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### **Deflation of services turnover indexes**

#### **The deflation of Wholesale Trade**

Cross cutting topic (11) – Production of a deflated index of turnover

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## **1. Introduction**

In Italy the services turnover survey collects turnover in euro excluding the VAT and other taxes. Turnover is collected also by Structural business statistics (produced annually). For both of them information is collected at enterprise level.

The services turnover index is an indicator which implicitly contains price movements. In order to obtain a measure of the change in the volume of services, it is necessary to deflate turnover, i.e. to remove the impact of price fluctuations. Deflation is obtained dividing turnover by the corresponding price index chosen as a deflator. The deflated turnover index is the most reliable proxy for the production index and it is able to measure the short-term dynamics of the production of services and to provide cyclical information on the volumes of services, made up to the production indicators in industry and construction and the volume indicator of the retail trade.

To eliminate the price level influence and consequently obtain an estimate of the turnover value, three different approaches can be followed:

- input indicators. Hours worked or deflated wages and salaries can be used to measure the value of output. This proxy is often used for mainly non-market sectors output (libraries, education and health);
- output indicators. For example, for the deflation of postal services a weighted average of letters, parcels and in general of all deliveries can be used. This type of indicator is also suitable for transport of passengers and goods;
- price indexes. Each service is deflated by dividing the turnover by the corresponding output price index; if not available, an alternative price index can be used, for example the consumer price indexes (CPI). The latter method is based on the assumption that the prices of the producing firms grow to the same extent as the selling prices. Clearly this proxy is more robust for services aimed at consumers (Business to Consumer) rather than for enterprises (Business to Business).

## **2. The Index of Production Services**

The compilation of the Index of Production Services is achieved according to the Italian classification of economic activities (ATECO 2007). The covered sectors are the 2-digit activity:

- Wholesale and retail trade and repair of motor vehicles and motorcycles (G45)
- Wholesale trade, except of motor vehicles and motorcycles (G46)
- Land transport and transport via pipelines (H49)

- Water transport (H50)
- Air transport (H51)
- Warehousing and support activities for transportation (H52)
- Postal and courier activities (H53)
- Accommodation (I55)
- Food and beverage service activities (I56)
- Publishing activities (J58)
- Motion picture, video and television programme production, sound recording and music publishing activities (J59)
- Programming and broadcasting activities (J60)
- Telecommunications (J61)
- Computer programming, consultancy and related activities (J62)
- Information service activities (J63)
- Legal and accounting activities (M69)
- Management consultancy activities (M702)
- Architectural and engineering activities; technical testing and analysis (M71)
- Advertising and market research (M73)
- Other professional, scientific and technical activities (M74)
- Employment activities (N78)
- Travel agency, tour operator reservation service and related activities (N79)
- Security and investigation activities (N80)
- Cleaning activities (N812)
- Office administrative, office support and other business support activities (N82)

According to the Regulation (EU) 2019/2152 of the European Parliament and of the Council of 27 November 2019 on European business statistics (EBS), the National Institute of Statistics, starting from 2024, will have to disseminate the deflated turnover indicators for the services sector, with reference periods starting in January 2021. In particular, it is required to deflate the turnover Wholesale and retail trade and repair of motor vehicles and motorcycles (G45) and Wholesale trade, except of motor vehicles and motorcycles (G46), the 2-digit G of Nace classification and, separately the turnover of all other services excluding G (sections H, I, J and M excluding 701, 72 and 75).

Among the possible methods to produce volume indexes the deflation by an appropriate output price index is considered to be the first feasible choice. This method is based on the assumption that the prices of manufacturing companies grow at the same rate as sales prices. Clearly this proxy is more robust for services aimed at consumers (Business to Consumer) rather than businesses (Business to Business).

### **3. The building of deflators**

The aim of this technical paper is to describe the main steps that lead to the calculation of the deflated indicators.

The most delicate phase of this work is the building of the matrix of the deflators. The construction of the deflators for section G and for all the others service sectors except G (TOTXG) is carried out separately.

