Estimation of National Accounts Aggregates
under the 2004-05 series and 2011-12 series: An Analytical Comparison

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Abstract

The revision in base year for GDP is a standard global practice to account for structural changes in the economy. However, the release of the back series of India's GDP for the period 2004-05 to 2011-12 on November 2018 by the National Statistical Office was mired with debates among academicians, politicians and media alike. This study focuses on explaining the causes for arriving at different estimates under the latest base year revision of national accounts i.e., from 2004-05 to 2011-12 and dispelling doubts on data related issues which have been raised frequently. The methodology for preparing the back-series estimates for the years 2004-05 to 2010-11 is largely the same as followed in the new base (2011-12) following the recommendation of System of National Accounts (SNA), 2008 and hence comprises a significant methodological shift. In certain cases, owing to the limitations of the availability of data, splicing method or ratios observed in the estimates in base year 2011-12 have been applied as appropriate. Substantial updation/revisions are observed between the 2004-05 and 2011-12 series, both at the aggregate and the sectoral level. Furthermore, it is observed that deflators in the new series are higher compared to the 2004-05 series, thereby leading to lower estimates of real macroeconomic aggregates. Secondly, the services sector underwent major downward revision in the back series. Finally, the dynamic rolling window correlation analysis in this paper suggests that the relationship between GDP and various macro indicators have worsened overtime. Although the most highlighting change in the 2011-12 base year series was incorporation of MCA database, the use of MCA database, however, was limited till 2010.

Key words: Backcasting, base-year, revision, national accounts, indicator, GDP

I. Introduction

The National Statistical Office (NSO), Ministry of Statistics and Programme Implementation (MOSPI) released the back series for the period 2004-05 to 2011-12 on November 2018. This was followed by the linked back series estimates (since 1950-51)   with new base year 2011-12 in August 2019. The compilation methodology for 2011-12 base year is as per the recommendation of UN System of National Accounts (SNA), 2008. The earlier base years such as 2004-05 and 1999-2000 followed SNA 1993 recommendations. Since SNA 2008 comprises significant updation and revisions over SNA 1993, and in view of the transition that the Indian economy has undergone over time, substantial differences occurred between the 2004-05 series and 2011-12 back series both at the aggregate and the sectoral level.

Even though base year shift warrants for change in estimation, the latest base year revision ignited some debate regarding possible over-estimation of GDP growth by around 2.5

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percentage points (Subramanian, 2019). Issues regarding lack of coherence of gross domestic product (GDP) with other macroeconomic indicators have also been highlighted frequently in media reports and commentaries. In the light of the ongoing debate, this article attempts to present a holistic view of the base year revision exercise from 2004-05 to 2011-12 delving into the methodological aspects at sub-sector level for the overlapping period in the two series.[2] Secondly, focussing on a longer time span, an attempt has been made to explore the dynamics of the relationship between GDP and select indicators using the dynamic rolling window correlation analysis.

The remainder of the article is structured in the following sections. Section II discusses the global practices regarding backcasting of GDP while Section III focuses on the Indian experience on base revision and backcasting. Section IV presents an analytical comparison of the 2004-05 series *vis-à-vis* the 2011-12 series. Section V demonstrates the dynamic correlation analysis between GDP and other macro-economic indicators. Section VI concludes the article.

II.   Backcasting GDP: Global Practices

National account statistics show how income originating in production, modified by taxes and transfers, flows to these groups and how they allocate these flows to consumption, saving and investment. Consequently, national accounts are one of the building blocks of macroeconomic statistics forming a basis for economic analysis and policy formulation. Estimation of GDP and other macroeconomic variables is nevertheless a challenging exercise. GDP is an indicator of overall economic activity for a given period and, therefore, aims to cover a comprehensive and varied list of activities taking place in the economy. However, with growing dynamism of the economy in the form of new business models, products and services, and productivity gains aided by technological advancement, the existing method of compilation of GDP might turn insufficient to capture it all. Especially with increasing share of services, accurate estimation and valuation has become even more challenging and warrants for frequent changes in the methodology of measurement of GDP (Prakash *et.al*, 2019).

At the outset, it may be useful to distinguish the 'routine or current revisions' from the 'benchmark or base year revisions' in national account statistics by statistical agencies.

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[2] The overlapping period is 2004-05 to 2011-12 for which data are available as per different methodologies 2004-05 as well as 2011-12 series. The NSO published national accounts statistics at 2011-12 base year since 1951 but simple spicing method was followed in backcasting for the years prior to 2004-05. Therefore, we haven't included the period prior to 2004-05 in our comparative analysis as these are not subject to methodological shifts. Also, 2011-12 series estimates for the over-lapping years are denoted as *back series*, while 2004-05 base year estimates are denoted as old series in this article.

Countries around the world regularly make revisions to their national accounts in the form of routine revisions (also called current revisions) to incorporate new information and more recent iterations of source data on a rolling basis in their quarterly and annual data estimation, which typically covers up to two preceding years. As regards routine GDP revisions, GDP is revised 1-3 times for most of the countries. India is the only country to report six releases- first and second advance estimates (FAE and SAE) followed by provisional estimates (PE) and then three revised estimates - first revised estimates (FRE), second revised estimates (SRE) and third revises estimates (TRE) in three successive years. Apart from current or routine revisions, statistical agencies undertake more fundamental revisions, from time to time, to incorporate methodological or definitional changes (including to incorporate changes in international principles of national accounting, such as the implementation of the 2008 System of National Accounts), to reflect changes in the structure of the economy, and to incorporate improved sources of data (such revisions are called benchmark and base year revisions).

The SNA provides an internationally agreed standard set of recommendations on how to compile measures of economic activity. The SNA describes a coherent, consistent and integrated set of macroeconomic accounts in the context of a set of internationally agreed concepts, definitions, classifications and accounting rules. In addition, the SNA provides an overview of economic processes, recording how production is distributed among consumers, businesses, government and foreign nations. The SNA is intended for use by all countries, having been designed to accommodate the needs of countries at different stages of economic development. It also provides an overarching framework for standards in other domains of economic statistics, facilitating the integration of these statistical systems to achieve consistency with the national accounts.

More fundamental revisions create breaks in national accounts time series. Such breaks are problematic because long time series for real GDP and other key variables are important for analytical purposes (such as modelling and forecasting) and for maintaining the economic history of a country. In these circumstances, many countries use statistical techniques to ensure the comparability of national accounts series over time. This process is generally referred to as backcasting.

There is currently no global best practice or standard for the backcasting of real GDP series and countries use a range of methods.[3] The most advisable approach in a country will depend

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[3] The statistics division of the UN Department of Economic and Social Affairs is currently developing a backcasting handbook, with input from the expert community, which is intended to provide advice and guidance. A draft version of the handbook (dated November 2018) is available at:

on country-specific circumstances, including the availability of time to conduct the exercise, statistical capacity (human resources), quality of source data, and the significance of changes that need to be backcasted. Also, the ability to disclose new and improved source data should dictate, to a certain extent, the backcasting approach, as transparency is critical for the credibility of the revised data series.

The recompilation of the national accounts database (or parts of it) from its elementary level using detailed source data or proxy information is one of the methods used for backcasting globally. Another widely used approach is the mechanical linking or splicing of the old and new (revised) national accounts data series, which requires some overlap in coverage between the two series. Other possible though less widely used approaches include estimation/modelling techniques and the metadata approach, in which the statistical agency does not attempt to link the series but provides users with entire data explaining the differences between the old and new national accounts databases (and thus leaves it up to users to compile their own backcasted data series).

