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What does the new 2011-12 IIP series tell about the Indian manufacturing sector?

Radhika Pandey, Amey Sapre, Pramod Sinha,

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Radhika Pandey, Amey Sapre and Pramod Sinha
National Institute of Public Finance and Policy, New Delhi, India

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Abstract

Purpose – This paper aims to discuss the changes in the new 2011-12 base year series of the Index of Industrial Production (IIP) to determine whether the new series has improved the understanding of the growth in the manufacturing sector.

Design/methodology/approach – This paper develops a simple framework to separately estimate the contribution of value- and volume-based commodities in the growth of the manufacturing index. The authors present a case study by analysing the growth performance of IIP drugs and pharmaceuticals sector by comparing it with real net sales of a common sample of firms in this segment.

Findings – The authors find that growth in value-based commodities contributes significantly in moving the index in either direction, and that high growth in value-based commodities coincides with periods of low inflation. On comparability, using real net sales as an alternate indicator of industrial output for the pharmaceuticals sector, the authors find that IIP and real net sales show contrasting trends, thereby raising issues of reliability. The authors also find that the IIP shows a disconnect with growth rates from Annual Survey of Industries for several industries.

Practical implications – The divergence between two measures of industrial activity raises crucial questions on the representativeness of the IIP.

Originality/value – The study builds a framework to separately estimate the contribution of value- and volume-based commodities in the growth of the manufacturing index.

Keywords Manufacturing, Industrial production

Paper type Research paper

1. Introduction

In this paper, we study the new 2011-12 base series of the Index of Industrial Production (IIP) and analyse whether the new series has improved our understanding about the performance of the Indian manufacturing sector (Tables AI and AII). The new IIP series was introduced by the Central Statistical Office (CSO) in May 2017 after a comprehensive revision of sources and methods of computation. Broadly, the changes include the addition and deletion of items in the commodity basket, changes in weight and composition of commodity groups and data sources. While the new series has improved the coverage of items, it has also opened several interesting questions for analysis, particularly in areas of measurement of items, composition of the index and the role of a representative deflator. Answers to questions in these areas are a pre-requisite in building our understanding about what the IIP conveys about the manufacturing sector.

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The debate about the state of the manufacturing sector gained a renewed attention after the old (2004-05) and new IIP series presented contrasting pictures of the state of manufacturing in the economy. The old series showed a low and stagnant state of the manufacturing sector (between April 2013 and January 2014 and again from September 2015 to May 2017), whereas the new series almost entirely reversed the picture by showing sharp upward revisions in growth of manufacturing activities during these periods. The magnitude of unexpected changes in growth rates also raised questions of reliability, especially when the new series revised the annual growth figures of manufacturing from –0.8 to 3.6 per cent in 2013-14 and from –0.1 to 4.9 per cent in 2016-17 (see CSO, 2017, for details).

The CSO in its press release (CSO, 2017) states that although the old and new series are not strictly comparable, revisions in the new series have made the index more representative of the structural changes in the economy. However, despite quality improvements, the IIP index continues to be marred with uncertainties as changes in sources and methods have not led to gains in confidence about the ability of the index to capture a fair and reasonable state of manufacturing activities. As IIP is an important high-frequency indicator of formal manufacturing activities in the economy, contrasting trends in growth rates pose difficulties in understanding the growth performance of the sector.

The debate about problems with IIP is also not new. In the past, several questions have been raised about:

- the non-representativeness of the IIP index;
- high volatility in growth rates of various commodities;
- inconsistent trends with other indicators of industrial output; and
- the lack of a dynamic sample frame for capturing the wide base of manufacturing activities.

For instance, Manna (2013) and Manna (2015) compared growth rates from IIP and Annual Survey of Industries (ASI) to suggest that an alternate formulation of the IIP can lead to growth rates that are much closer to the ASI. CSO (2012) studied the internal consistency of the 2004-05 IIP Index to identify the commodity groups that had a high impact on the growth of the manufacturing sector. They found food products, basic metals, machinery and motor vehicles to have a high impact on the growth of the manufacturing sector. They also found that using annual data at a five-digit classification, the coefficient of variation in growth of around 324 commodities was within the range of 0–30 per cent; 30-60 per cent for 59 commodities and over 60 per cent for the remaining 14 commodities.

Sastry (2011) conducted a statistical audit of the 2004-05 IIP series to document a variety of problems related to data, methods and alignment of the index with international practices. The audit gave important recommendations on extending the coverage of items, incorporating seasonal adjustment, and the creation of a business register based on the Sixth Economic Census for a representative sample of industrial units. Nagaraj (2002) critically analysed the state of industrial statistics and pointed out the problems with the registration of factories and the non-filing of regular production data. In an earlier study, Nagaraj (1999) compared the growth rates of manufacturing given by IIP and the NAS series. The author found that there had been a severe deterioration of the data quality of the IIP, and that no amount of updating or refining of the weighting diagram would have compensated for the lack of reliable primary data. Singhi (2000) analysed the IIP and ASI data and came to a similar conclusion that the old series witnessed a gradual erosion of representativeness of the sector because of a dated and non-dynamic sample frame. Also,

regular validation of IIP with alternative indicators was not carried out by way of an institutional mechanism.

It is widely accepted that routine base-year revisions are carried out to address problems of sources and methods to improve the quality of the index. However, problems of data sources alone may not explain the reasons of divergence between series with different base years. Computational changes could also play a significant role in the movement of the index. To build on this line of approach, we make an attempt to understand the reasons for divergence (or at least a part thereof) between the old and new series and ask the following questions:

Q1. Does a change in measurement from volume to value lead to differences in growth rates?

Q2. Do value base items affect the overall growth rates of the IIP?

Q3. Whether methodological changes have helped in improving our understanding of the performance of the manufacturing sector?