For what concern the components of the TOTXG aggregate, the price indexes used to construct the matrix of deflators are the production price indexes of services (PPS) for the BTB component and the harmonized consumer price indexes (HCPI) for the BTC component. The aggregation of price indexes, where available, is based on data from the matrix of USE, referred to the year 2015, produced by the Directorate of National Accounts. In particular, the values of final household consumptions and intermediate consumptions, are used to assign weights to the HCPI and PPS respectively.

Regarding section G, in particular the Nace divisions 45 and 46, as there are no series of price indices available, to identify the deflators is used a different approach. The deflators are calculated starting from a detailed analysis of the sectors involved. In particular, the wholesale trade sector, is split in order to have the complete break-down and to be able to associate each service with the corresponding price or, in the absence of this, the most representative of the sector. The situation is quite varied as for some services there is a one-to-one correspondence, and this is certainly the simplest case: the deflator coincides with the identified price. Many services, however, have the characteristic of being associated with more than one production price. In this case the two separate indexes are synthesized by means of weighted arithmetic mean, in a single index, which measures the price trends. The weighting coefficients are based on estimates of the net turnover referring to the base year 2015.

The following table shows in details the price indexes used and the structure of the weights for each division/group that contributes to the calculation of the turnover index of section G.

DESCRIPTION	PRICE	COD. PRICE	DESCRIPTION	WEIGHT%
<b>451 Sale of motor vehicles</b>	PPI	291	Manufacture of motor vehicles	95.17
	PPI	292	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	4.83
<b>452 Maintenance and repair of motor vehicles</b>	IPCA	07.2.3	Maintenance and repair of private transport vehicles	50
	IPCA	07.2.1	Parts and accessories for private transport	50
<b>453 Sale of motor vehicle parts and accessories</b>	PPI	293	Manufacture of parts and accessories for motor vehicles	99.99
	IPCA	07.2.1.2	Parts for private means of transport	0.01
<b>454 Sale, maintenance and repair of motorcycles and related parts and accessories</b>	PPI	3091	Manufacture of motorcycles	100
<b>461 Wholesale on a fee or contract basis</b>	PFAS	462	Wholesale of agricultural raw materials and live animals	100
	PFAS	463	Wholesale of food. beverages and tobacco	100
	PFAS	464	Wholesale of household goods	100
	PFAS	465	Wholesale of information and communication equipment	100
	PFAS	466	Wholesale of other machinery. equipment and supplies	100
	PFAS	467	Other specialised wholesale	100
	<b>462 Wholesale of agricultural raw materials and live animals</b>	PPI	106	Manufacture of grain mill products, starches and starch products
	PPI	1091	Manufacture of prepared feeds for farm animals	14.72
	PPI	15	Manufacture of leather and related products	68.58
<b>463 Wholesale of food. beverages and tobacco</b>	PPI	10	Manufacture of food products	54.02
	PPI	1011	Processing and preserving of meat	5.49
	PPI	1012	Processing and preserving of poultry meat	1.01
	PPI	1013	Production of meat and poultry meat products	4.42
	PPI	103	Processing and preserving of fruit and vegetables	5.23
	PPI	104	Manufacture of vegetable and animal oils and fats	3.49
	PPI	105	Manufacture of dairy products	8.69
	PPI	108	Manufacture of other food products	8.75
	PPI	11	Manufacture of beverages	8.91

<b>464 Wholesale of household goods</b>	PPI	13	Manufacture of textiles	12.55
	PPI	14	Manufacture of wearing apparel	17.19
	PPI	15	Manufacture of leather and related products	17.1
	PPI	264	Manufacture of consumer electronics	0.37
	PPI	2751	Manufacture of electric domestic appliances	0.15
	PPI	2041	Manufacture of soap and detergents. cleaning and polishing preparations	2.31
	PPI	231	Manufacture of glass and glass products	3.55
	PPI	2341	Manufacture of ceramic household and ornamental articles	0.24
	PPI	2571	Manufacture of cutlery	0.15
	PPI	2042	Manufacture of perfumes and toilet preparations	2.98
	PPI	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	15.29
	PPI	1393	Manufacture of carpets and rugs	0.16
	PPI	31	Manufacture of furniture	12.37
	PPI	274	Manufacture of electric lighting equipment	2.25
	PPI	2562	Machining	7.64
	PPI	321	Manufacture of jewellery. bijouterie and related articles	3.25
	PPI	1729	Manufacture of other articles of paper and paperboard	1.11
	PPI	323	Manufacture of sports goods	0.91
	PPI	324	Manufacture of games and toys	0.37
	PPI	322	Manufacture of musical instruments	0.08
<b>465 Wholesale of information and communication equipment</b>	PPI	26	Manufacture of computer. electronic and optical products	100
<b>466 Wholesale of other machinery. equipment and supplies</b>	PPI	283	Manufacture of agricultural and forestry machinery	14.32
	PPI	284	Manufacture of metal forming machinery and machine tools	13.98
	PPI	2892	Manufacture of machinery for mining. quarrying and construction	7.52