In practice, most countries use hybrid approaches, which involve both recompilation of the national accounts series backward as well as linking/splicing. Broadly, countries with better source data that can be easily disclosed and verified, and stronger statistical capacity tend to rely more on recompilation, covering more sectors with this methodology and recompiling for longer periods backward. Countries with a less developed statistical apparatus tend to rely more heavily on linking/splicing. The United States, for instance, fully recompiles its national accounts series backwards when it undertakes benchmark and base year revisions. Australia has recompiled part of its series for recent years where source data was available, while using splicing for years further back. Similarly, Brazil has used a combination of recompilation and splicing for backcasting. At the other end of the spectrum, Bhutan has relied purely on mechanical methods to backcast its GDP series. Canada's statistics service, however, follows the metadata approach and does not provide a back series after fundamental national accounts revisions.

Russia has the latest base year 2016. Most of the advanced and emerging countries updated their base year to 2010 or later. Brazil, Thailand, Argentina, Peru and Turkey still use earlier years *viz.*, 1995, 2002, 2004, 2007, 2009, respectively, as base year.

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As regards some major differences in national accounts compilation, a few are worth mentioning. Among the major advanced and emerging market economies, India is the only country to follow financial year (April-March) instead of calendar year (January- December). Most of the countries use industry-of-origin (production-side) approach which deals with the sectors of the economy and compute gross value added (GVA) at basic prices. The United States is a major exception in this regard which estimates GDP exclusively using expenditure approach. Japan and Indonesia use both the production as well as expenditure approach. Additionally, while most countries use quarterly/monthly surveys, India relies on quinquennial surveys. In most countries except for India and Turkey, construction of quarterly GDP is done based on quarterly surveys. In India and Turkey, indicators-based approach is used to estimate quarterly GDP/GVA. Except for India and Indonesia, all major advanced and emerging economies officially report seasonally adjusted quarterly GDP series[4].

III.   Backcasting of National Accounts: Indian Experience

GDP estimation is not a stand-alone exercise. Various survey findings, indicators relating to output and prices are used directly or indirectly in the GDP estimation process. Since no regular accounts (annual or quarterly) are maintained in case of the unorganised segment of the economy, survey results (usually conducted during the benchmark year) serve as the base. Estimates for subsequent years are moved using relevant proxy indicators. In the latest base series (2011-12), the unincorporated segment of manufacturing sector is compiled using the effective labour input method using the 67th (Unincorporated Enterprise survey) and the 68th (Employment Unemployment survey) rounds of National Sample Survey (NSS) for the benchmark year. The benchmark estimates are moved using Annual Survey of Industries (ASI) growth rates for the subsequent years. Likewise, in case of construction, NSS 70th round of All India Debt and Investment Survey (AIDIS), 2013 and NSS 65th round Survey on Housing Conditions (2008-09) are used for estimating different components.

Until 1993-94, base year revisions were conducted every 10 years because of the decennial compilation of the work force estimates. After 1993-94, India started using the results of quinquennial (every five years) employment and unemployment surveys (EUS) for the base year revision, and latest series of all other relevant output and prices indicators such as consumer price index (CPI), wholesale price index (WPI), index of industrial production (IIP)

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4 Information based on a survey conducted by the Goldman Sachs on 20 advanced and emerging economies.

etc., reducing the gap in revisions to five years. This practice was broken in 2009-10 because this year was not considered a 'normal' year as it succeeded the global financial crisis of 2008. Hence, the next base year was fixed for 2011-12. The history of base year revisions of National Accounts in India is presented below (Table 1).

Table 1: Schedule of past base-year revisions

Base Year	Year Introduced
1948-49	1956
1960-61	1967
1970-71	1978
1980-81	1988
1993-94	1999
1999-2000	2006
2004-05	2010
2011-12	2015

With every revision of the base year, the NSO also undertakes the compilation exercise of the back series estimates to maintain completeness and comparability with old data sets. The rationale of compiling back series is to make use of newly available data and methodology which more accurately capture economic activities. Hence, whenever a new series of NAS is introduced with an updated base period, it is customary to link the old series to the series on the new base period. With increased frequency of base year revision, ensuring consistency in the data pertaining to macro variables has become very crucial. As a result, the issue of base year revision and back series compilation of various aggregates has become increasingly important and draws expert attention as it forms the basis of almost all spheres of economic research and analysis.

Changes in methodology in the light of SNA 2008 recommendations occurred in the following major areas. First, the SNA 2008 mandates estimation of gross value added (GVA), net value added (NVA) and related aggregates at basic prices[5] and GDP at market prices instead of GDP at factor cost as was the practice till 2004-05 series. Accordingly, valuation of GDP at factor cost is discontinued and replaced by GVA at basic prices for the year 2004-05 to 2011-12 in

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[5] As defined in SNA, the basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, plus any subsidy receivable, on that unit as a consequence of its production or sale; it excludes any transport charges invoiced separately by the producer. It includes subsidies and other taxes on production.

the latest series. Secondly, it calls for estimates for different institutional sectors, *viz.,* non-financial and financial corporations, both private and public, and general government and households including non-profit institutions serving households (NPISH). Other important changes include use of Ministry of Corporate Affairs database (MCA 21) for compilation of value added of the private corporate sector which also mark a shift from the establishment to the enterprise approach. And finally, as mentioned above, the latest available survey results are used in GVA compilation of the unorganised segment of industry and services sectors.

However, it was not possible to implement all these changes for distant years since new data sets required for compilation as per new methodology were not available. In addition, maintaining the growth rates at the component level and at each level of aggregation, would result in the components not adding up at the aggregate level. Accordingly, the estimation of the 2011-12 back series has been carried out separately for the recent period and for the past years using different methodologies.

i. **2004-05 to 2011-12**: For this period, adequate information is available for recompilation as per new methodology hence, the back series is compiled as per the methodology followed in 2011-12 series to the extent possible. As a result, for any particular year, growth rates differ in the two series.

ii. **Prior to 2004-05:** Adequate information is not available for distant past and, therefore, splicing method is used to compile the estimates at component-wise and aggregate level for this period.
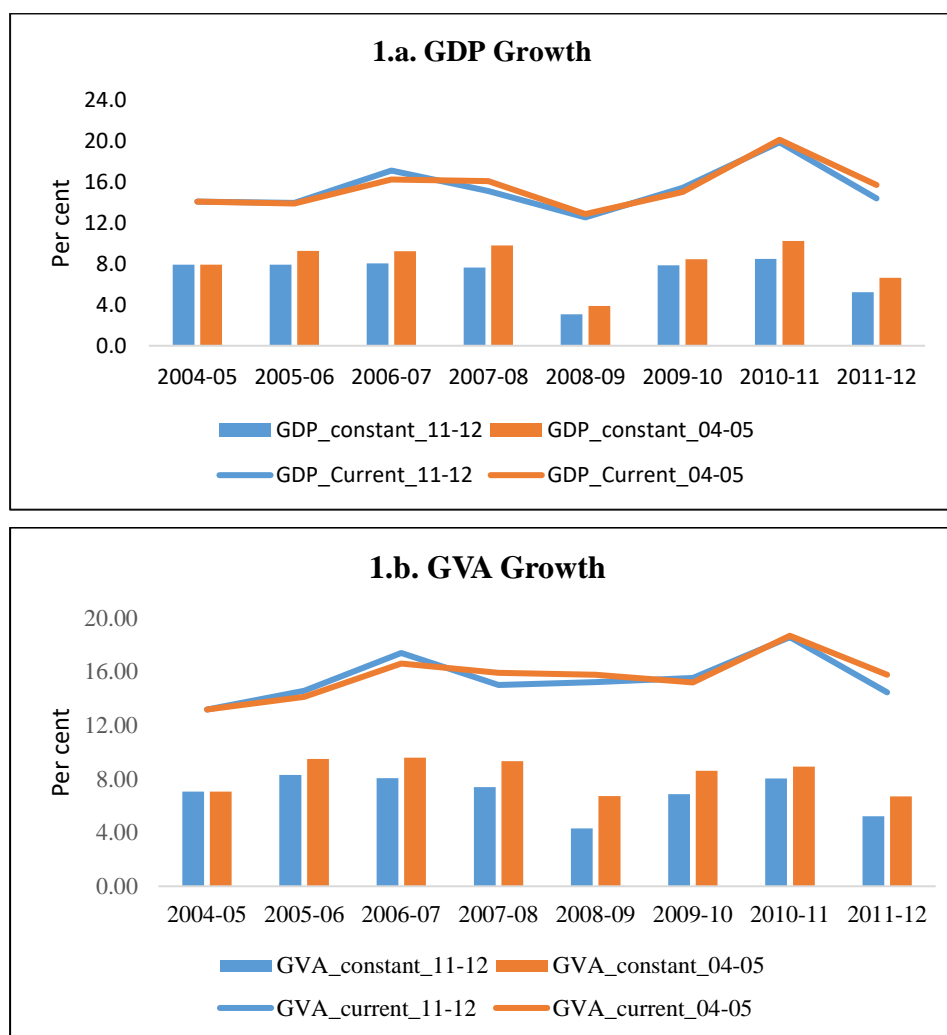
IV.   New series *vis-à-vis* Old series: An Analytical Comparison