To answer these questions, a simple comparison of the composition of the old and new IIP series gives us a starting point for the analysis. One of the changes in the new series was the increase in number of value-based items from 54 to 109 (see CSO, 2017, 2014 for details). Inclusion of value-based items in the index are *per se* not a source of problem in building the index and have a subtle reason for being included. In principle, value-based items are measured in money (rupee) value, instead of production volume. To convert the same to volume, value-based data are deflated using an appropriate commodity group from the Wholesale Price Index (WPI) [see CSO (2014) for a detailed discussion and UK-ONS (2017), ECB (2004) for a similar procedure adopted in other countries]. However, in the process, value-based items bring in the role of the deflator, which can also influence the growth rates at the commodity level. To delve deeper, we compare the change in measurement from volume to value of two NIC compilation categories (fasteners and air conditioning systems) to highlight the extent of changes in growth rates. We also develop a simple framework to separately estimate the contribution of value- and volume-based items to the overall index. The method allows us to explicitly analyse the role of the WPI index that is used for deflating the value-based commodities.

To gauge the overall performance, we use real net sales of pharmaceuticals as an alternate indicator of manufacturing activity and compare it with the representative IIP category. We also compare industry-wise growth rates from IIP and ASI to understand the extent of divergence. Combining the two pieces, we are able to understand trends of manufacturing activity at an industry level and draw a comparison with the picture presented by the IIP Index. As a precursor, the analysis suggests the following arguments:

- A change in measurement from volume to value of a commodity can potentially change growth rates.
- Value-based items have a considerable share in the overall index, and growth in value added commodities contributes increasingly to the growth of the index.
- As value based commodities are deflated by a representative WPI, the periods of high and low growth of the index also coincide with the trends of WPI.
- In case of the pharmaceuticals sector, real net sales and the pharmaceuticals group in the IIP index show contrasting trends.
- IIP and ASI growth rates for several industries show a disconnect as both measures show opposite movements for a comparable set of years.

In what follows, in Section 2, we draw a comparison of the old and new IIP series, and in Section 2.1, we estimate the contribution of volume and value-based commodities to the overall growth of the IIP index. In Section 3, we compare growth in real net sales of value-based items such as pharmaceuticals with its corresponding IIP group and also draw a comparison with growth rates at the industry level from the ASI. Section 4 concludes the discussion with a summary of issues.

2. Old vs new series: differences in composition

We begin with some stylised facts about the composition of the IIP series. Changes in the new series can be classified into the following four broad categories:

(1) changes in commodity basket;

(2) changes in weights of commodities;

(3) changes in methods of computation for some commodities; and

(4) changes in data sources.

The new IIP series retains the previous broad sectoral composition, i.e. Electricity, mining and manufacturing, but uses the 2008 NIC classification for grouping industrial activities. The new series also uses the three-digit NIC classification for a wider coverage of items instead of the earlier two-digit broad classification. On the commodity basket, the new series has a total of 809 commodities clubbed into 407 groups, as compared to the earlier 620 commodities and 399 groups. The weights for each item group are computed from their respective contribution to the gross value added of the manufacturing sector. A summary of the groups and their weights is presented in Table I.

Other finer changes in the commodity basket include addition of 149 and deletion of 124 commodities in the manufacturing group, deletion of 32 items in the mining group and addition of 55 value-based items, thus increasing their count from 54 in the earlier series to 109 in the new series.

A comparison of the trajectory of the old and new series reveals the impact of the changes and the periods of divergence. In Figure 1, we plot the year-on-year growth rates of the IIP manufacturing index from the old and new series.

If we divide the time range into three periods that highlight the divergence, i.e. from April 2013 till October 2014, November 2014 till September 2015 and September 2015 onwards, we see nearly opposite trends of both series in these periods. In the first period, the new series shows a remarkably high growth, whereas the old series shows a negative growth. In the second period, the new series shows a secular decline during 2015, whereas the old series indicates this to be a high growth period. A sharp contrast is visible in the

Table I. Sectoral composition of 2004-05 and 2011-12 IIP series

	2011-12 series		2004-05 series	
Sector	Weight (%)	Groups	Weights (%)	Groups
Electricity	7.994	1	10.316	1
Mining	14.373	1	14.157	1
Manufacturing	77.633	405	75.527	397
Total	100	407	100	399

Source: CSO (2017)

third period (post September 2015) where the new series shows a consistent rise in industrial output.

To delve into the question of what explains such divergence, we analyse the composition of the index in two parts:

(1) analysing the shift in measurement of items from volume to value unit; and

(2) separately compute the contribution of volume- and value-based items in the overall index.

To begin with, across industries, the value-based commodities contribute approximately 19.22 per cent of the manufacturing index. Within the value-based items, NIC groups of 21, 28 and 29 have a significant share totalling up to 11.28 per cent of the manufacturing index. Table II shows the distribution of value and volume-based commodities for all manufacturing groups in NIC 2008.

In terms of numbers, the value-based items constitute approximately 25 per cent (109 out of 405 manufacturing items) of the total manufacturing index. Value-based items include some items that were earlier captured as volume, while others have been included for the first time in the 2011-12 series. The items for which the measurement has changed from volume to value presents a case for comparing the change in growth rates. As an illustration, we compare the changes in growth rates for two NIC groups. Table III describes the changes in brief.

In the 2004-05 series, the NIC code 28991 Fasteners (High Tensile)/Bolts and Nuts was captured in volume, whereas after in the 2011-12 series (based on NIC 2008), the same was captured in value with the NIC code 25991. A similar case is with NIC code 29192 (Air Conditioners, etc.) which was earlier captured in volume (numbers). In the 2011-12 series, the same series is captured in value terms with the NIC code 28192. The representative (or closest matching) WPI (2011-12 series) used for deflating the series on Fasteners (expressed in value terms in the 2011-12 series) is the WPI item of Bolts, Screws, Nuts and Nails of Iron and Steel, while for deflating the Air Conditioning series (expressed in value terms), we use the Manufacture of Other General-Purpose Machinery item from WPI.

