surveys and the new estimation on capital stock from the National Accounts become available. Too frequent revisions, though, may create a negative impact on users. It is therefore necessary to adopt a clear revision policy scheduling over the year the release of revised series. According to the periodicity, it can envisaged:

- an annual revision;

- a quarterly revision.

The first one is carried out using new micro-data drawn from structural business statistics, to check for the development of labour productivity, and new estimations of capital stock. In this study the estimates of the production function carried out with 1997 structural data, have been controlled using 1998 data, and there is no evidence of changes in the coefficients. A new estimation with micro-data referring to 1999 data is planned for next July, when also the estimations of capital stock for year 2001 will be available. These revisions will be published at the end of August, together with the release of the second quarter.

Quarterly revisions are necessary in order to reach a complete coverage of the amount of hours worked collected by the C.E. It is only 150 days after the end of the month that these data can be considered as final. Quarterly revisions are carried out only for the data of the previous reference period, as the new release of the subsequent period is published. So, for example, at the end of May 2002 provisional estimates of the 1st quarter 2002 have been published together with the revised indexes for the last quarter of 2001.

4 Concluding remarks

In this study a methodology to calculate the new quarterly production index for the construction sector (NIPC) is proposed. The NIPC can be released with a delay of 60 days from the reference month, as requested by the Council Regulation for Short-term Statistics. The NIPC covers the whole activity of the construction sector and, in particular, it includes repair, maintenance and improvement works. As the NIPC shows a significant calendar effect and a strong seasonal pattern, the working days adjusted and the seasonally adjusted series has been estimated using TRAMO-SEATS. Further work needs to be carried out to understand better the revision process of data on hours worked and to update the coefficient of the production function. Moreover according to STS Regulation, the split of the production indices in construction between the building and civil engineering activity have to be provided. In the NIPC methodological framework this is possible if at least one of the inputs indices provides separate information for the two main activities. The new C.E. data collection system supports this requirement.

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