In this section, we attempt to understand the divergence observed in the estimates of the new series (base: 2011-12) and the old series (base: 2004-05) series in light of the changed methodology and improved coverage in terms of use of new data. The controversies and debates among the users of national accounts data since the release of 2011-12 back series in November 2018, invite a deep delve into the two series – we not only analyse the growth rates at aggregate and sectoral level, but also certain issues which have frequently come up in recent discussions. In particular, this section covers the issue of large deflator in the 2011-12 series, high investment rate raising the question about efficiency of investment, limited use of MCA database in respect of private corporate sector for the overlapping period, larger revisions within the services sector, and finally estimation of net indirect taxes in the two series.

For the overlapping period (2004-05 to 2011-12) for which data are available on both 2004-05 series as well as 2011-12 series i.e., 2004-05 to 2011-12, the difference in the growth rates between the two series is minimal as far as estimates at current prices are concerned. However, at constant prices, the growth rate figures differ significantly.

The growth in real GDP/GVA for the period 2004-05 to 2009-10 is estimated to be lower in the 2011-12 base year compared with the 2004-05 base year series (Chart 1). The growth rate in the new series fell by as much as 2.1 per cent during the year 2007-08. The average growth during 2005-06 to 2011-12 declined from 8.8 per cent in the 2004-05 series to 7.2 per cent in the 2011-12 series which was marginally higher than the average GDP growth observed since 2014-15 (6.8 per cent).

Chart 1: GDP and GVA in the two series

Source: NSO.

Sectoral composition in new series also underwent a significant change. The share of agriculture and industry sectors increased on an average by 3.7 and 3.0 per cent, respectively while there was a commensurate decline in the share of services sector in the 2011-12 series over the 2004-05 series (Chart 2). Growth rates have been revised down across all the sectors in the new series, but the revisions in the services sector growth were notably high.
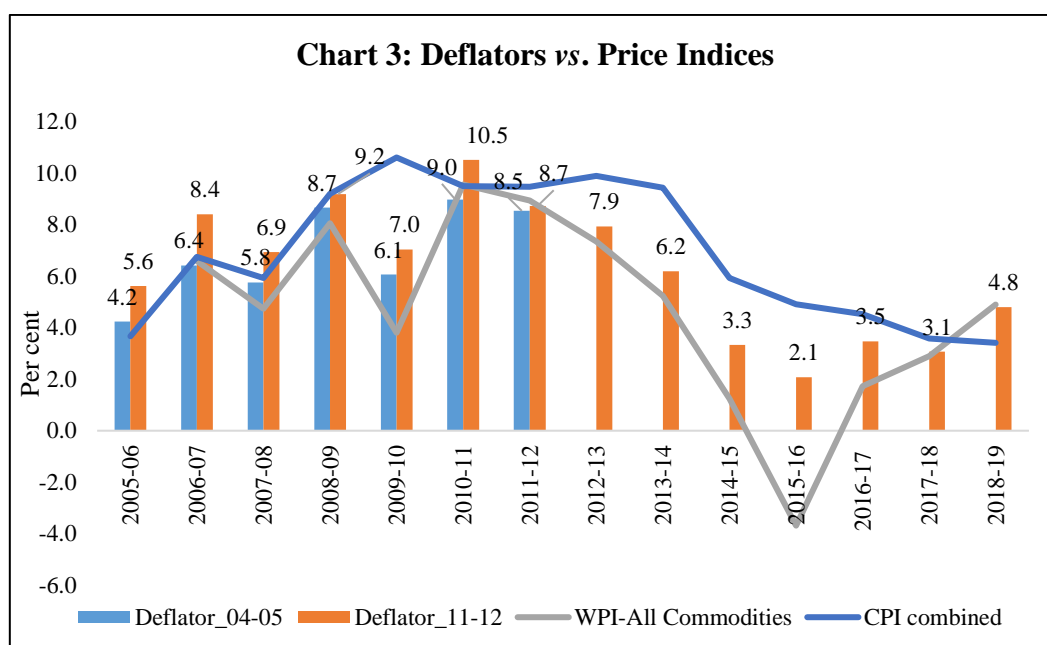
Chart 2: Sector-wise composition and growth

2.a. Agriculture

Share_04-05 Share_11-12 Growth_04-05 Growth_11-12

2.b. Industry

Share_04-05 Share_11-12 Growth_04-05 Growth_11-12

2.c. Services

Share_04-05 Share_11-12 Growth_04-05 Growth_11-12

Source: NSO.

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IV.1 Larger deflator in the 2011-12 series

The difference observed in GDP growth rates in current price and constant price certainly point towards the role played by deflator in the two series. The GDP deflators as well as all sectoral deflators in the new series are higher (Chart 3) compared to that in the 2004-05 series. The major difference between the deflators in the two series is that in the 2004-05 series, the estimates were prepared for the rural and urban which were estimated on the basis of consumer price index (CPI) general (Agricultural Labour-AL) and CPI general (Industrial worker-IW) respectively while combined CPI is used in the 2011-12 series. Also, it is observed that the divergence between the wholesale price index (WPI) and CPI, the two major constituent of GDP deflator has been more pronounced post 2011-12.

Chart 3: Deflators *vs*. Price Indices

Source: NSO and Office of the Economic Advisor, Department for Promotion of Industry and Internal Trade, Government of India.

Sector-wise, industry deflator is 1.6 percentage points higher in the new series while in case of services, the gap is one percentage point (Chart 4). Also, sector specific CPIs (for example, CPI for education) is being used for estimating GVA of education sector. The 2004-05 series used CPI (AL) and CPI (IW) relevant to each sub-sector. Therefore, use of more specific deflators in the new series is an improvement over previous base in terms of precision of the estimates.

India continues to use single deflator (price index like CPI, WPI or any other) in the manufacturing, construction and mining sector (Dholakia 2015) while countries like the USA,