In Table IV, we tabulate the growth rates (corresponding to the same month of the previous year) for these groups from January 2015. For the old series, in both cases, the growth rates were derived directly from the number of units, whereas in case of the new series, the value of production was first deflated and subsequently, the growth rates were computed. Table IV shows that the new series shows opposite trends and sharp movements

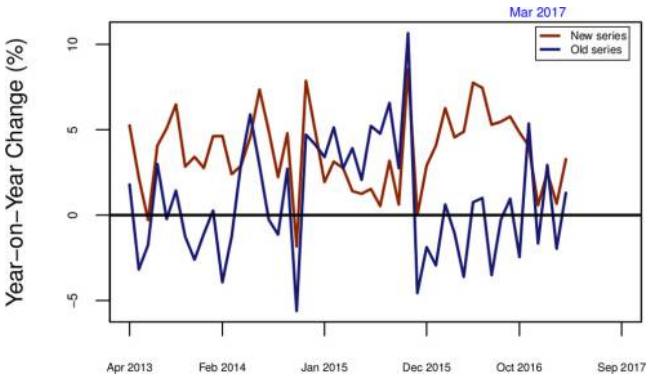

Figure 1.
Annual percentage change in IIP manufacturing, 2004-05 and 2011-12 series

Table II. Distribution of value and volume-based items in the manufacturing basket, 2011-12 series

NIC 2	Commodity	Value	Value	Vol.	Total
Digit	Group	Items	Wt	Wt	Wt
10	Food products	0	0.00	5.3	5.3
11	Beverages	0	0.00	1.04	1.04
12	Tobacco products	1	0.24	0.56	0.8
13	Textiles	3	0.13	3.16	3.29
14	Wearing apparel	4	1.32	0.00	1.32
15	Leather and related products	2	0.15	0.36	0.5
16	Wood and of products etc	2	0.06	0.13	0.19
17	Paper and paper products	1	0.23	0.64	0.87
18	Printing, recorded media, etc	4	0.44	0.24	0.68
19	Coke and refined petroleum	0	0.00	11.77	11.77
20	Chemical products	2	0.37	7.51	7.87
21	Pharmaceuticals, medicinal etc	20	4.98	0.00	4.98
22	Rubber and plastics	4	0.43	1.99	2.42
23	Other non-metallic mineral	3	0.29	3.79	4.09
24	Basic metals	0	0.00	12.8	12.8
25	Fabricated metal products	12	1.62	1.03	2.65
26	Computer and electronic products, etc	6	0.60	0.97	1.57
27	Electrical equipment	5	0.86	2.14	3.00
28	Machinery and equipment	22	2.78	1.99	4.77
29	Motor vehicles, trailers, etc	5	3.52	1.34	4.86
30	Other transport equipment	1	0.19	1.59	1.78
31	Furniture	3	0.13	0.00	0.13
32	Other	9	0.88	0.06	0.94
Sum		109	19.22	58.41	77.62

Source: Computed from CSO (2017)

Table III. Changes in measurement from volume to value

Item	S. No.	NIC	Commodity	Unit
2004-05 series	281	28991	Fasteners (high tensile)/bolts and nuts	Tones
2004-05 series	298	29192	Air conditioner (packaged)	Numbers
2004-05 series	299	29192	Air conditioner (Room)	Numbers
2011-12 series	282	25991	Fasteners (high tensile)/ bolts and nuts	Rs. Crore
2011-12 series	352	28192	Air conditioning systems/ plants for industrial use	Rs. Crore

in growth rates for several periods for both items. The difference is much more pronounced for Fasteners. In some periods, the old and the deflated new series show nearly opposite trends. As an example, in October 2015, the old series for Fasteners expressed in volume registered a contraction of 4.2 per cent. For the same period, the deflated new series of Fasteners showed an impressive growth of almost 23 per cent. To visualise this more clearly, Figure 2 plots the trends of growth rates of the two components for the Fasteners and Air Conditioner series.

Figure 2(a) superposes the growth of the Fasteners old series with the deflated new series. While for some periods, we notice a similarity in the trajectory of the two series, we also observe periods where the two series show divergent growth. Figure 2(b) compares the growth rate of Air Conditioner series at old base year and the growth rate of the deflated series at the new base year.

NIC/Series	Fasteners	Fasteners	WPI Fasteners	Air Con.	Air Con.	WPI (GPM)
Period	04-05	11-12	11-12	04-05	11-12	11-12
January 2015	5.08	18.37	−0.39	23.76	27.93	−1.53
February 2015	9.40	22.02	−0.50	27.23	0.28	1.72
March 2015	−0.33	14.78	0.70	44.53	4.33	3.96
April 2015	−4.81	−0.99	−1.18	34.38	44.50	−5.56
May 2015	−10.53	11.47	−6.71	7.50	24.33	−1.75
June 2015	−1.71	16.68	−8.06	10.10	21.25	2.52
July 2015	6.99	18.16	−8.57	−40.36	14.32	1.57
August 2015	−1.42	24.98	−15.57	−19.60	−13.29	4.93
September 2015	1.77	24.42	−14.65	−7.61	−5.53	−0.69
October 2015	−4.20	22.80	−14.52	5.97	70.38	2.78
November 2015	−10.44	5.18	−7.40	11.99	2.14	−5.25
December 2015	−8.49	6.01	−8.16	18.24	7.47	2.00
January 2016	7.12	12.23	−7.96	−3.45	15.92	0.74
February 2016	12.17	17.98	−6.70	0.55	13.73	−5.01
March 2016	4.28	12.63	−8.72	4.89	7.27	−5.64
April 2016	12.06	24.46	−9.71	10.89	0.38	−0.73
May 2016	19.05	24.98	−8.37	37.18	−7.75	−4.50
June 2016	6.91	14.80	−7.78	17.18	0.74	−5.22
July 2016	−0.49	10.70	−8.28	89.94	25.93	−8.33
August 2016	5.10	6.94	−5.01	53.03	21.59	−5.61
September 2016	−6.42	−2.73	−2.56	16.35	4.33	−2.48
October 2016	−10.36	−0.04	−2.03	10.42	−11.02	−2.85
November 2016	13.42	6.01	0.85	9.43	33.37	−1.95
December 2016	−4.22	−6.06	6.10	−24.13	29.18	−1.25
January 2017	−1.08	−4.05	6.62	3.55	12.67	1.79
February 2017	−3.25	−12.34	6.32	0.46	38.74	1.95
March 2017	2.74	−3.26	6.73	7.77	34.07	1.86
January December 2015 (Avg.)	−1.56	15.32	–	9.68	16.51	–
January December 2016 (Avg.)	4.89	10.16	–	18.52	11.14	–
January March (Avg.)	−0.53	−6.55	–	3.93	28.49	–