	PPI	2894	Manufacture of machinery for textile, apparel and leather production	4.83
	PPI	3101	Manufacture of office and shop furniture	5.85
	PPI	289	Manufacture of other special-purpose machinery	53.52
<b>467 Other specialised wholesale</b>	PPI	19	Manufacture of coke and refined petroleum products	22.18
	PPI	24	Manufacture of basic metals	18.81
	PPI	1623	Manufacture of paper stationery	2.08
	PPI	2223	Manufacture of builders' ware of plastic	0.67
	PPI	2311	Manufacture of flat glass	0.13
	PPI	232	Manufacture of refractory products	0.22
	PPI	233	Manufacture of clay building materials	2.06
	PPI	2342	Manufacture of ceramic sanitary fixtures	0.17
	PPI	252	Manufacture of tanks, reservoirs and containers of metal	0.83
	PPI	256	Treatment and coating of metals; machining	6.18
	PPI	257	Manufacture of cutlery, tools and general hardware	2.85
	PPI	259	Manufacture of other fabricated metal products	6.23
	PPI	282	Manufacture of other general-purpose machinery	12.72
	PPI	20	Manufacture of chemicals and chemical products	17.91
	PPI	237	Cutting, shaping and finishing of stone	1.56
	PPI	1721	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	2.44
	PPI	2016	Manufacture of plastics in primary forms	2.96
<b>469 Non-specialised wholesale trade</b>	PFAS	462	Wholesale of agricultural raw materials and live animals	100
	PFAS	463	Wholesale of food, beverages and tobacco	100
	PFAS	464	Wholesale of household goods	100
	PFAS	465	Wholesale of information and communication equipment	100
	PFAS	466	Wholesale of other machinery, equipment and supplies	100
	PFAS	467	Other specialised wholesale	100

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#### 4. The weighting system

The next step concerns the definition of the weighting system. In order to compile turnover indexes at higher levels of NACE. The indexes at the lowest level have to be aggregated by using weights based on information on turnover (for section G) and added value (for all the other service sector TOTXG), integrated with other data from different sources. This data, provided by Structural Business Statistics, are available for each activity and are referred to the base year (2015).

More in deep, we start from a list of activity codes classified according to the ATECO classification each of which is associated with the corresponding information on turnover and added value. Next, taking into account the aggregation system for the indexes, we arrive at a scheme like the one described in the following table.

**Tab. 1 - Indexes Aggregation System**

ATECO_C	ATECO_A	AGGREGATION_LEVEL	FATT3	VA3	FATTS	VAS	FATTR	VAR
451	45	30	80338252	5248937	113653390	13070398	7068707	4015897
451	G	50	80338252	5248937	641927704	75578028	1251516	694506
452	45	30	13325505	4699320	113653390	13070398	1172469	3595392
452	G	50	13325505	4699320	641927704	75578028	207586	621784
453	45	30	16831329	2732869	113653390	13070398	1480935	2090884
453	G	50	16831329	2732869	641927704	75578028	262200	361596
454	45	30	3158304	389272	113653390	13070398	277889	297827
454	G	50	3158304	389272	641927704	75578028	49200	51506
461	46	30	26429767	9864004	528274314	62507630	500304	1578048
461	G	50	26429767	9864004	641927704	75578028	411725	1305142
462	46	30	20546168	1422594	528274314	62507630	388930	227587
462	G	50	20546168	1422594	641927704	75578028	320070	188229
463	46	30	108156625	9163730	528274314	62507630	2047357	1466018
463	G	50	108156625	9163730	641927704	75578028	1684872	1212486
464	46	30	128806237	17819918	528274314	62507630	2438245	2850839
464	G	50	128806237	17819918	641927704	75578028	2006554	2357817
465	46	30	26786510	3626976	528274314	62507630	507057	580245
465	G	50	26786510	3626976	641927704	75578028	417282	479898
466	46	30	32846060	6193681	528274314	62507630	621761	990868
466	G	50	32846060	6193681	641927704	75578028	511678	819508
467	46	30	166164018	12154154	528274314	62507630	3145412	1944427
467	G	50	166164018	12154154	641927704	75578028	2588516	1608160
469	46	30	18538929	2262573	528274314	62507630	350934	361967
469	G	50	18538929	2262573	641927704	75578028	288801	299369