Australia, Canada, France, Germany, Italy, Japan, Mexico and Brazil have switched to double deflators - using separate deflator for output and input. As per the IMF's Special Data Dissemination Standards (SDDS), India may have to work towards adopting 'double deflators' in GDP estimations by developing new price indexes.
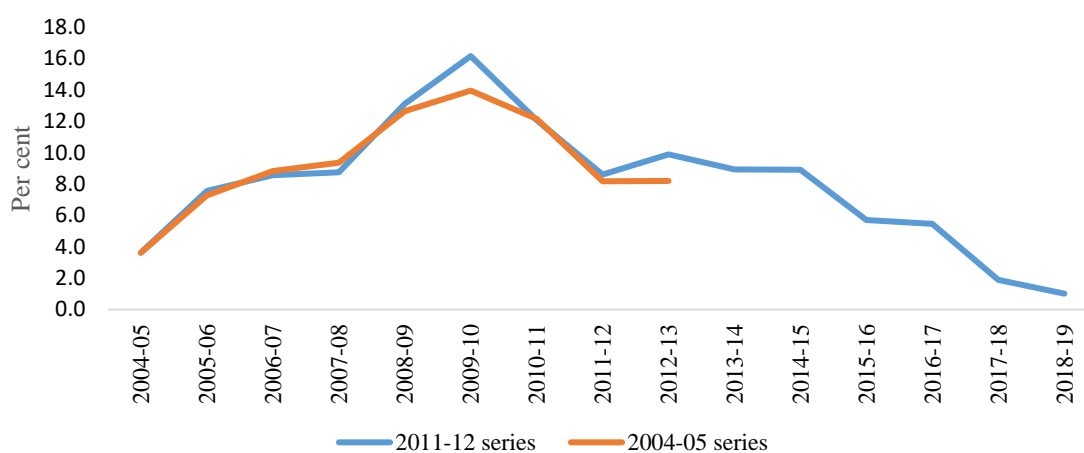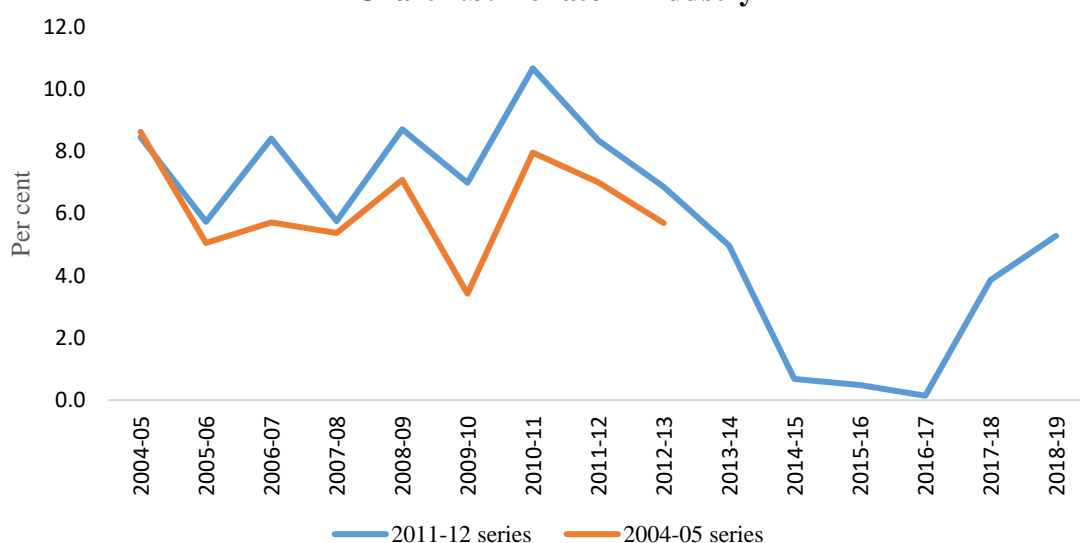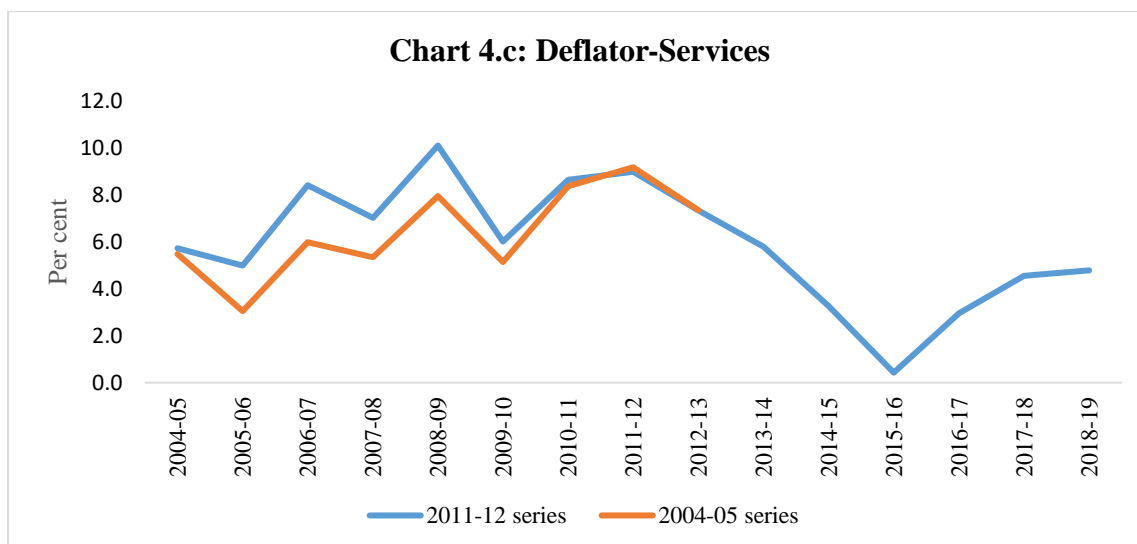
Chart 4.a: Deflator- Agriculture, Forestry and Fishing

Chart 4.b: Deflator- Industry
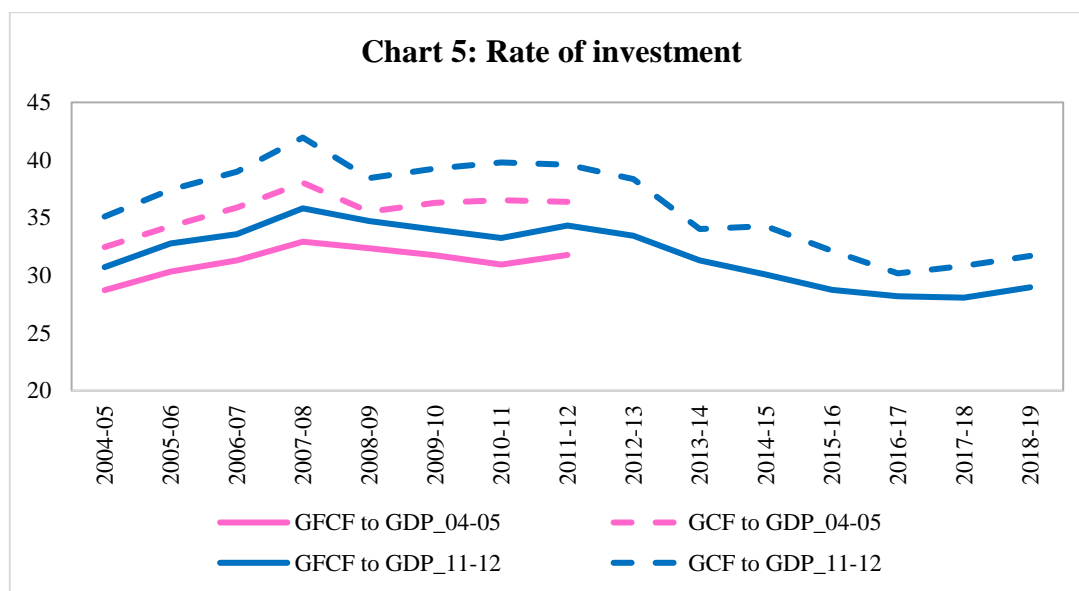
Chart 4.c: Deflator-Services