Notes: Air Con. is NIC 28192 Air Conditioning systems and GPM is General Purpose Machinery in WPI. The number of factories in 2004-05 and 2011-12 series is likely to be different on account of additions, deletion of factories and reclassifications of sub-sectors in the 2011-12 series

Table IV. Change in growth rates (%) from volume to value units for two NIC categories

The figures in Table IV highlight the fact that volume (numbers) and the value (monetary) of the same item need not necessarily follow a similar trajectory. Statistically, while we expect value and volume to be correlated, this fact alone does not allow us to clearly determine which of the two measures is more appropriate for the purpose of the index. To elaborate using the figures in Table IV, the correlation between growth rates of NIC 28991 (Fasteners) in old and new series is 0.496, while the correlation between the new series and the corresponding WPI series is –0.759. Similarly, for Air Conditioning, the correlation between growth rates of old and new series is as low as 0.062, whereas the correlation is 0.044 between the growth rate from new series and its corresponding WPI category.

The analysis leaves a wide scope of interpretation on whether the change in measurement has led to gains in capturing levels of production for these particular items, or on a broader level, which of the two series captures a more representative picture of the sector. Nevertheless, the growth rates of the WPI index do suggest the following. As the relation of value items and its deflator is expected to be negative, a lower growth rate on

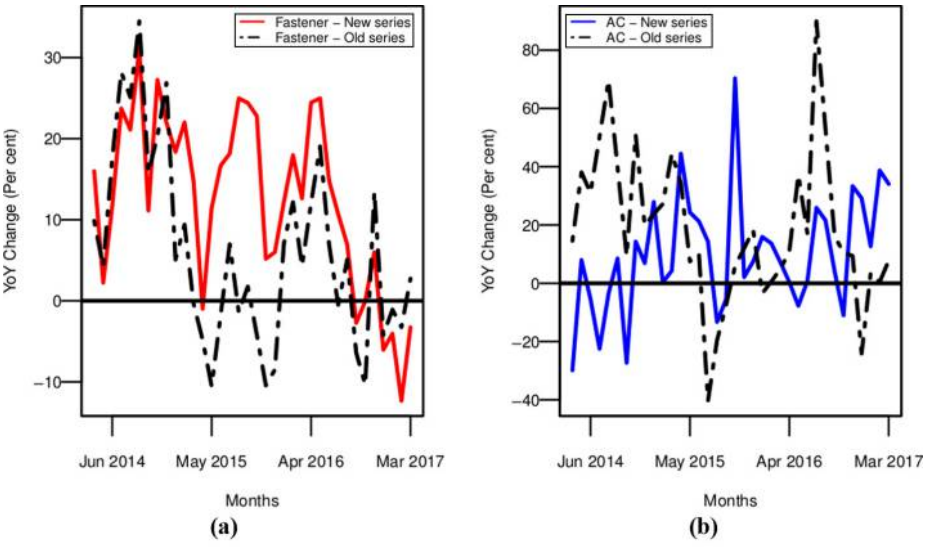

Figure 2.
Comparison of growth rates of sub-components, 2004-05 and 2011-12 series

Notes: (a) Fasteners; (b) air conditioners, etc

the WPI index and a stronger correlation will tend to inflate the growth of the IIP. In Table IV, the periods of low (and falling) inflation are indicative of this feature, particularly for the Fasteners category. The comparison has given us a starting point that value-based items may influence the overall movement of growth of the IIP. To analyse and answer the question, we develop a framework to estimate the contribution of volume- and value-based commodities to the overall IIP growth rates.

2.1 Estimating contribution of volume- and value-based commodities

We begin by classifying the 405 commodities across the manufacturing sector into three groups, namely:

(1) *Group item is completely volume-based*: For instance, NIC two-digit code 10: "Manufacture of Food products" has all volume-based items with a weight of 5.3025 per cent in the index. Interestingly, there are only three categories which are purely volume-based.

(2) *Group item is completely value-based*: For example, NIC two-digit code 21: Manufacture of pharmaceuticals, medicinal chemical and botanical products comprises all value-based items, with a weight of 4.9810 per cent in the index.

(3) *Group item is both volume and value-based*: NIC two-digit code 29: Manufacture of motor vehicles, trailers and semi-trailers has a total weight of 4.8573 per cent, of which 3.5192 per cent is value-based and 1.3381 per cent is volume-based. Based on the above grouping, we use the individual commodity weights to reconstruct two separate value- and volume-based indexes. Let C_{vai} and C_{voi} denote value- and volume-based commodities, and w_{vai} and w_{voi} their respective weights at NIC five-digit level in each industry category. By definition, summing over both types of

commodities, the weighted average of value- and volume-based commodities gives the level of the index for the industry group at the two-digit level, i.e.:

$$I_i = \sum_i w_{vai} \,.\, C_{vai} + \sum_i w_{voi} \,.\, C_{voi} \tag{1}$$

where I_i represents industry group, and weights and commodity groups are defined as earlier. The same method can be extended for all commodities across NIC industry groups such that it gives the aggregate level of the manufacturing index as a weighted average of value- and volume-based commodities. With these two components, the next step is to calculate their contribution in the growth of the index. The contribution can be estimated using the expression:

$$C_g = \left(\frac{CV - PV}{PV_I}\right) \tag{2}$$

where C_g is the growth of the component (either value or volume), CV is the current period value of the index, PV is previous value and PV_I is the previous value of the manufacturing index.

