

An indicator of Italian inventories: preliminary analysis

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Abstract In several documents it has been argue about the relevance of short-term statistics on change in inventories. This issue is even more relevant during this period. To fill this gap until a direct survey on the item, in this paper we propose an analytical framework to explore the feasibility to derive, for Italy, an estimation on change in inventories starting from the monthly data on industrial production and industrial turnover at the highest level of disaggregation (3 digit of the Nace rev.2). The hypothesis is that theoretically sales represented by turnover, should equal production minus change in inventories. After deflating turnover, from this account equation it is possible to derive a first roughly approximation for change in inventories. At the same time we integrate the previous study with a micro level analysis based on individual enterprises data for the manufacture of machinery

Key words: Statistics for business and industry, Time series analysis

1 Introduction

In several documents (see for example [3]) International Monetary Fund has pointed out the relevance of short-term statistics on change in inventories to improve quarterly national account estimations based on expenditure approach. For United States, data on inventories are monthly collected by Census bureau but at European level there are no basic quarterly indicators for the changes in inventories (see [4]). Moreover the availability of this data should shed lights on particular aspects of the business cycle, such as the volatility decline appeared in the recent years ([9]).

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To fill this gap until a direct survey on the item, in this paper we propose an analytical framework to derive, for Italy, an estimation on change in inventories starting from the monthly data on industrial production and industrial turnover at the highest level of disaggregation (3 digit of the Nace rev.2 classification of economic activity). The hypothesis is that theoretically sales represented by turnover, should equal production minus change in inventories. After deflating turnover, from this account equation it is possible to derive a first roughly approximation for change in inventories. However difference between the two indexes could be related also to the features of the survey. As Banca d'Italia has argued (see [2]), during the acceleration phase in 2007 turnover indexes have exhibited a more dynamic behavior respect to industrial production. These differences have partly disappeared with the change of the base years (2005=100) that has occurred in 2009 (see [7]). To investigate the influence of the features of the two survey design we integrate the previous study with a micro level analysis based on individual enterprises data for the manufacture of machinery. In this way we have built up an enterprises panel to integrate the results coming from the macro analysis.

In paragraph 2 we present the characteristics of the surveys while paragraph 3 is related to the preliminary empirical results based on macro data and finally paragraph 4 reports investigation on microdata for the machinery division.

2 Characteristics of the industrial production and turnover surveys

In the national economic system measurement of economic evolution, can be made, theoretically, by monitoring the processes of production in terms of added value. As report by Eurostat ([5]), 'one of the key issues relating to the compilation of the Industrial Production Index (hereafter IPI) is the choice of *basic method*. This stems from the difficulty of collecting value added data on a monthly basis, combined with the requirement for a volume index'. As a consequence a variety of methods are used. Three main methods can be identified, and these are:

- measuring as a value the output of the observation unit as a whole, and then using a deflator
- measuring as a value the output (sold or total production, or production intended for sale) for products, and then using a deflator
- measuring the physical quantity (tonnes, litres, pieces etc.) of output at the product level

In addition to these three basic methods, it is common knowledge to use both the hours worked and the measuring the physical quantity (or deflated value) of inputs (raw materials or energy). The survey of industrial production, concerning exclusively industries belonging to sections B, C and D, of Nace 2 classification. The Italian survey is based on a longitudinal panel of enterprises, usually with more than 20 employees, that provides monthly information about production volumes for

1,300 representative products. These elementary products are grouped into a subset of 541 homogenous products for which the elementary indices are calculated. These are then aggregated to classes, groups, divisions, sections, main industrial groupings using a system of weighted Laspeyres type. The longitudinal panel of enterprises is chosen at the beginning of base reference year according to a judgemental criterion in order to minimize the number of selected enterprises for each class of economic activity and maximize the coverage in terms of valued added (the STS regulation requires a quote of 90 per cent for the section C). For each class the most representative products are selected on the basis of information coming from the annual survey on production structure. For each product, enterprises are ranked in a decreasing order. Then enterprise are selected so as to cover at least 70 per cent of the value of production of the concerned domain.

Table 1 Basic methods used for Italian IPI - base year 2005

Method	% in total industry	% in machinery division
Physical quantities	65.5	42.7
Number of pieces	9.6	3.5
Hours worked	12.6	36.7
Value of production	7.9	17.1
Other	4.4	-
Total	100	100