Source: NSO.
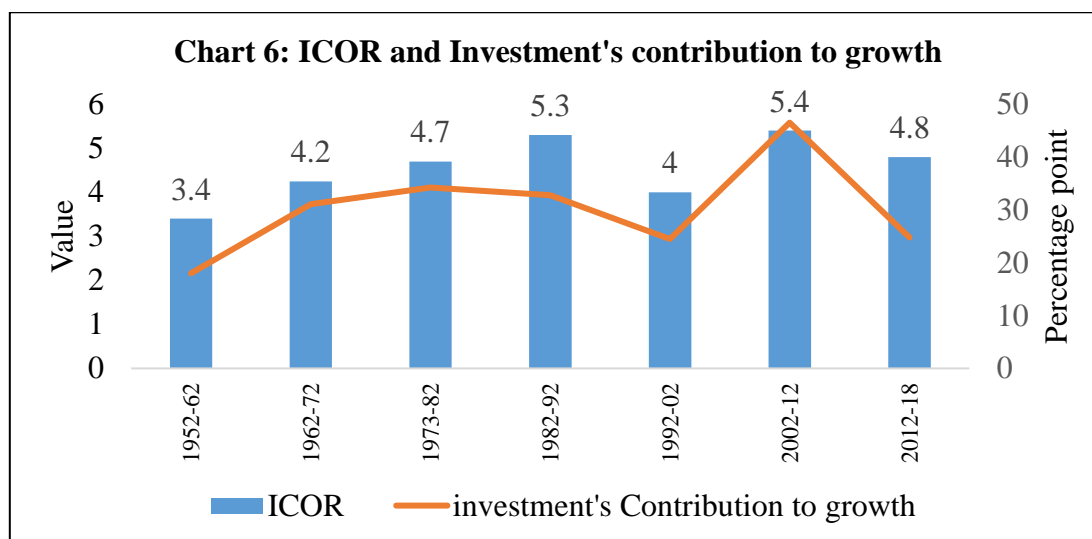
IV.2 *Efficiency of Investment*

Economic boom during the period 2004-05 to 2007-08 was marked as investment-led growth regime with share of GFCF in GDP reaching 33 per cent of GDP in 2006-07 from around 25 per cent the latter half of 1990s. In the revised series, rate of investment turned out to be even higher possibly due to downward revision in GDP level. This raises questions regarding efficiency of investment during the period.

Chart 5: Rate of investment

Source: NSO.

Historically, the incremental capital output ratio (ICOR) is considered as a measure of efficiency of investment, reflect an upward trend (Chart 6). Especially during the decade 2002 to 2012, ICOR was historically at its highest level, before it started to decline during the

subsequent period. Although the higher value of ICOR may reflect a shift towards higher capital intensity in production process as (investment's contribution to growth was also highest during the decade 2002-2012), it may be deduced that efficiency of investment has improved after 2011-12.

Chart 6: ICOR and Investment's contribution to growth

Source: NSO.

Industry-wise share of GFCF also presents some interesting picture. Share of agriculture as a recipient of GFCF (in current prices) remained stagnant whereas surprisingly the share of manufacturing in total GFCF gone down steeply overtime. Reduction in the share of machinery in GFCF share might be reflective of reduced share of GFCF going to manufacturing (Chart 6). Within services sector, except real estate, ownership of dwelling and professional services, all other sectors share in GFCF have increased. However, real estate, ownership of dwelling and professional services is one that registered highest growth rates along with trade hotels and restaurants despite continuous decline in its share in investment. Similarly, agriculture's share in total GVA has come down but share in GFCF remaining constant indicates towards inefficiency of factor inputs in this sector.

IV.3 Use of MCA database

The most highlighting change in the 2011-12 base year series is incorporation of MCA database as a major database for compilation of GVA of the corporate segment of the manufacturing and services sector. The MCA database with its massive coverage of over 17 lakhs registered firms is likely to provide better estimates for these sectors. The annual estimates of the organised segment of the manufacturing and services GVA are compiled using MCA data in the 2011-12 series. In case of manufacturing, change in data source also pertains to change

from establishment or plant level data to the enterprise level data. It has been anticipated that shift from establishment to enterprise level data may alter the composition of GVA of this sector. This is because enterprise approach of GVA estimation incorporates in addition to the product, the associated services rendered by the manufacturing firms while in establishment approach considered only the value added from the product.

However, in the back series (2004-05 to 2011-12), the use of MCA database has been limited because MCA database got stabilised in the year 2010-12 and hence it is not available for the earlier periods. Also, it has been indicated by the NSO that MCA data has not been used for compilation of manufacturing GVA in the 2011-12 back series. Compilation category-wise data from the ASI continued to remain as data source for estimation of manufacturing GVA. Given unchanged data sources for the organised manufacturing sector, the reduction in GVA level in the back series should come from the unorganised manufacturing (accounts for less than 20 per cent of total manufacturing GVA) which is estimated based on NSS surveys (67th and 68th round) of updated benchmark year.

IV.4 Revisions within the Services Sector

The services sector underwent major downward revision in the back series. Certain changes in estimation method of services GVA explain such revision to some extent. In the absence of any regular accounts, value added of the unorganised segment are usually estimated using surveys conducted on base year which is then moved forward by growth rates of some proxy variable. In the new series, the 68th round of NSS Employment-Unemployment survey data (2011-12) have been used to replace the earlier rounds (1999-2000 and 2004-05) for employment estimates. In the latest surveys, the employment estimates are substantially lower causing a downward level shift in the estimates of the unorganised services.

Another methodological change that took place in the estimation of GVA of this sector is the shift from 'Labour Input Method' to 'Effective abour Input Method'. The latter is an improvement as it assigns weightage according to labour productivity in contrast to the earlier method which assigned equal weight to all type of workers.

In case of trade, hotel and restaurants, there are major changes in data source for both organised and unorganised segments. In the earlier series, organised trade (both wholesale and retail trade) GVA were estimated based on sample studies undertaken by the Reserve Bank of India (RBI) while unorganised GVA was estimated for the base year using economic census and moved forward by Gross Trading Income (GTI) index worked out based on marketable surplus
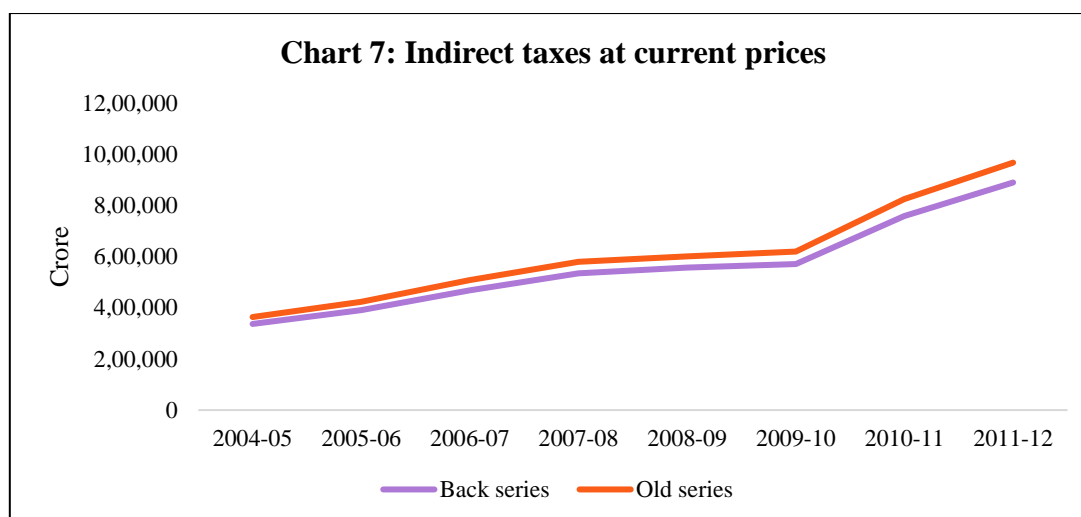
and trade margins of various commodities. In the 2011-12 base year series, MCA data has been used for organised trade and sales tax return goes into estimation of the unorganized counterpart. In the back series, estimation of organised trade is retained same as the 2004-05 since MCA data is not available before 2010-11. The unorganised sector GVA has been re-complied using sales tax returns in the backcasted series. The sharp contraction observed may therefore be attributed to unorganised trade alone.