Table V gives the aggregate levels of value- and volume-based commodities summed across different industry groups and their corresponding year-on-year growth rates. The growth rate of the IIP manufacturing index can now be understood as approximately equal to the sum of the growth of its two components, namely, value and volume. As an illustration, the growth in all volume-based commodities in 2017 Q2 as compared to its corresponding quarter in the previous year can be computed as ([87.43 – 87.96]/119.17) × 100 ≈ −0.44. The pattern of

Period Qtrs	Vol. Index	Val. Index	IIP Mfg. Index	Vol. Y-o-Y (%)	Val. Y-o-Y (%)	IIP Mfg. Y-o-Y (%)
June 2013	79.38	25.59	104.97	1.89	0.48	2.34
September 2013	80.87	26.98	107.83	4.14	1.10	5.20
December 2013	81.47	26.37	107.83	1.68	1.31	2.99
March 2014	85.75	28.03	113.77	2.78	1.07	3.83
June 2014	83.93	26.21	110.13	4.34	0.59	4.92
September 2014	84.94	27.19	112.13	3.78	0.19	3.99
December 2014	85.64	26.05	111.70	3.86	–0.29	3.59
March 2015	87.00	29.72	116.73	1.10	1.49	2.61
June 2015	84.58	27.10	111.67	0.59	0.81	1.39
September 2015	85.47	28.26	113.73	0.47	0.95	1.43
December 2015	86.02	29.83	115.87	0.35	3.38	3.73
March 2016	91.68	30.80	122.50	4.01	0.93	4.94
June 2016	87.96	31.22	119.17	3.02	3.69	6.72
September 2016	88.20	31.80	120.00	2.40	3.11	5.51
December 2016	88.18	31.29	119.47	1.86	1.26	3.11
March 2017	90.25	34.93	125.17	–1.17	3.37	2.18
June 2017	87.43	33.70	121.13	–0.44	2.08	1.65

Note: Vol. and Val. denote volume and value, Mfg. is manufacturing and Y-o-Y denotes year on year growth rate

Table V.
Aggregate value and volume-based index and contribution to growth of IIP, 2011-12 series

growth reveals that value-based items have been contributing increasingly in the growth of the index. The impact is clearly visible post December 2015, especially during periods where the growth in value-based items has exceeded the growth in volume index. Using the same information, in Figure 3, we stack the contribution of value- and volume-based items in quarterly growth of IIP Manufacturing for the period from June 2013 to March 2017.

Recall that value-based items are deflated by a representative category of WPI to get a measure of production volume. Thus, the role of the deflator also has to be analysed. If we map the trends of the IIP and WPI manufacturing index, the period of rise in the IIP post September 2015 coincides with the fall in the WPI index. To visualise, we plot the trends in the year-on-year growth rate of both the indexes in Figure 4.

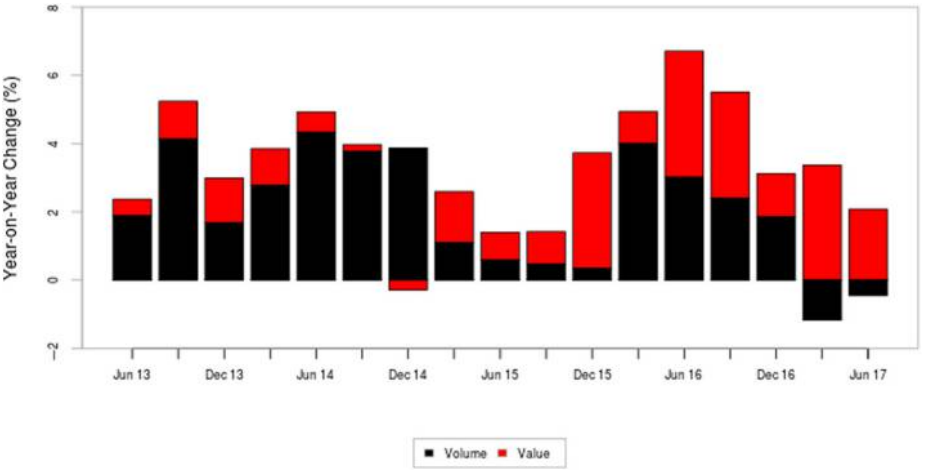

Figure 3.
Share of value- and volume-based contribution in growth of IIP manufacturing, 2011-12 series

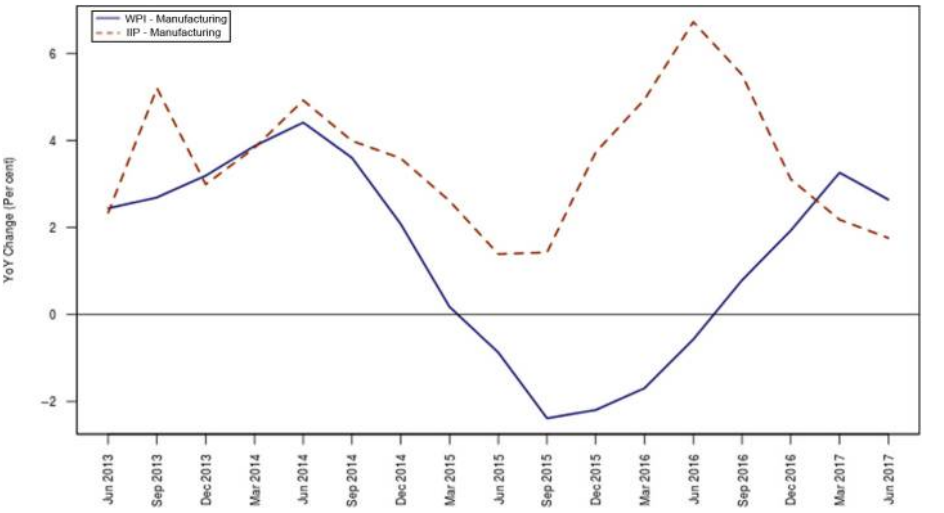

Figure 4.
Trajectory of growth in IIP manufacturing and WPI inflation, 2011-12 series

It is evident that the high growth rate of the IIP and hence the divergence with the old base year series is partly a result of the fall in the WPI deflator since September 2015 till around June 2016. In this context, a key finding is that the trends of the manufacturing index and especially of value-based components are increasingly affected by the movements in WPI. The manufacturing index has the possibility to show inflated growth on account of a rise in the value components, particularly during times of falling inflation. A reverse situation may also happen where the index shows a subdued growth in manufacturing on account of rise in some of the components of the WPI index. These two inferences can be readily drawn by comparing the trajectory of the IIP and WPI series post June 2016.

