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Abstract

We discuss the changes in the new 2011-12 base year series of the Index of Industrial Production (IIP) to ask, whether the new series has improved our under-standing of the growth in the manufacturing sector. We develop a simple framework to separately estimate the contribution of value and volume based commodities in the growth of the manufacturing index. We 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. Findings also show that movements in the IIP Index are increasingly influenced by the trends of WPI as growth in value based commodities may inflate or become subdued, given the fall or rise in the WPI index. As a case study of value based commodities, we compare the trends of IIP (Pharmaceuticals) and real Net Sales of firms in the pharmaceuticals sector. Our findings show that real Net Sales and IIP have contrasting trends. Such divergent trends between two measures of industrial activity raise crucial questions on the representativeness of the IIP.

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1 Introduction

In this paper we study the 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. The new IIP series was introduced by the Central Statistical Organisation (CSO) in May, 2017 after a comprehensive revision of sources and methods of computation. Broadly, the changes include; addition and deletion of items in the commodity basket, changes in weight and composition of commodity groups and data sources. The new series was also aimed at improving the coverage of manufacturing activities and resolving conflicts with the diverging trends of the manufacturing sector shown by 2011-12 GDP series.

The debate about the state of the manufacturing sector gained a renewed attention after the old and new IIP series presented contrasting pictures of the state of manufacturing in the economy. The old 2004-05 IIP series showed a low and stagnant state of the manufacturing sector (between April 2013 and Jan 2014 and again during Sept. 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 such unexpected changes in growth rates raise questions of reliability especially when the new series revised the annual growth figures of manufacturing from –0.8% to 3.6% in 2013-14, and from –0.1% to 4.9% 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 the same level of uncertainty as in the case of the 2004-05 series. With unexpected movements in growth rates, changes in sources and methods have not led to gains in confidence about the ability of the index to capture the true state of manufacturing activities. Since IIP is an important high frequency indicator of formal manufacturing activities in the economy, contrasting trends in growth rates pose difficulties in understanding the true state of the sector.

In the past, several questions have been raised about (i) the non-representativeness of the IIP index, (ii) high volatility in growth rates of various commodities, and (iii) the lack of a dynamic sample frame for capturing the wide base of manufacturing activities. For instance, (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 5-digit classification, the coefficient of variation in growth of around 324 commodities was within the range of 0–30%; 30-60% for 59 commodities and over 60 % 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 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 finds 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 compensate 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 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. In this paper, 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 question: whether methodological changes have helped in improving our understanding of the performance of the manufacturing sector?

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. Value based items are measured in money (rupee) value, instead of production volume. To convert the same to volume, value based data is deflated using an appropriate commodity group from the WPI. In this context, it is worth asking: does the rise in number of value based commodities influence the growth and movement of the overall IIP index? Since this aspect is quantifiable, we first 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.

Second, to gauge the overall performance of the IIP index, we compare it with the trajectory of real Net Sales of value based commodities as an alternate indicator of manufacturing activity. 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 three important line of arguments, (i) growth in value added commodities contributes increasingly to the growth of the index, (ii) since value added commodities are deflated by a representative WPI, the periods of high and low growth of the index also coincide with the trends of WPI and (iii) compared to real Net Sales of value based commodities as another measure of industrial output in the pharmaceuticals sector, the IIP index shows contrasting trends, thus raising questions of reliability and representativeness of industrial production.

The rest of the paper is structured as follows: In Section 2, we draw a comparison of the old and new IIP series, 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 Section 4 concludes the discussion.

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 summarised under 4 broad heads, viz. (i) changes in commodity basket, (ii) changes in weights of commodities, (iii) changes in methods of computation for some commodities and (iv) 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 3-digit NIC classification for a wider coverage of items instead of the earlier 2-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 397 groups. The weights for each item group are computed from their respective contribution to the Gross Value Added (GVA) of the manufacturing sector. A summary of the groups and their weights is presented in Table 1.

Other finer changes in the commodity basket also includes: 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 revels the impact of the changes and the periods of divergence.