The first two columns refer respectively to the groups and divisions of the ATECO classification. We need to distinguish the two distinct levels of classification as these results are obtained step by step. Starting from the 3-digit., if the aggregation level is 30, it means that the weight associated with this code is used to obtain the corresponding 2-digit., as shown below:

**Tab. 2 - Indexes Aggregation System (first level)**

ATECO_C	ATECO_A	AGGREGATION_LEVEL	FATT3	VA3	FATTS	VAS	FATTR	VAR
451	45	30	80338252	5248937	113653390	13070398	7068707	4015897
452	45	30	13325505	4699320	113653390	13070398	1172469	3595392
453	45	30	16831329	2732869	113653390	13070398	1480935	2090884
454	45	30	3158304	389272	113653390	13070398	277889	297827
461	46	30	26429767	9864004	528274314	62507630	500304	1578048
462	46	30	20546168	1422594	528274314	62507630	388930	227587
463	46	30	108156625	9163730	528274314	62507630	2047357	1466018
464	46	30	128806237	17819918	528274314	62507630	2438245	2850839
465	46	30	26786510	3626976	528274314	62507630	507057	580245
466	46	30	32846060	6193681	528274314	62507630	621761	990868
467	46	30	166164018	12154154	528274314	62507630	3145412	1944427
469	46	30	18538929	2262573	528274314	62507630	350934	361967

If the aggregation level is 50., the corresponding weight is used to obtain the G section.

**Tab. 3 - Indexes Aggregation System (second level)**

ATECO_C	ATECO_A	AGGREGATION_LEVEL	FATT3	VA3	FATTS	VAS	FATTR	VAR
451	G	50	80338252	5248937	641927704	75578028	1251516	694506
452	G	50	13325505	4699320	641927704	75578028	207586	621784
453	G	50	16831329	2732869	641927704	75578028	262200	361596
454	G	50	3158304	389272	641927704	75578028	49200	51506
461	G	50	26429767	9864004	641927704	75578028	411725	1305142
462	G	50	20546168	1422594	641927704	75578028	320070	188229
463	G	50	108156625	9163730	641927704	75578028	1684872	1212486
464	G	50	128806237	17819918	641927704	75578028	2006554	2357817
465	G	50	26786510	3626976	641927704	75578028	417282	479898
466	G	50	32846060	6193681	641927704	75578028	511678	819508
467	G	50	166164018	12154154	641927704	75578028	2588516	1608160
469	G	50	18538929	2262573	641927704	75578028	288801	299369

The last six columns are referred to the weights: FATT3, FATTS and FATTR are related to data on turnover; VA3, VAS and VAR refers to added value. We call FATT3 and VA3 the data referred to the 3-digit levels and, in particular, the value in the table is obtained summing the turnover or the added value by the 3-digit ATECO code. The same is true for the two columns FATTS and VAS. In the last two columns are reported the final weights, which are given by the ratio of the previous two and then multiplied by  $10^7$  to avoid using decimals digits.

## 5. The turnover volume indexes

At this point we have all the needed information to calculate the volume indexes: the raw indexes of turnover for the 3-digit levels and their aggregates, the matrix of deflators and the weights, so we simply obtain the deflated indexes dividing the raw indexes by the deflators. In order to calculate

2-digit indexes and the totals (G and FATXG) we use the weights to get the superior aggregations. Finally, the deflated indexes are treated to remove the seasonal component.