Since 1973 Istat collects monthly information on turnover and new orders for industry keeping apart domestic components from non-domestic. Questionnaires are sent to enterprises at the beginning of the year. The deadline for responses is fixed at the 15th day after the reference month. Data collection is closed 46 days after the reference month. There are approximately 32,000 enterprises with more than 20 employees in the reference population. Approximately 7,000 enterprises, taken from the business register ASIA, have been selected with the aim of maximising the coverage, considering the distribution of turnover within groups of economic activity (3 digit level) in the reference year 2005. A weighting scheme, different for domestic and foreign components of turnover and new orders is used to aggregate the indexes at the upper level. The weighting system is based on the enterprises' turnover estimated from Structural Business Statistics data. A quote of 73% of the total turnover is sold on the domestic market (27% for export market). From both surveys looking at the C Section (Manufacturing) we derive a common set of 80 time series, at three digit level of economic activity, starting from January 2000 to October 2009. This dataset has been integrated by the last data on production prices both on domestic market and non domestic market. However for this last domain series starts only in January 2002 (see table 2 for the description of all the elementary serie). The selected set of time series cover the 90 per cent of the total activities. Due to the characteristics of the products, we do not take in consideration the Manufacture of tobacco products (division 12 of economic activity), the Manufacture of other transport equipment (division 30 of economic activity) the other manufactur-

ing (division 32 of economic activity) and Repair and installation of machinery and equipment (division 33 of economic activity).

3 Preliminary results on macro data

Our analysis, that extend our preview work (see [1]) has started with the compilation of deflated turnover. For each of the 3 digit economic activity, we have deflated separately domestic turnover and non domestic turnover with the correspondent prices (80 series for domestic and 78 series for non domestic). Then, using the weighting scheme of the turnover survey we derive the total indexes for each activity. For the deflated turnover, time spans from January 2002 to September 2009 meanwhile for IPI we consider January 2000 as starting period. Data for IPI are also updated till September 2009 with the last revision released in April 2010. Working at three digit level, both industrial production and total deflated turnover have been seasonal adjusted using Tramo-Seats ([6], dos version of the program) in an automatic mode with the hypothesis of no outliers for the last year. It is important to stress that, till now, Istat does not release the seasonal adjusted figures at this level of disaggregation both for IPI and Turnover ¹.

We derive an indicator for the change in inventories by means of the following equation:

$$\Delta I_t^g = P_t^g - F_t^g \quad (1)$$

where P_t^g represents the seasonal adjusted IPI index for the month t and the group g of economic activity and F_t^g represents the seasonal adjusted deflated turnover for the same period and group. Then we derive the quarterly indicators. For the selected series, seasonal adjusted data for Inventories has been sum up both for the Main Industrial Groups (MIGs) and for the general index according to the weighting scheme of the turnover. It is important to note that in the panel we consider only *Manufacture of coke and refined petroleum products* division for the energy, so we do not provide a figure in the MIGs classification but we consider the group in the general index². Looking at the total of the groups selected, figure 1 (top) presents both the value of the change in inventories and their levels (initial level plus cumulated changes), according to the formula 1, and the cumulative values, supposing zero the initial level in January 2002.

The evidence suggests at least three different pattern. There is positive absolute value of inventories until 2005 together with the end of the recession period (December 2004). Then a progressive reduction both in the change and levels (scale for the change is plotted on the right axis) is followed by an intensive contraction

¹ In April 2010, Istat has released the revised data for IPI till February 2010 together with a meaningful revision of the Arima models to take into account the recession effects, see for example [8]

² In table 2, second column, it is indicated the relation between group of economic activity and MIGs