In substance, the sharp rise in the growth of the IIP index may be not necessarily reflect a rise in volume levels as value-based commodities play a significant role in driving the index in either direction. To delve further into the question of growth in value-based commodities, we make use of other measures of industrial output to compare the picture shown by the IIP. The analysis helps us to focus on two key areas:

(1) trend and direction of growth; and

(2) representativeness of the IIP for any particular sector.

3. What do other measures of output tell?

A reliable measure is one which is broadly consistent with other similar measures. Does the new IIP series present a picture consistent with similar measures? We present two measures of comparison. In the first sub-section, we compare the growth rate in one segment of IIP with the corresponding growth rate in the companies' performance of the same segment. In the second sub-section, we present a comparison with the growth rates for manufacturing NIC groups from the ASI.

3.1 Comparison with firm-level data

To draw a comparison, we look at the trends of industrial sales of firms as sales are expected to be closely related to production. We use net sales of industries as a close proxy of manufacturing output. In particular, of the three value-based groups in IIP, namely, 14 (wearing apparels), 21 (pharmaceuticals) and 31 (furniture), we select NIC 21 for the analysis as we are able to obtain firm level sales and a representative WPI deflator. To maintain comparability with the IIP index, we use lagged net sales to adjust for differences in time period of production and sale of commodities. We adjust net sales by the median of the industry inventory cycle (in days) to make a comparable period with the production cycle as captured by the IIP. Next, we deflate net sales to remove the effect of prices to obtain a close measure of output volume, similar to the IIP. In Figure 5, we plot the growth in real net sales of a common sample of 68 firms and IIP pharmaceuticals for the period from June 2013 till June 2017. The details of the firms in the sample are mentioned in Notes 1 and 2. The two series show a complete contrast in trends and direction, particularly after December 2015. Real net sales of major listed pharmaceuticals firms have shown a secular decline, whereas the IIP shows a year-on-year growth in excess of 25 per cent.

As the WPI deflator is common to both series in this case, the difference in two measures of industrial activity clearly points to the limitations of the IIP in capturing the state of affairs in this sector. Even if we abstract from the common deflator used in both series, the falling and negative growth in net sales indicates a decline in levels of industrial sales. However, while interpreting this result, one caveat needs to be emphasised. At the

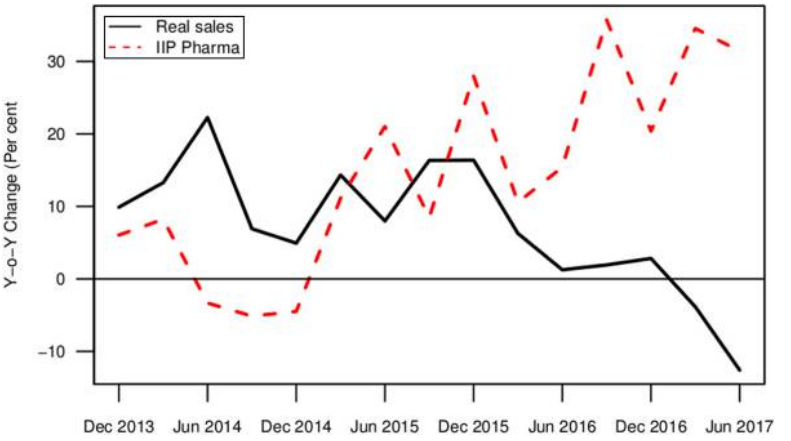

Figure 5.
Trend of growth in net sales and IIP (pharmaceuticals), 2011-12 series

aggregate, the net sales of firms correspond to the NIC group (21 this case) and not to any particular manufactured drug or pharmaceutical product.

As the IIP sub-indexes are also represented at a compilation category level, the growth rates capture broad industry-level trends, as opposed to any particular product. Nevertheless, it remains to be understood how such an industry-wide decline in sales corresponds to a high growth period as shown by the IIP index. The magnitude of such high growth rates is equally questionable. Previous studies and findings of the statistical audit have already indicated the need to analyse commodity groups that show a volatile growth rate as they have a high impact on the growth of the overall index. In the new series, the pharmaceutical sector is one such case that has a high impact on the growth of the index. The problem may further get magnified as the movement of this component is influenced by the trends of the WPI.

3.2 Comparison with Annual Survey of Industries

In the literature, there have been other points of comparison. Manna (2013) cross-validates growth rates of some important item groups taken from IIP and ASI. To build on the same, Manna (2015) explores an alternative IIP by selecting registered manufacturing units above a certain employment size criterion to rebuild the index using the deflated total value of production. To get a sense of the comparison between growth rates from IIP and ASI, we take the following approach. For the IIP series, we take the annual growth rates from the index of each NIC group (10-32). For the ASI, we take the gross value of output for each NIC group and deflate them with their corresponding broad WPI categories. The details of value of output and the WPI index for each NIC category are provided in Appendix Table AI and Table AII. This process gives us an approximation to volume changes from the ASI, which to some extent can be compared with the IIP. Table VI tabulates the growth rates by NIC groups for the comparable years.