Downward revision in financial services could be to some extent attributed to the change in the treatment of output of RBI. Earlier, the banking division of RBI was considered as market enterprise. In the new series, entire operations of the RBI are considered as non-market and GVA is estimated by cost method which led to lower estimates of GVA. Secondly, financial auxiliaries, which include regulatory authorities were not covered in the 2004-05 series. Financial auxiliaries are incorporated in the 2011-12 series, but their coverage is still low.
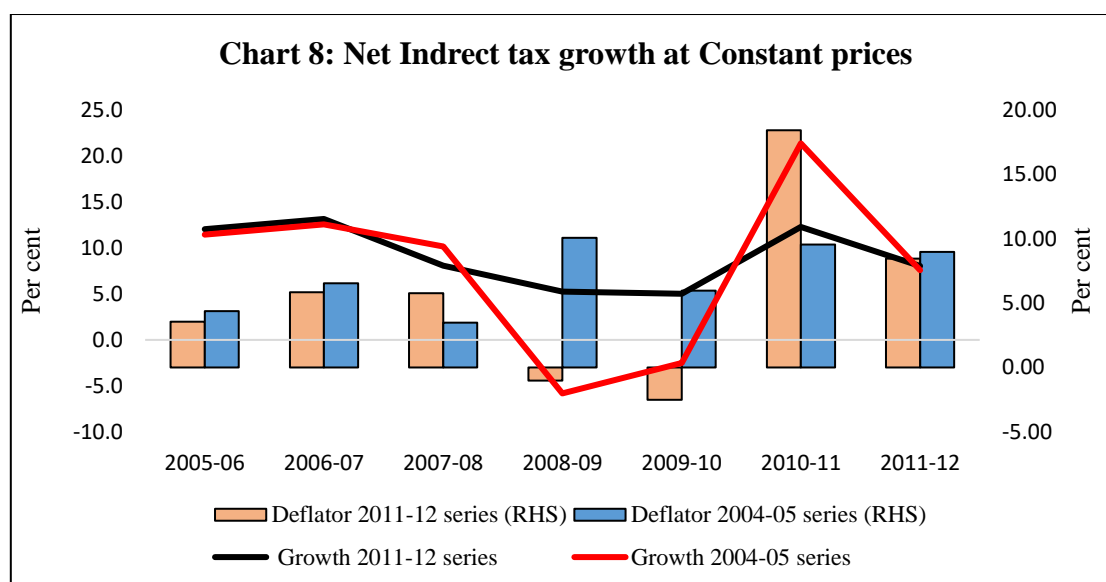
IV.5 Estimation of Net Indirect Taxes

Net indirect taxes (product taxes less of subsidies) are added to GVA in order to arrive at GDP at market prices. It is evident that there is downward level shift in indirect taxes despite tax revenue collection being firm data (Chart 7). The reason for this downward shift is that net indirect taxes in 2011-12 series only comprised of product taxes while production taxes are, by definition, become a part of GVA at basic prices.

At constant prices, the changes are even more striking. Growth in net indirect tax collection seems to be relatively stable in the 2011-12 series as compared to 2004-05 series (Chart 8). However, the deflators of net indirect taxes remained largely volatile in the back series. As per the methodology outlined by the NSO, the constant price estimates of indirect or product taxes are obtained by moving forward the base year tax collection using growth rates of imports, manufacturing and services while subsidies are deflated using GDP deflator to arrive at constant prices estimates. With downward revision in both manufacturing and services growth rates in the 2011-12 back series, growth in indirect tax at constant prices was also expected to be lower. However, during 2007-08 to 2009-10, the estimates were actually higher due to very low deflator during those years.

Chart 7: Indirect taxes at current prices

Source: NSO

Chart 8: Net Indrect tax growth at Constant prices

Source: NSO.

V.   Relationship with Other Macroeconomic Indicators

Another controversy relates to the new growth figures portraying an inconsistent picture with other macroeconomic indicators during that period. Indian economy experienced a boom during the period 2003-04 to 2007-08 which was also reflected in almost all other indicators of economic activity. In other words, strong co-movement could be observed between GDP and other sector-specific indicators (IIP and auto-sector indicators) as well as indicators of overall economic activities (exports, imports, credit growth, *etc*.). However, credit growth, tax revenue growth, external trade, corporate sales and profit *etc.* presented an ebullient scenario which appeared to be inconsistent with the lower growth numbers in the 2011-12 series. In this section, we scrutinise some of these relationships.

The dynamic correlation between GDP and a few macroeconomic indicators is examined by performing rolling window[6] correlation analysis with a fixed window of twenty quarters to examine the changing relationship between GDP and macroeconomic indicators (Chart 9). The indicators are clubbed together according to nature of the relationship with GDP growth portrayed by the indicators. IIP, IIP manufacturing, foreign tourist arrivals and domestic air passenger traffic growth are some of the indicators which display a robust relationship with GDP. But even these indicators do point to a weaker relationship since the window started including quarters of 2011-12 and later. The reason for lower correlation with IIP in the 2011-12 series is that unlike 2004-05 series, IIP was no longer major the indicator for estimating manufacturing growth. In 2011-12 series, corporate results of the listed companies are used for the organised manufacturing whose share is above 80 per cent of total manufacturing GVA. IIP is used only for the unorganised manufacturing whose share is less than 20 per cent. Therefore, lower representation of IIP in the GDP estimation have led to weaker correlation with GDP in the 2011-12 series.

Automobile sector indicators such as commercial vehicle sales, passenger vehicle sales, motorcycle and two-wheeler sales which are crucial indicators of consumption demand in the economy also present similar picture. Auto sector indicators too shows weaker correlation post 2011-12 although there are no methodological changes in the estimation of transportation GVA and the same set of indicators being used in both the series.

Another set of indicators such as railway passenger traffic, IIP mining and IIP electricity does not present any specific pattern over time and the correlation remained volatile during the entire period under consideration. Finally, exports, imports, non-food credit growth which are considered as major indicators of overall demand and economic activities show strong correlation with GDP for the period prior to 2011-12. However, the correlation breaks down completely, and even turned negative for the subsequent quarters in 2011-12 base series. Faster proliferation of other institutions such as non-bank financial institutions, mutual funds in the credit market is a major factor behind deterioration in correlation post 2011-12. The share of bank loans in credit to the commercial sector was around 56 per cent and that of non-bank sources of credit (commercial paper, corporate bonds and external commercial borrowings),

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[6] Rolling correlations are simply applying a correlation between two time series for a subset of the total observation at a time. The window can be either fixed or expanding to gradually cover the entire period. The advantage of rolling correlation is that we can visualize the change in correlation over time. Also one can distinguish impact of certain event which led to significant changes in the relationship between two variables.

44 per cent in 2011-12. By 2017, the trend has reversed, and banks' share had plummeted to around 38 per cent while that of non-bank sources rose to 62 per cent (Nair *et.al*). Worsening correlation between GDP growth and exports and imports growth are also reflective of the muted contribution of exports and imports to GDP growth post global financial crisis and domestic sectors of the economy has since been the driver of growth.