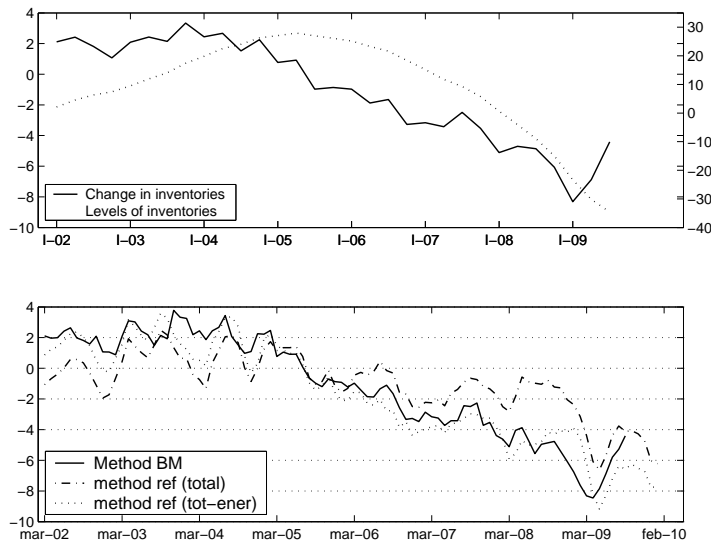


Fig. 1 Inventories series for total industries - Change and level values

starting in the middle of 2008. Finally, in the second quarter of 2009 the change in inventories exhibits a downturn. However this effects does not implies a correspondance effect in the levels. To assess on the characteristics of the proposed measure of the inventories, we provide a comparison with the analysis proposed by REF (see [10], page 44-45). In the figure 1 (bottom) we present three different series for the change in inventories: that one proposed in this work (method BM), that one based on the deflation of the seasonal adjusted turnover for the general index (method ref (total)) and another one calculated only on the MIGs, excluding energy, (method ref (tot-energy)). The second one seem to us coherent with the graph proposed by [10] at page 44. From our point of view, the comparison between production and deflated turnover, needs to take carefully into account the difference in the survey domain. Respect to IPI, STS regulation does not require information on Turnover for the 'Electric power generation, transmission and distribution' (group 351) and for the 'Manufacture of gas; distribution of gaseous fuels through mains' (group 352). Including or not these groups into analysis produce relevant differences in the pattern of the change in inventories especially for the period 2006-2009. Our disaggregate approach seems in line with the aggregate exercise that exclude energy.

Starting from data at groups level in figure 2 we provide the evidence for the change in inventories for the MIGs.

Firstly we note that, as expected, there is no evidence of inventories for the non durable goods. Secondly, the behaviour of the value for the total industries is mainly related to the capital goods sector.

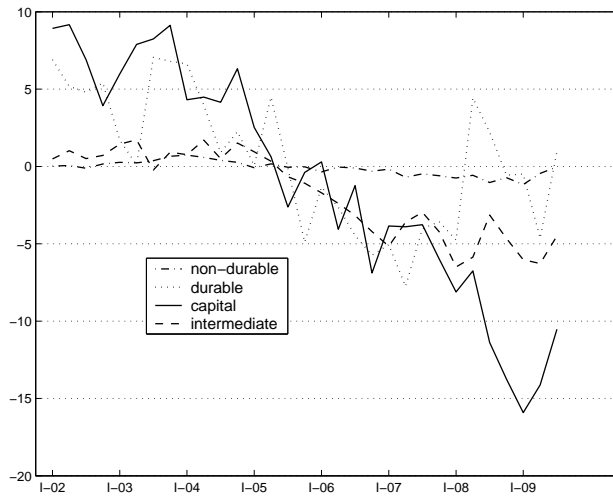


Fig. 2 Inventories series for MICS - Change values

4 Investigation on microdata

At this stage of the work, it has been performed the deterministic record linkage from enterprise selected in both surveys only for one important subsection activity of the industry, the machinery and equipment section. The choice has been made because the field represent about 12% for the index of production basket and over 10% for index of turnover one. Besides the machinery represent half of the production and sales of capital goods. The choice has been driven also from the availability of different proxies in the measurement of monthly production. After the record linkage, we select more than 200 enterprises with the monthly data on total turnover and industrial production. We look at the comparison for all the unit of measure foreseen from the survey design (weight, hours worked and deflated value of production). For the panel of linked enterprises, monthly total production and total turnover has been derived. Preliminary results on the percentage $t/t-12$, for the period January 2005-September 2009, are presented in figure 3, for all the unit of measures.

Looking at the figure 3, we note that the hours worked are less elastic to the economic cycle; changes made on production index measured by the value of production have a trend similar to that of turnover; the physical quantities (weights) show an high degree of elasticity. All the proxies confirms the decline in the level of production and turnover but with different strength. It will be important for the future to deeply explore the influence of the proxies on the change of inventories.

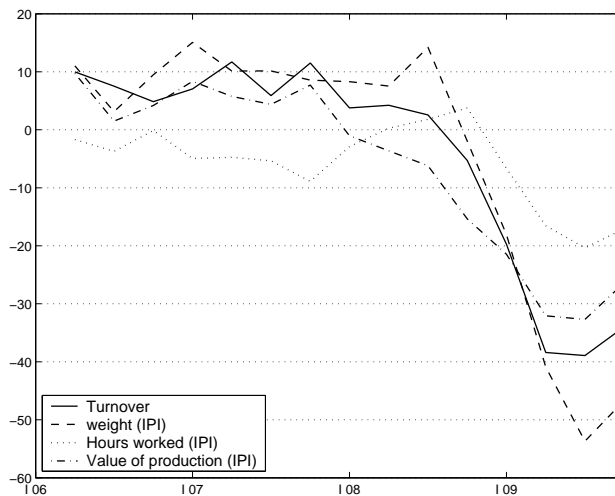


Fig. 3 Turnover and industrial production for a set of common enterprises - annual variation

5 Conclusion

We have presented an indirect index for the inventories based on the existing indexes of industrial production and turnover. Preliminary results seem encouraging. In the next months we will concentrate our attention both on the implication of the basic methods using microdata, and on the implication of seasonal adjustment. At this stage of the analysis it is possible to argue that difference in the unit of measure could be related to the measure of the inventory level presented before.