The tables and plots that follow show the main results obtained.

**Tab. 4 - Turnover value indexed (yearly average)**

ANNO	G45_46	G45	G46	H	H49	H50	H51	H52	H53	I	J	M	N	TOTXG
2015	100,0	100,0	100,0	95,3	100,1	89,7	88,9	90,6	99,8	76,3	97,3	91,9	91,8	91,8
2016	102,9	112,7	100,8	96,0	101,3	84,5	81,6	92,1	101,0	79,1	97,7	92,0	91,0	92,3
2017	106,9	118,6	104,4	100,3	106,3	87,6	86,2	96,1	103,2	80,2	99,3	92,1	97,8	94,9
2018	109,7	120,9	107,3	103,5	110,6	86,5	91,5	98,4	108,7	81,5	100,2	91,9	104,6	97,0
2019	110,0	123,9	107,0	104,2	105,2	84,3	98,0	98,4	106,9	83,5	101,0	86,6	104,3	96,4
2020	101,0	103,3	100,5	99,0	106,9	93,1	74,1	90,9	109,1	64,1	99,3	84,1	100,5	90,8
2021	116,4	117,3	116,2	88,0	91,7	47,1	30,8	87,9	132,5	35,2	102,5	89,5	100,0	85,8
2022	129,9	122,8	131,4	112,4	118,7	67,8	65,1	111,6	141,7	74,5	108,4	93,8	112,2	101,7
2023	138,0	148,7	135,7	129,2	146,4	99,1	107,2	114,2	143,5	99,0	113,5	101,6	116,2	113,0

**Tab. 5 - Turnover volume indexed (yearly average)**

ANNO	G45_46	G45	G46	H	H49	H50	H51	H52	H53	I	J	M	N	TOTXG
2015	100,0	100,0	100,0	95,3	100,0	91,8	90,3	90,3	99,1	77,8	97,5	92,2	92,2	92,1
2016	103,8	112,3	102,0	95,5	102,4	95,9	83,8	87,4	101,2	79,9	98,3	92,1	90,7	92,4
2017	105,6	117,3	103,1	99,9	107,9	87,6	86,8	92,8	106,4	80,0	100,2	91,4	96,1	94,6
2018	106,7	119,0	104,1	100,7	110,0	85,0	85,6	92,9	107,8	80,3	99,4	90,5	101,7	95,2
2019	106,4	120,2	103,5	99,6	106,2	80,6	89,6	91,0	105,2	81,7	99,8	84,1	100,0	93,4
2020	98,5	99,3	98,4	93,5	103,1	83,6	72,3	83,3	109,3	62,0	100,4	82,4	96,8	88,4
2021	107,3	109,5	106,8	82,8	88,3	42,8	22,1	79,6	134,3	33,3	104,5	87,7	96,3	83,7
2022	106,0	106,7	105,9	101,9	109,8	53,8	42,3	99,3	140,3	68,1	110,6	91,1	106,0	97,0
2023	110,2	128,2	106,3	111,6	129,2	76,7	58,4	96,4	141,7	84,6	113,0	95,8	106,5	103,6