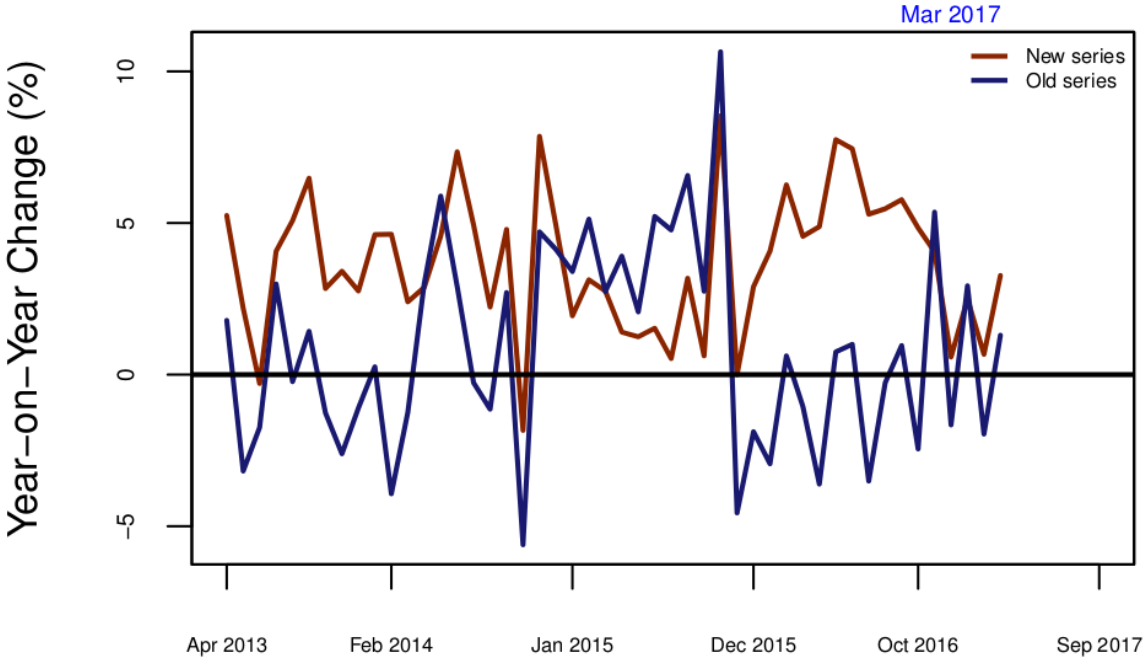
Table 1: Sectoral composition of 2004-05 and 2011-12 IIP series

Sector	2011-12 series		2004-05 series	
	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)

In Figure 1, we plot the year-on-year growth rates of the IIP Manufacturing Index from the old and new series.

Figure 1: Annual percentage change in IIP Manufacturing, 2004-05 and 2011-12 series



If we divide the time range into three periods, 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 all these period. In the first period, the new series shows a remarkably high growth, whereas the old series showed a negative growth. In the second period, the new series shows a secular decline during 2015, whereas the old series had shown this to be a high growth period. A sharp contrast is visible in the third period (post Sept. 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 by its two broad categories, namely: value and volume commodities. Across industries, the value based commodities contribute approximately 19.22% 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% of the manufacturing index. Table 2 shows the distribution of value and volume based commodities for all manufacturing groups in NIC 2008.

Table 2: Distribution of value and volume based items in the manufacturing basket, 2011-12 series

NIC 2 Digit	Commodity Group	Value items	Value wt.	Vol. wt.	Total 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, electronic 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)

In terms of numbers, the value-based items constitute approximately 25% (109 out of 405 manufacturing items) of the total manufacturing index. Is this share significant enough to bring about a change in the manufacturing index? To answer the question, we propose to separately estimate the contribution of these two commodity groups in the growth of manufacturing index of the IIP.

2.1 Estimating contribution of volume and value based commodities

In this section we develop a framework to estimate the contribution of volume and value-based commodities. We classify the 405 commodities across the manufacturing sector into three groups, namely;

(a) Group item is completely **volume** based: For instance, NIC-2 digit code 10: 'Manufacture of Food products' has all volume-based items with a weight of 5.3025% in the index. Interestingly, there are only 3 categories which are purely volume based.

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

(c) Group item is both **volume and value** based: NIC-2 digit code 29: Manufacture of motor vehicles, trailers and semi-trailers has a total weight of 4.8573%, of which, 3.5192% is value based and 1.3381% 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 5 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 2 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 3: Aggregate value and volume based index and contribution to growth of IIP, 2011-12 series

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

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

Table 3 gives the aggregate levels of value and volume based commodities summed across different industry group 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, viz. 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 $((87.43-87.96)/119.17)\times 100 \approx -0.44$. The pattern of growth revels that value based items have been contributing increasingly in the growth of the index. The impact is clearly visible post Dec. 2015, especially during periods where the growth in value based items has exceeded the growth in volume index. Using the same information, in Figure 2, we stack the contribution of value and volume based items in quarterly growth of IIP Manufacturing for the period June 2013 till 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 indices in Figure 3.