In Table VI, the last column highlights the instances where the growth rate from the two sources show opposite trends. Specifically, these are cases where the year-on-year movements do not show the same direction. For instance, for several industries (leather, wood, paper products, printing media, etc.), the IIP shows a fall in growth rate over the previous year, whereas ASI shows an opposite trend, and vice-versa. Thus, as earlier, the point of disconnect with other measures of industrial output is reinforced. However, there are few caveats in comparing growth rates from different measures of output. First, the

Period/ Categories	2013-14 IIP	2013-14 ASI	2014-15 IIP	2014-15 ASI	2015-16 IIP	2015-16 ASI	Disconnect
Food products	1.24	5.54	5.99	9.46	−5.57	1.87	0
Beverages	−1.83	10.95	3.29	14.53	1.42	−1.78	0
Tobacco products	8.32	0.43	12.58	8.23	3.99	8.56	1
Textiles	4.24	11.73	3.80	1.72	2.16	1.50	0
Wearing apparel	16.00	31.72	−0.33	−21.76	14.48	15.44	0
Leather and related products	2.22	7.87	8.87	1.74	0.42	16.80	1
Wood and wood products	−2.52	6.42	0.76	−8.30	2.33	0.52	1
Paper and paper products	10.54	15.42	0.85	6.08	1.15	3.51	1
Printing and media, etc	9.25	−15.49	−5.41	32.39	3.82	−17.36	1
Chemical and chemical products	4.67	3.86	0.34	5.82	4.15	12.96	1
Pharmaceuticals products, etc	5.79	9.12	2.20	2.20	13.07	10.55	0
Rubber and plastic products	11.32	4.53	4.77	9.19	0.47	3.91	1
Other non-metallic mineral products	0.21	−1.43	4.93	15.68	2.02	−3.43	0
Basic metals	4.35	13.72	9.73	−1.28	0.65	9.95	1
Fabricated metal products	4.69	6.30	4.33	−1.85	−2.39	9.83	1
Computer and electronic products	14.53	14.97	2.14	−6.90	5.04	14.56	0
Electrical equipment	3.88	5.09	3.93	−2.26	5.25	7.09	1
Machinery and equipment N.E.C	0.36	−9.35	−0.63	13.15	3.23	3.36	1
Motor vehicles, trailers and semi-trailers	−1.06	−4.70	3.56	15.33	−1.48	11.11	0
Other transport equipment	4.32	1.35	6.30	6.66	2.23	7.91	1
Furniture	11.08	−1.99	−7.78	−1.21	41.74	11.83	0
Other manufacturing	−7.03	13.00	0.52	12.45	13.34	−26.30	1
Annual aggregate growth rates							
Aggregate*	3.59 (−0.77)**	8.78	3.75 (2.3)**	5.01	2.9 (2.0)**	−0.33	

Notes: (1) Disconnect indicates the instance where IIP and ASI growth rates have opposite movements *Growth rates for aggregate ASI are at nominal prices; **indicates annual growth rate of IIP Manuf. for the 2004-05 base year series

Table VI. Growth rates (%) from IIP 2011-12 series and ASI

ASI has a much larger sample frame as compared to IIP; hence, growth rates may not show a large volatility as in the case of IIP. Second, the objective of IIP is to capture short-term movements, which the ASI does not capture. Thus, the two measures offer comparability that is limited to cross-validation of volumes and not short-term fluctuations. Also, at the aggregate, in this particular case, the IIP cover manufacturing activities only within the NIC 10-32 groups, whereas the aggregate ASI covers a much wider range of NIC groups.

Taking into account the different points of comparison, our analysis suggests that the IIP growth figures may present an inconsistent picture of the state of industrial activity on two counts:

(1) inflated or subdued growth in value-based commodities, which eventually pushes or drags down the overall index; and

(2) disconnect with other measures of industrial activity.

The findings also open up few questions on the choice of measurement units for items in the index. While inclusion of value-based items is *per se* not a source of problem, the inherent compilations they bring through the deflator are a matter of detailed investigation.

Problems of measuring and analysing industrial production are not limited to any specific country. Measurement-related problems have also been recognised in other countries. For instance, ECB (2004) highlighted the problems of divergence between industrial production and value addition. Other than seasonal factors, one of the reasons for divergence is the relative movement of production and (input/output) prices. To quote, based on nominal turnover data, a slowdown in real value added as indicated by the industrial production data would imply that either inputs to production rose sharply, that inventories of finished products have been reduced (both hypotheses implying a difference between turnover and value added concepts) or that output prices fell significantly compared with input prices (leading to a gap between growth rate developments in nominal and real terms) (ECB, 2004, p. 41). This fact also corroborates the relation we observe between nominal figures of value-based items and their corresponding WPI deflator series. The key takeaway from the analysis is that while the aggregate IIP growth rate may show much higher (or lower) growth rates, it may be more useful to analyse item- or group-wise growth rates to get a much clearer picture of industrial production.

4. Conclusion

In this paper, we analyse the changes in the new 2011-12 IIP series to ask whether the new series has improved our understanding of the growth in the manufacturing sector. The new series was introduced after a comprehensive revision in the commodity basket that led to substantial differences in growth rates as compared to the previous 2004-05 series. As IIP is an important high-frequency indicator of formal industrial activity, understanding the differences in the pictures presented by the 2004-05 and 2011-12 series requires an in-depth analysis in areas of measurement of items, data sources and computation.

Among other contentious issues with the IIP, we answer three questions stated earlier in the paper, *Q1*, *Q2* and *Q3*.

To assess the impact of change in measurement, we compare the growth rates of two sub-components for which the units were changed from volume to value in the new series. We find that the change in measurement leaves a wide scope for interpretation on whether such a shift has led to gains in capturing levels of production of items. In the new series, value-based measurement shows a much higher variation in growth rates, and unexpected peaks and falls coincide with the trends of the representative WPI deflator. To analyse this feature in detail, we develop a simple framework to separately create value- and volume-based indexes and analyse their contribution in the growth of the manufacturing sector. The growth pattern of the two indexes suggest that value-based commodities have increasingly contributed to the overall growth of the index. We also find that at the aggregate, the trends of the manufacturing index are equally affected by the movements in the WPI index.

To assess the consistency with other measures of industrial output, we first use net sales of firms in the drugs and pharmaceuticals sector to draw a comparison with the pharmaceutical component of the IIP. We find that the two series show contrasting trends, suggesting that the IIP component of pharmaceuticals does not show a representative picture of the sector. Real net sales have shown a consistent decline in the past four quarters, whereas the IIP pharmaceuticals has risen in excess of 25 per cent over the same period. The divergence between the two measures raises questions on the limitations of the IIP in presenting a realistic picture of the sector. This non-representative is in addition to the fact

that growth in the pharmaceuticals sector has contributed substantially to the rise of the IIP index in recent times. The result is also similar when we compare growth rates from IIP and ASI for various industries. We find several cases of disconnect, especially when ASI and IIP show opposite trends in growth rates.