**Tab. 6 - Turnover seasonally adjusted indexed (yearly average)**

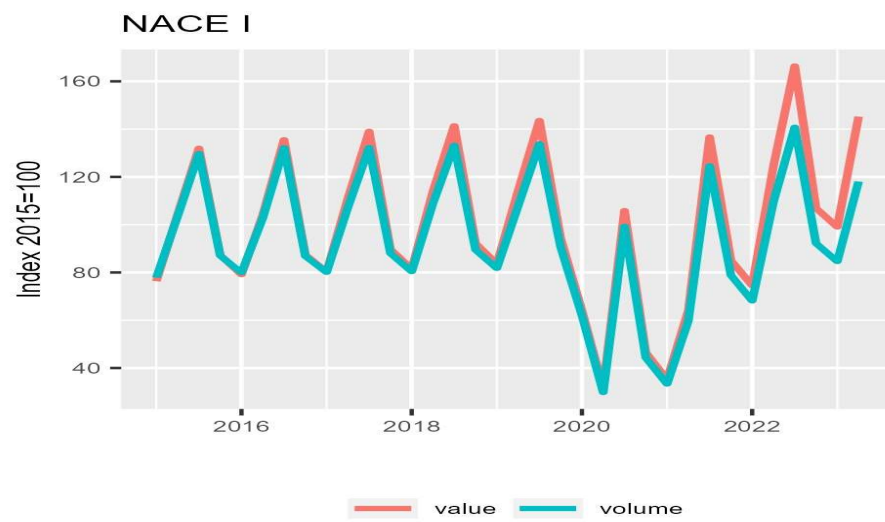
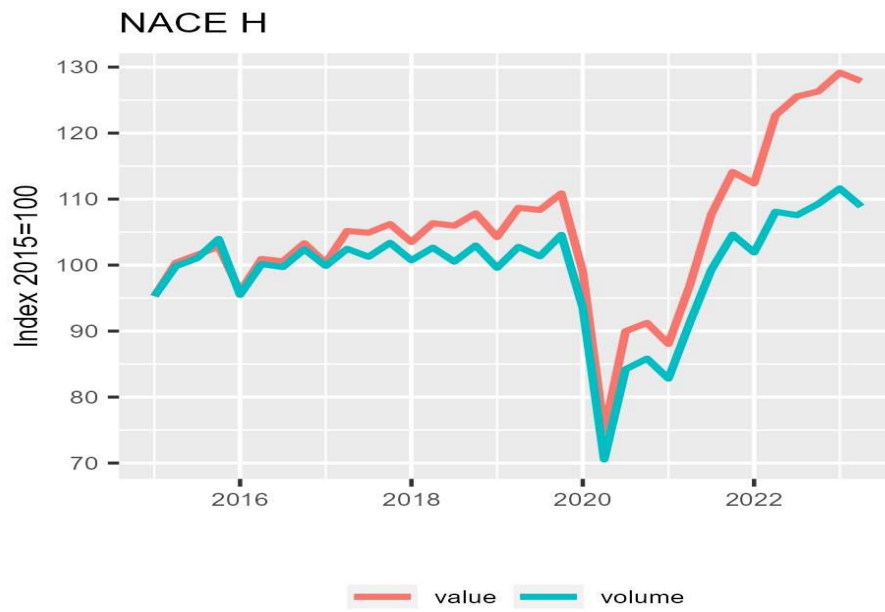
ANNO	G45_46	G45	G46	H	H49	H50	H51	H52	H53	I	J	M	N	TOTXG
2015	99,9	100,2	99,9	100	99,9	100,5	100,2	100	99,7	99,9	99,9	99,5	100	99,9
2016	104	112,3	102,3	99,4	101,2	102,4	96,4	96,6	105,4	100,9	101,1	100,2	97,9	99,9
2017	105,9	117,3	103,5	101,9	105,8	94	97,4	99,7	107,5	102,3	101	99,6	99,9	101
2018	106,6	118,7	104	101,9	104,9	91,9	96,6	101,1	108,4	103,2	100,2	97,7	101,1	100,8
2019	106,4	120,3	103,5	102,2	104,4	93,6	101,9	100,6	113,1	103,8	101	96,1	100	100,7
2020	98,6	100,5	98,2	83,5	90,6	59,2	38,4	87,2	120,1	59,7	99,9	88,6	80,9	83,9
2021	107	109,2	106,6	94,9	101	53	35,3	108,7	137	71,9	105,9	95,6	89,5	93,1
2022	106	106,9	105,8	106,1	109	71,1	53,4	124,6	137,4	101,5	111,8	101,1	99	104,6
2023	106,1	121,8	103	105,1	113	89,1	58,7	111,1	138,5	111,7	114,8	103,4	99,7	107,1