Chart 9.1: Relatively Robust Indicators
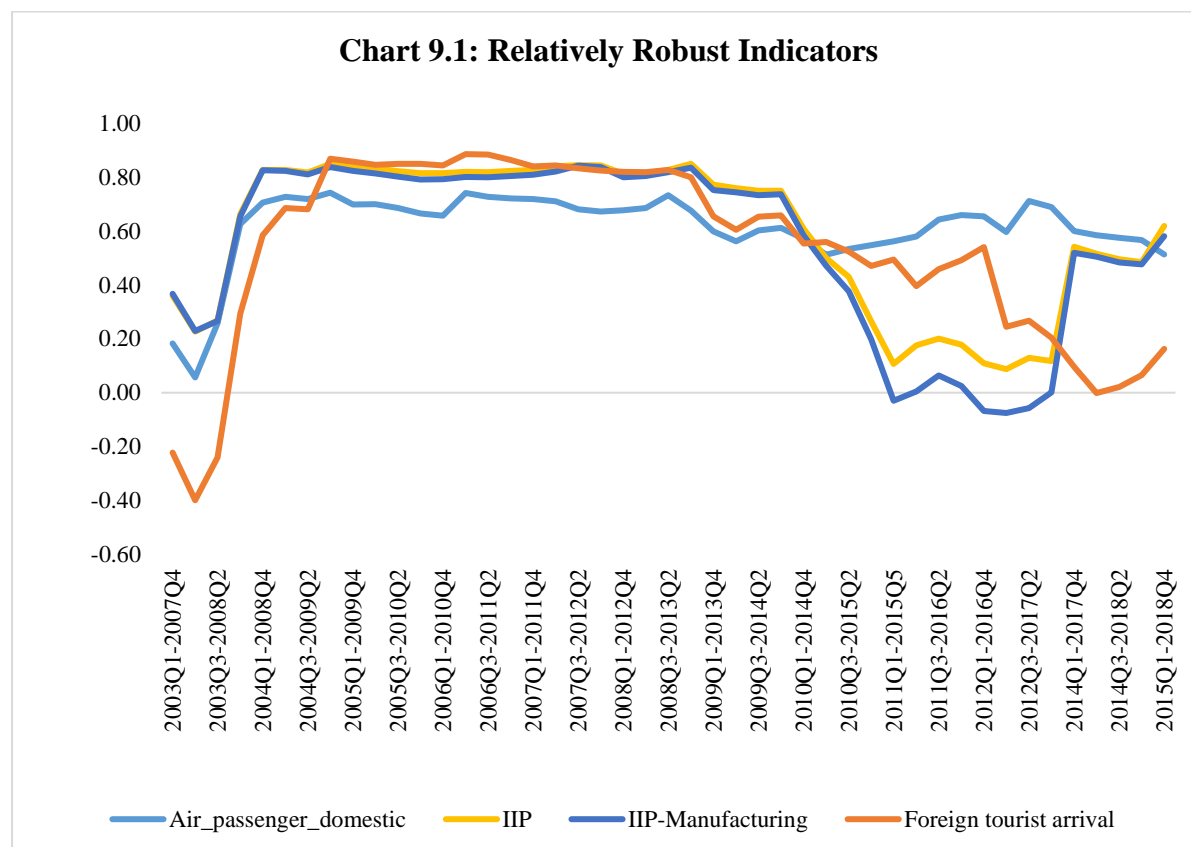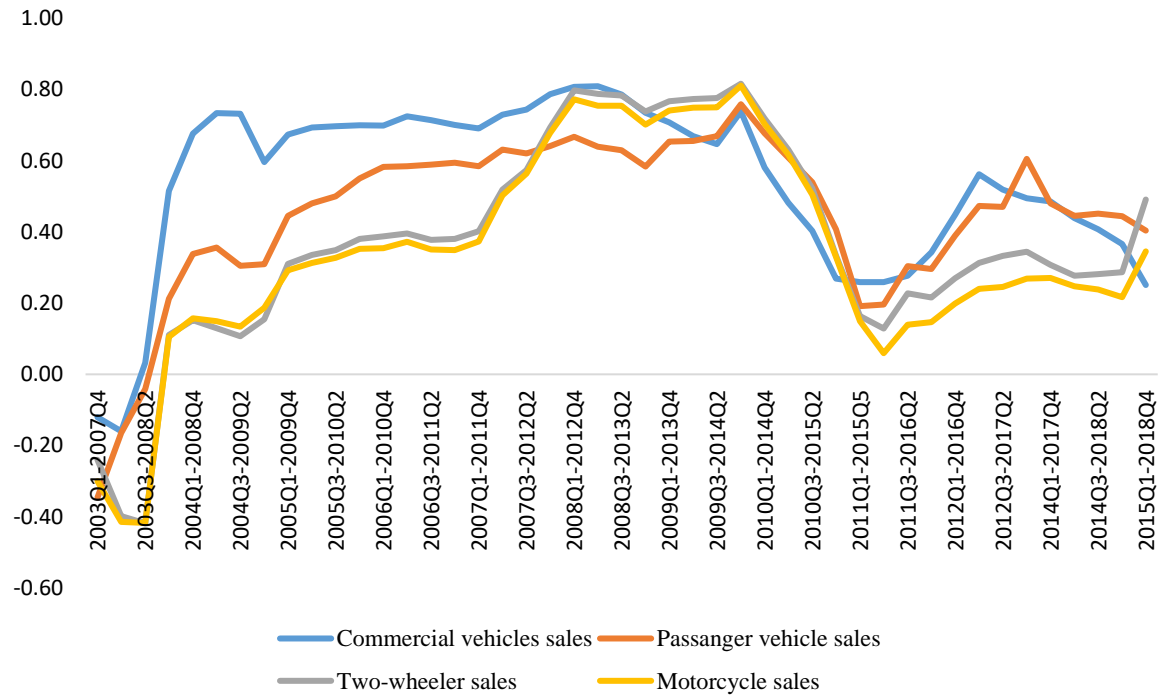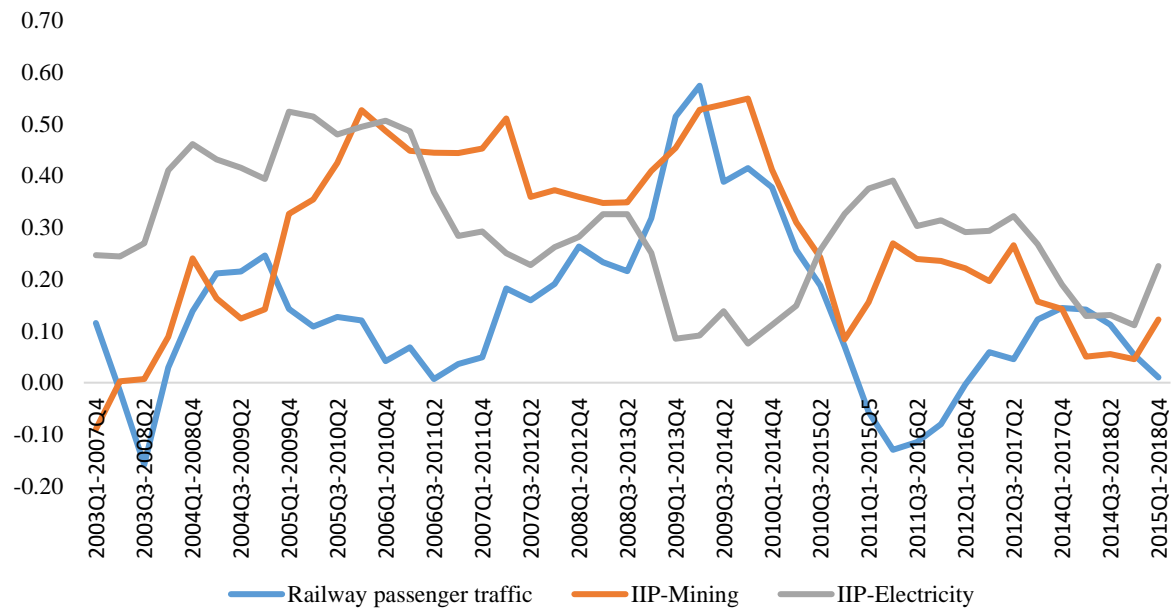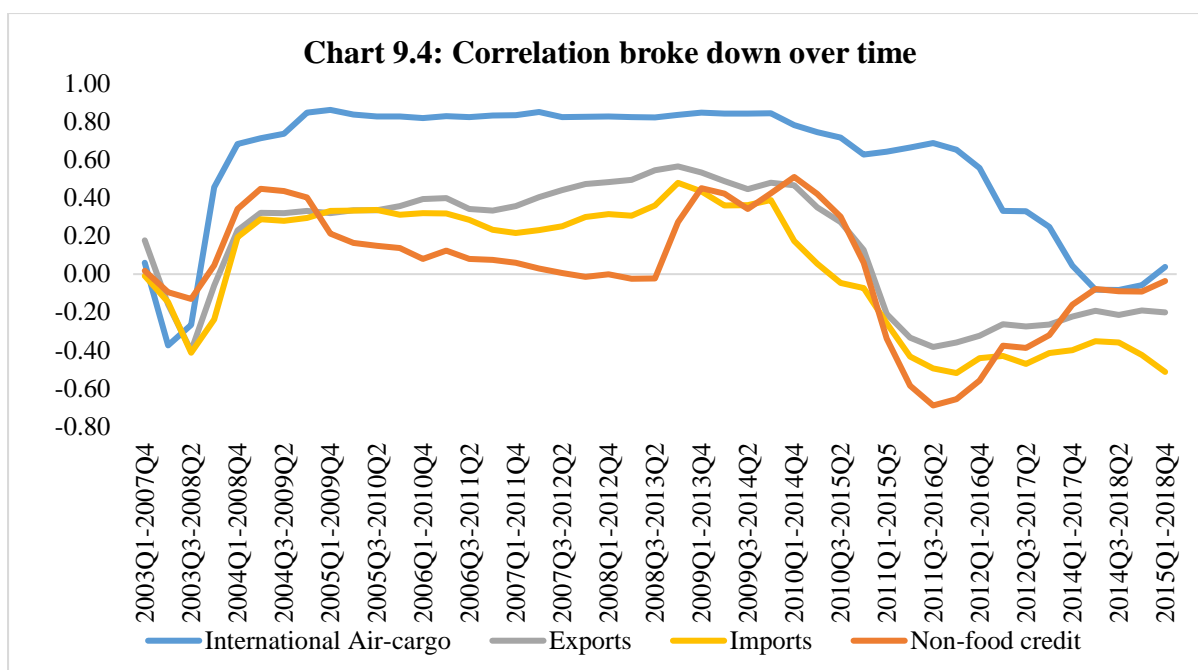
Chart 9.2: Auto-Sector Indicators