In the past, several issues have already been raised over the reliability of the IIP index. It is an accepted fact that subsequent base-year revisions are expected to address the existing problems of sources and methods. However, the performance of the new series suggests that quality improvements have not led to gains in confidence about the IIP index. The 2011-12 IIP series have thrown new challenges of a different order. Deciphering the actual change in production continues to be a difficult task. To summarise the analysis on what the new IIP series tells about manufacturing, we find that while changes have improved the quality of the index, its main purpose of capturing volume of production has been overshadowed by the nuances of revisions and the technicalities of its composition.

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Corresponding author
Amey Sapre can be contacted at: amey.sapre@nipfp.org.in

Appendix

(1) Details of firms in the pharmaceutical sector:

Table AI. Details of firms in the pharmaceutical sector

Main products	NIC name	NIC code	*N*
Ayurvedic and Unani medicaments	Manuf. of Ayurvedic or Unani Preparation	21003	4
Bio-tech base drugs	Manuf. of Other Pharma. and Botanical Prod. N.E.C	21009	1
Drug formulations	Manuf. of Allopathic Pharma. Prep	21002	35
Drugs, medicines and allied products	Manuf. of Pharma., Medicinal Chemical and Botanical Prd	2100	21
Empty capsules	Manuf. of Other Pharma. and Botanical Products N.E.C	21009	2
Penicillin	Manuf. of Medicinal Substances, etc	21001	2
Pharmaceutical products, NEC	Manuf. of Other Pharma. and Botanical Prod. N.E.C	21009	1
Vaccines	Manuf. of Medicinal Substances, etc	21001	1

(2) Firms in the sample were selected on the basis of their main product, which has also been classified as per NIC 2008.

(3) Computation of growth rates from Annual Survey of Industries (ASI) for different NIC groups using Gross output and representative WPI categories:

Year	NIC	Output (INR million) 2012-13	2013-14	2014-15	2015-16	WPI Index 2012-13	2013-14	2014-15	2015-16	Real Gr. rates 2013-14	2014-15	2015-16
Food products	10	6,982,078.20	7,735,073.30	8622756.00	8,655,144.80	108.70	114.10	116.20	114.50	5.54	9.46	1.87
Beverages	11	522,597.60	610,895.20	719965.90	71,0914.50	104.50	110.10	113.30	113.90	10.95	14.53	−1.78
Tobacco products	12	328,811.30	348,510.20	406521.60	47,6042.00	108.40	114.40	123.30	133.00	0.43	8.23	8.56
Textiles	13	3,102,175.20	3,725,995.30	3820538.60	3,753,860.40	104.00	111.80	112.70	109.10	11.73	1.72	1.50
Wearing apparel	14	904,285.30	1,249,526.60	1018389.30	1,234,159.00	112.20	117.70	122.60	128.70	31.72	−21.76	15.44
Leather and related products	15	412,772.80	476,395.90	509577.20	60,1602.10	107.30	114.80	120.70	122.00	7.87	1.74	16.80
Wood and wood products	16	186,320.30	212,402.30	204277.20	21,4229.80	110.90	118.80	124.60	130.00	6.42	−8.30	0.52
Paper and paper products	17	685,962.90	842,168.80	924181.70	94,5666.00	103.60	110.20	114.00	112.70	15.42	6.08	3.51
Printing and media etc	18	339,972.10	308,635.70	434432.40	38,7195.00	110.50	118.70	126.20	136.10	−15.49	32.39	−17.36
Chemical and chemical products	20	4,729,682.70	5,139,033.80	5572441.00	6,104,739.60	108.30	113.30	116.10	112.60	3.86	5.82	12.96
Pharmaceuticals products, etc	21	1,902,815.20	2,145,637.90	2318335.30	2,656,948.60	104.80	108.30	114.50	118.70	9.12	2.20	10.55
Rubber and plastic products	22	1,941,885.30	2,155,121.80	2389532.60	2,402,994.80	103.70	110.10	111.80	108.20	4.53	9.19	3.91
Other non-metallic mineral products	23	1,952,873.70	1,930,282.00	2311784.20	2,216,345.90	107.20	107.50	111.30	110.50	−1.43	15.68	−3.43
Basic metals	24	7,683,981.50	8,579,833.50	8519171.50	8,326,133.40	104.80	102.90	103.50	92.00	13.72	−1.28	9.95
Fabricated metal products	25	1,624,911.40	1,723,981.50	1738086.20	1,910,685.60	103.20	103.00	105.80	105.90	6.30	−1.85	9.83
Computer products, etc	26	1,068,121.90	1,252,283.80	1215650.80	1,400,456.40	101.00	103.00	107.40	108.00	14.97	−6.90	14.56
Electrical equipment	27	2,134,933.20	2,273,973.90	2322371.10	2,475,703.70	103.40	104.80	109.50	109.00	5.09	−2.26	7.09
Machinery and equipment N.E.C	28	2,546,012.50	2,357,066.00	2730156.90	2,845,321.00	103.60	105.80	108.30	109.20	−9.35	13.15	3.36
Motor vehicles, etc	29	398,0912.30	3,963,531.50	4673217.60	5,235,169.30	102.80	107.40	109.80	110.70	−4.70	15.33	11.11
Other transport equipment	30	1,326,745.10	1,364,540.00	1500580.40	1,614,699.30	101.50	103.00	106.20	105.90	1.35	6.66	7.91
Furniture	31	147,406.10	15,2833.00	157752.60	170,667.00	105.40	111.50	116.50	112.70	−1.99	−1.21	11.83
Other manufacturing	32	1,576,746.10	1,768,855.00	2190628.70	1,790,709.00	96.40	95.70	105.40	116.90	13.00	12.45	−26.30

Table AII.
Computation of growth rates from ASI for different NIC groups using gross output and representative WPI categories