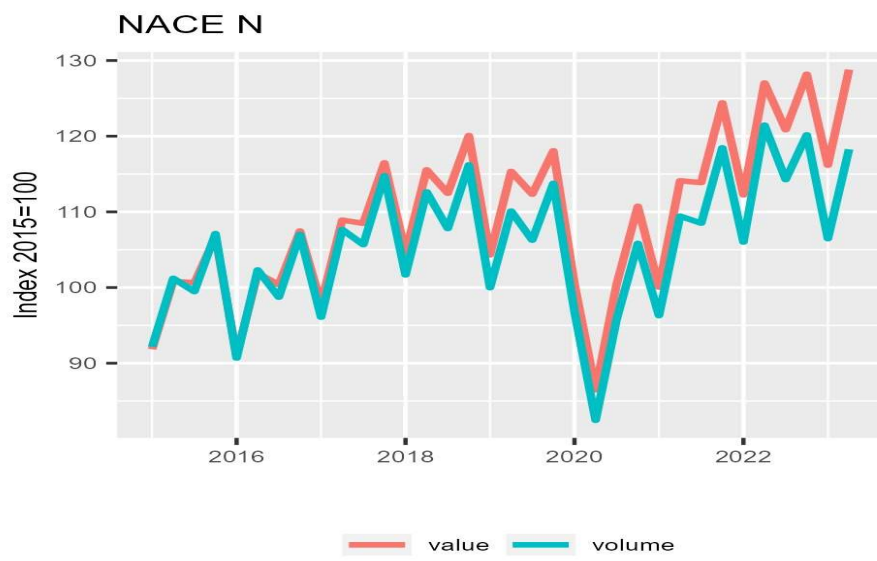
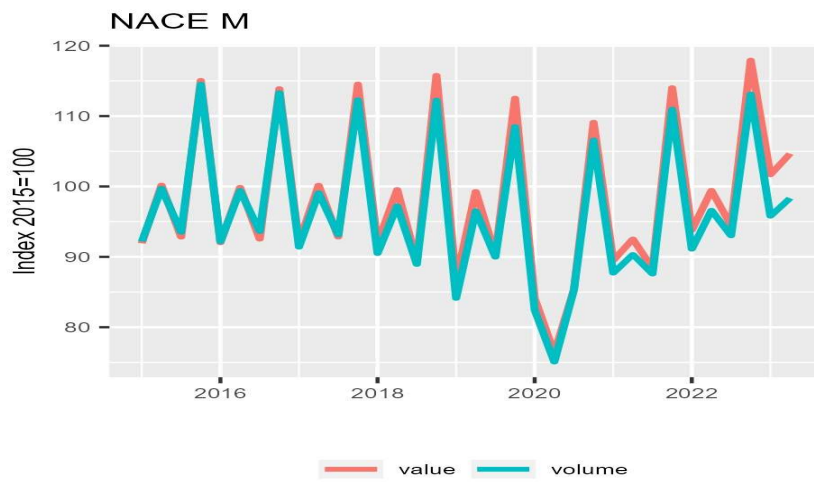
### NACE TOTXG



### NACE G







## 6. Conclusions and future considerations

Currently the services turnover index is calculated and released on a quarterly basis, but will become monthly starting from the data referring to January 2024. For this reason the deflation process and the main results refer to quarterly data but, in parallel, the full process has been set up for monthly indicators. This great job allows us to have a complete and exhaustive indicator of the volume of production considering the volume of turnover together with the indicators of industry and constructions. The followed approach is also consistent with the deflation system used by the National Account Department.

However, some critical issues remain. Firstly, the transition to monthly indexes introduces uncertainties on some prices (PPSs) which, remaining quarterly, will have to be temporally disaggregated and estimated in some way and forecasted accordingly. Secondly, some sectors have rather high differences between the indexes in value and those in volume. Among these, for example Accommodation and Food and beverage service activities (section I of the NACE). The deflated indexes of this sector could be supported by additional quantitative information (i.e number of nights in hotels or other accommodation facilities). Similarly for the Transport activities (section H of the NACE), in addition to the deflated indexes, the number of plane or train tickets could be considered. Lastly, the strength of the work is the automation of the entire process, through an R procedure allowing the direct access to all the databases involved (PPI, PPS, IPCA, turnover, added value and the USE matrix), the estimation of the weighting system, the calculation matrix of deflators and, finally, the deflated turnover. The seasonal adjustment and seasonally adjusted indexes are not completed yet. The direct approach will be used to aggregate the indexes at higher level.

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