Legend: Commercial vehicles sales, Passanger vehicle sales, Two-wheeler sales, Motorcycle sales

Chart 9.3: Volatile Indicators

Legend: Railway passenger traffic, IIP-Mining, IIP-Electricity

Chart 9.4: Correlation broke down over time

Legend: International Air-cargo — Exports — Imports — Non-food credit

Thus, lack of coherence between GDP with other indicators raises questions on 2011-12 series which cannot entirely be explained by methodological changes. Given the fact that most of these indicators goes into compilation of GDP as well as projection of GDP growth by various agencies, misalignment of trend in GDP growth and other set of indicators remains a concern.

VI.   Concluding Observations

Based on the above analysis, we find that the revised figures in the back series reflect mostly the effect of use of newly available data sources as well as conceptual and methodological improvements and thereby, demonstrate better picture of the economy. Going forward, the cross-country experience of national account measurements presented above provides some valuable insights for our national accounts estimation and revision exercise. The cross-country experience suggests that despite several improvisations introduced during the base revision, there is still ample scope of improvement in a number of areas including inter alia increasing frequency of surveys, and construction of an official seasonally adjusted series.

Comparison of the two series with 2004-05 and 2011-12 base years shows some differences in the growth rates particularly in constant prices. Base revision has also led to major changes in the shares of the different sectors of the economy as well as their growth rates reflecting their growing /declining role in the economy. However, certain grey areas such as possible underestimation of the secondary sector especially manufacturing, larger deflator, movement in. net indirect taxes, non-alignment with other indicators *etc.* remains which require

justification on part of the compilers. There is no question regarding credibility of the NSO as an official co-ordinator of statistical activities in the country. Also, there are clear evidence of sound expertise and sincere that effort had gone in the revision exercise from very granular level. However, from user's point of view, availability of more background information which goes into compilation of each sector would be much helpful for better understanding of the economy.

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Annex Table I. Share and Growth Rate - Sector wise

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	
Share in GDP (2004-05 series)									
Agriculture, forestry & fishing	19.0	18.3	17.4	16.8	15.8	14.6	14.6	14.4	
Industry	20.2	20.1	20.7	20.6	20.1	20.4	20.3	20.3	
Services	60.7	61.7	62.0	62.5	64.1	64.9	65.1	65.3	
Share in GDP (2011-12 series)									
Agriculture, forestry & fishing	22.6	21.9	20.9	20.5	19.6	18.2	18.3	18.5	
Industry	22.4	22.4	23.7	23.6	23.4	24.0	24.1	22.9	
Services	54.9	55.6	55.4	55.9	57.0	57.8	57.6	58.6	
Growth Rates (2004-05 series)									
Old Series	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	Average
Agriculture, forestry & fishing		5.1	4.2	5.8	0.1	0.8	8.6	5.0	4.2
Industry		8.5	12.9	9.2	4.1	10.2	8.3	6.7	8.6
Services		10.1	14.3	10.3	4.3	11.3	8.9	7.4	9.5
Growth Rates (2011-12 series)									
Agriculture, forestry & fishing		4.8	2.9	5.5	-0.2	-0.9	8.8	6.4	3.9
Industry		8.4	14.2	6.7	3.4	9.6	8.6	0.1	7.3
Services		9.7	7.6	8.4	6.4	8.4	7.6	7.0	7.8

Annex Table II. Services GVA at Current Price

Sectors		2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Trade & repair services	Old Series	433967	513238	609623	705025	813503	923004	1143104	1330489
	Back series	272046	315530	374306	422836	480934	542511	666811	793681
Hotels & restaurants	Old Series	43336	53691	65724	78222	81894	87228	107368	127076
	Back series	30362	36649	44319	52108	55860	60782	75400	89901
Railways	Old Series	29162	30771	37429	43608	47478	55571	56877	62710
	Back series	28601	30555	36759	42473	46376	53681	55464	61150
Other means of transport	Old Series	169995	192716	224389	254404	289327	325126	387533	456754
	Back series	131453	152378	172506	188183	208804	230811	279020	337347
Communication & services	Old Series	49280	54035	58694	66069	75430	86483	80099	89747

related to broadcasting	Back series	62352	71354	82652	96567	109958	121796	110779	125930
Financial services	Old Series	171098	184118	217196	251195	298931	331793	410407	481495
	Back series	147718	180851	228107	266110	315614	347819	427102	480226
Real estate, ownership of dwelling & professional services	Old Series	502799	578308	668439	779067	943680	1112536	1328566	1556114
	Back series	381137	430240	495890	583601	688776	784722	916683	1050651
Public administration and defence	Old Series	174638	189827	206081	234992	306653	403641	442120	498346
	Back series	175040	190538	207404	236404	304702	396920	435761	491155
Services Total	Old Series	1805110	2067493	2412524	2804206	3311143	3830052	4532259	5298025
	Back series	1661092	1912763	2231256	2588413	3031615	3483299	4070842	4747310

Annex Table III. Sector wise share in GFCF						
Sectors	**2004-05**	**2007-08**	**2009-10**	**2012-13**	**2014-15**	**2016-17**
Agriculture, forestry and fishing	8.0	7.2	8.6	8.0	8.6	7.6
Mining & quarrying	3.9	4.5	3.7	2.3	1.8	1.5
Manufacturing	31.0	33.8	27.5	17.2	17.0	18.7
Electricity Gas, water supply and other utility services	5.6	5.8	6.5	9.3	8.9	9.1
Construction	5.6	5.8	4.3	6.5	3.7	4.2
Trade, repair, hotels & restaurant	5.9	6.9	8.2	10.7	9.0	7.9
Transport, storage & communication & services related to broadcasting	7.3	6.3	9.0	7.9	6.3	9.9
Financial services	0.6	0.8	0.5	1.0	1.1	1.1
Real estate, ownership of dwelling and professional services	32.1	29.0	31.8	24.2	28.7	22.6
Public administration & defence	9.0	9.1	9.8	8.1	9.2	10.1

Annex Chart 1: Industry-wise growth rates in back series *vis-à-vis* old series

a. Food, Beverages and Tobacco

b. Textile, Apparel and Leather

c. Metal, Machinery and Equipment

d. Construction

e. Financial Services

f. Real estate, ownership of dwelling and professional services