Figure 2: Share of value and volume based contribution in growth of IIP Manufacturing, 2011-12 series

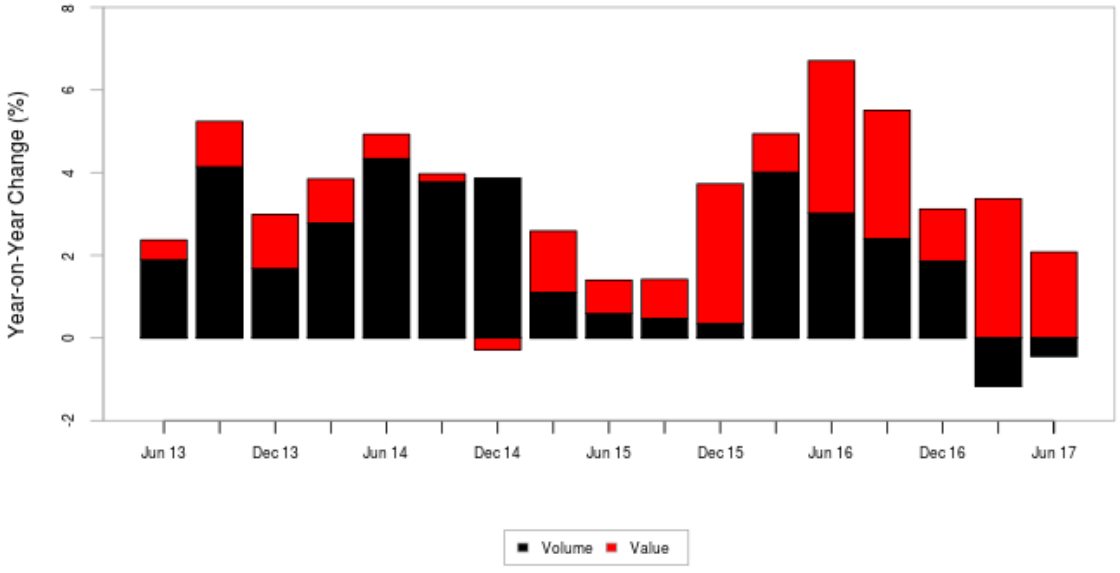
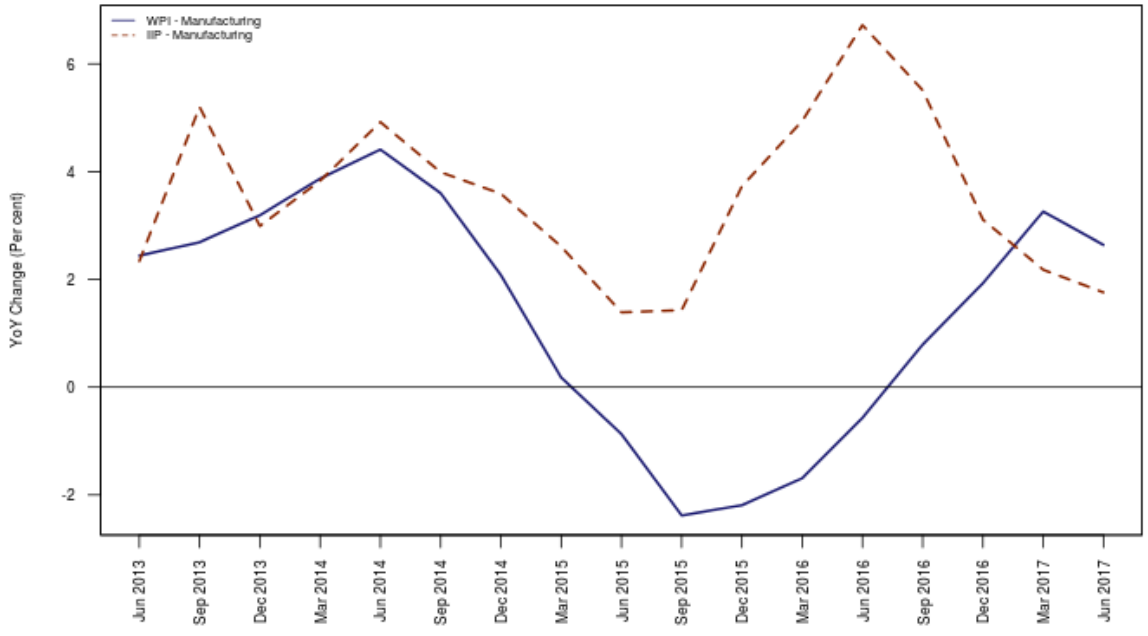


Figure 3: Trajectory of growth in IIP- Manufacturing and WPI inflation, 2011-12 series



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 increase in contribution of value based items and the fall in the WPI deflator since September 2015 till around June 2016. A key finding is that the trends of the manufacturing index are increasingly affected by the movements in WPI. The new manufacturing index is likely 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 the WPI index. These two inferences can be readily drawn by comparing the trajectory of the IIP and WPI series post June 2016.