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Table 2 Groups of economic activity considered for the analysis - weights in terms of Value added at the base year 2005

Groups	MIGS	Description	weights VA
101	non-durable	Proc. and pres. of meat and production of meat products	1.47
102	non-durable	Proc. and pres. of fish, crustaceans and molluscs	0.13
103	non-durable	Proc. and pres. of fruit and vegetables	0.63
104	non-durable	Man. of vegetable and animal oils and fats	0.28
105	non-durable	Man. of dairy products	1.34
106	intermediate	Man. of grain mill products, starches and starch products	0.35
107	non-durable	Man. of bakery and farinaceous products	2.37
108	non-durable	Man. of other food products	1.24
109	intermediate	Man. of prepared animal feeds	0.28
11	non-durable	Man. of beverages	1.23
131	intermediate	Prep. and spinning of textile fibres	0.70
132	intermediate	Weaving of textiles	1.12
133	intermediate	Finishing of textiles	0.75
139	non-durable	Man. of other textiles	1.20
141	non-durable	Man. of wearing apparel, except fur apparel	3.29
143	non-durable	Man. of knitted and crocheted apparel	0.68
151	non-durable	Tanning and dressing of leather; Man. of luggage, handbags, saddlery and harness; dressing and dyeing of fur	1.08
152	non-durable	Man. of footwear	1.47
161	intermediate	Sawmilling and planing of wood	0.40
162	intermediate	Man. of products of wood, cork, straw and plaiting materials	1.93
171	intermediate	Man. of pulp, paper and paperboard	0.53
172	intermediate	Man. of articles of paper and paperboard	1.62
181	non-durable	Printing and service activities related to printing	2.27
191	energy	Man. of coke oven products	0.02
192	energy	Man. of refined petroleum products	1.92
201	intermediate	Man. of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	1.77
202	intermediate	Man. of pesticides and other agrochemical products	0.09
203	intermediate	Man. of paints, varnishes and similar coatings, printing ink and mastics	0.75
204	non-durable	Man. of soap and detergents, cleaning and polishing Prep.s, perfumes and toilet Prep.s	1.19
205	intermediate	Man. of other chemical products	0.72
206	intermediate	Man. of man-made fibres	0.10
211	non-durable	Man. of basic pharmaceutical products	0.50
212	non-durable	Man. of pharmaceutical Prep.s	2.60
221	intermediate	Man. of rubber products	0.84
222	intermediate	Man. of plastic products	3.51
231	intermediate	Man. of glass and glass products	1.01
232	intermediate	Man. of refractory products	0.08
233	intermediate	Man. of clay building materials	1.35
234	intermediate	Man. of other porcelain and ceramic products	0.30
235	intermediate	Man. of cement, lime and plaster	0.62
236	intermediate	Man. of articles of concrete, cement and plaster	1.55
239	intermediate	Man. of abrasive products and non-metallic mineral products n.e.c.	0.31
241	intermediate	Man. of basic iron and steel and of ferro-alloys	2.06
242	intermediate	Man. of tubes, pipes, hollow profiles and related fittings, of steel	0.46
243	intermediate	Man. of other products of first Proc. of steel	0.86
244	intermediate	Man. of basic precious and other non-ferrous metals	0.67
245	intermediate	Casting of metals	0.87
251	capital	Man. of structural metal products	2.79
252	capital	Man. of tanks, reservoirs and containers of metal	0.35
253	capital	Man. of steam generators, except central heating hot water boilers	0.07
254	capital	Man. of weapons and ammunition	0.16
255	intermediate	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	1.43
256	intermediate	Treatment and coating of metals; machining	3.60
257	intermediate	Man. of cutlery, tools and general hardware	1.46
259	intermediate	Man. of other fabricated metal products	2.73
261	intermediate	Man. of electronic components and boards	1.09
262	capital	Man. of computers and peripheral equipment	0.23
263	capital	Man. of communication equipment	0.91
264	durable	Man. of consumer electronics	0.07
265	capital	Man. of instruments and appliances for measuring, testing and navigation; watches and clocks	0.85
271	intermediate	Man. of electric motors, generators, transformers and electricity distribution and control apparatus	1.49
272	intermediate	Man. of batteries and accumulators	0.06
273	intermediate	Man. of wiring and wiring devices	0.51
274	intermediate	Man. of electric lighting equipment	0.45
275	durable	Man. of domestic appliances	1.31
279	intermediate	Man. of other electrical equipment	0.69
281	capital	Man. of general-purpose machinery	3.02
282	capital	Man. of other general-purpose machinery	4.22
283	capital	Man. of agricultural and forestry machinery	0.91
284	capital	Man. of metal forming machinery and machine tools	1.12
289	capital	Man. of other special-purpose machinery	3.16
291	capital	Man. of motor vehicles	0.81
292	capital	Man. of bodies (coachwork) for motor vehicles; Man. of trailers and semi-trailers	0.32
293	capital	Man. of parts and accessories for motor vehicles	2.33
310	durable	Man. of furniture	3.38
Total			90.02