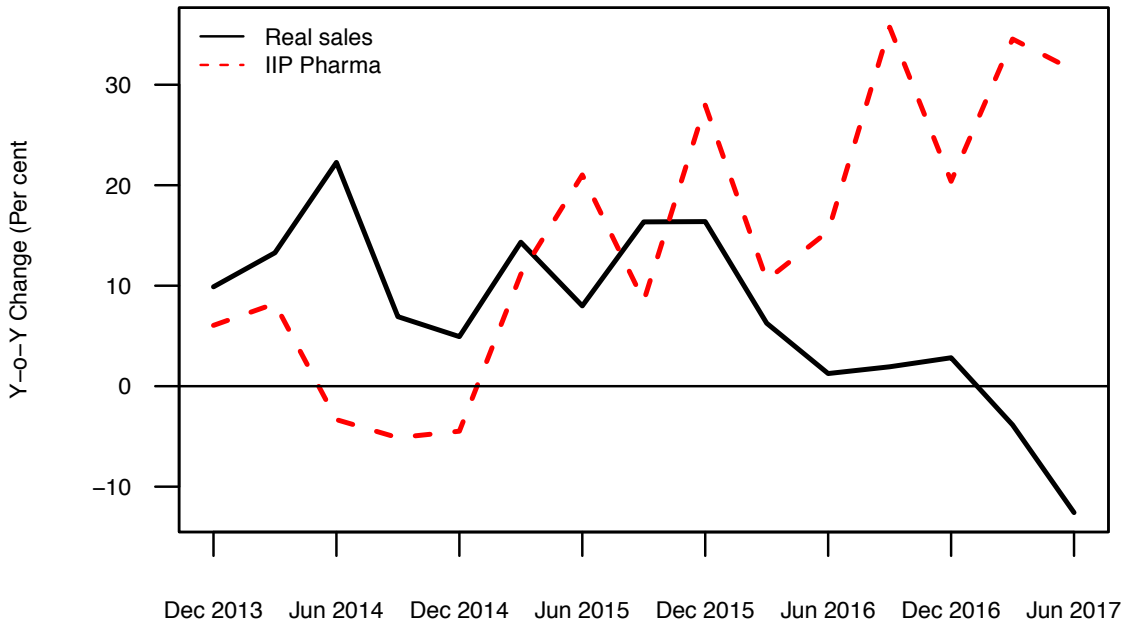
In substance, the sharp rise in the growth of the IIP index may not necessarily reflect a rise in volume levels as value based commodities play a significant role in driving the index in either direction. To delve further into the question of growth in value based commodities, we make use of other measures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

3 What do other output measures tell?

A reliable measure is one which is broadly consistent with other similar measures. Does the new IIP series presents a picture consistent with similar measures? We attempt to answer this question by looking at the trends in one segment through the lens of IIP and firm level data. We use Net Sales of industries as a measure of manufacturing output. Of the three value based groups, 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. In Figure 4 we plot the growth in real Net Sales of a common sample of 68 firms and IIP pharmaceuticals for the period June 2013 till June 2017. The two series show a complete contrast in trends and direction, particularly after Dec. 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%.

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 sales. 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

Figure 4: Trend of growth in Net Sales and IIP (Pharmaceuticals), 2011-12 series



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.

The analysis suggests that the IIP growth figures may present an inconsistent picture of the state of industrial activity on two counts (i) inflated or subdued growth in value based commodities, which eventually pushes or drags down the overall index, (ii) disconnect with other measures of industrial activity.

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 a different sectoral composition of the index. Since 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 data sources and computation. We argue that among other contentious issues with the IIP, on the computational front, the rise in the number of value based items plays a significant role in the movement of the index.

We develop a simple framework to separately create the value and volume based indexes and analyse their contribution in the growth of the manufacturing. The growth

pattern of the two indexes suggest that value based commodities have been increasingly contributing to the growth of the index. We find that the trends of the manufacturing index are increasingly affected by the movements in the WPI index.

To assess the representativeness and scale of consistency with other output based measures, we pick pharmaceuticals segment as a case study. We use Net Sales of pharmaceuticals firms 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 last four quarters, whereas the IIP pharmaceuticals has risen in excess of 25% over the same period. The divergence between the two measures raises crucial 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 value of pharmaceuticals has contributed substantially to the rise of the IIP index in recent times.

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 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 has thrown challenges of a different order. Deciphering the actual change in production continues to be a difficult task. Thus, to summarise our analysis on the new IIP series, 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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