NATIONAL COUNCIL OF APPLIED ECONOMIC RESEARCH

Working Paper: WP 107

Domestic Product at Current and Constant (2004-05) Prices in India: Issues in Estimation of Communication Sector

Prepared by

Kanhaiya Singh[1] and R. P. Katyal

APRIL 2015

Domestic Product at Current and Constant (2004-05) Prices in India: Issues in Estimation of Communication Sector[12]

Kanhaiya Singh[3] and R. P. Katyal[4]

Synopsis

This paper examines the estimation procedure of domestic product for communication sector in India at constant prices. It is observed that the methods used for estimating domestic product at constant prices suffer from serious flaws with respect to communication sector. When corrected by using a simplified method, it is found that the growth in real terms in communication sectors during 2004-12 is much lower than the reported figures. The average annual real growth in communication sector works out to be almost zero instead of about 23 per cent as reported in National Accounts Statistics during 2004-12. As a result, the overall growth during this period gets moderated to 7.97 per cent from the reported figure of 8.45. Thus, the opinion that communication was major driver of growth in India seems to be exaggerated. In addition the observed inconsistency calls for a need of statistical audit to fine tune the statistical system and make it more responsive to dynamics of economic developments.

JEL Classification: E01

Keywords: Domestic Product, Communication Sector, India

[1] This paper was prepared for conference organised by Indian Association of Research in National Income and Wealth, to be held on 6-7 March 2013 at Ahmedabad.

[2] The opinions expressed in this paper are exclusively those of the authors and in no way it should be linked to the institutions to which authors are or have been affiliated

[3] Senior Fellow, National Council of Applied Economic Research, New Delhi

[4] Former Head, NAD, CSO Government of India

1. INTRODUCTION

The National Accounting System has a tradition of estimating and reporting national income in nominal as well as real terms. While nominal income is estimated at current prices, the real income is estimated at constant prices with respect to a base year. Estimation of income at constant price is important in its own right from the point of view of measurement of aggregate real progress (growth) in economic activities and welfare of population. The idea behind estimating real income is to eliminate the effects of changes in prices of commodities over time. However, while estimation of nominal income is relatively less problematic because of the availability of data at actual prices, estimating national income at constant prices is fraught with several problems including the procedure of aggregation, indexing to base year, and so on.

The current national accounts series in India uses 2004-05 as the base year for which estimates of value added are produced meticulously. However, for producing estimates for subsequent years, there is no uniform procedure to estimate different components either at current prices or constant prices. In several cases the current as well as constant price values are obtained by projection. Several such projections are backward looking because of the use of survey data of previous years. Some of the projections are made using proxy variables. If such proxies are not selected meticulously, the projections run the risk of producing distorted estimate.

Normally, it would be desirable to estimate the current values first and then apply deflators to obtain the constant price values. However, at times reverse process is also adopted where the constant price series is obtained first using quantum indices and then price index/deflator is used to obtain the current price series. Such practices require extra caution as it may lead to distortions in extrapolated series. It appears that the National Accounts Division (NAD) of the Central Statistical Organization (CSO) uses mix of price and quantum indicators for obtaining nominal and real values (see CSO_GOI (2010)).[5]

Importantly, in the case of communication it is observed that for several components, the current and constant price series are estimated independently. As a result there are observable anomalies in the two series. For example, the estimates at constant prices are more than the estimates at current prices for several years, which is contrary to the expectation. There are several other indications of distortion in both current as well as constant price series. Therefore, there is need to examine these sectors for the procedure applied on them and re-estimate the same to find out the variations in real domestic products of these sectors as also the aggregate economy. The rest of the paper is organised as follows. In Section 2 attempts has been made to document some of the evidences that point towards problem in estimates. Section 3 presents critique of the methods that could lead to distortions observed in Section 2. In Section 4 attempt has been made to estimate constant price series using a crudely simplified method to demonstrate plausible state of real economy in communication sector and the effect of such re-estimate on the overall gross domestic product (GDP) of the country. Concluding remarks are made in Section 5.

[5] CSO published document on sources and methods of National accounts in 2007 (CSO_GOI 2007) and 2012 (CSO_GOI 2012) and details of structure was published in 2010 (CSO_GOI 2010).

2. ISSUES AND INCONSISTANCIES IN ESTIMATES

The reported time series data for the communication sector throws several challenges to its interpretation. The change of base year leaves the user of the data perplexed due to huge variations. Some of such mind teasers are presented below.

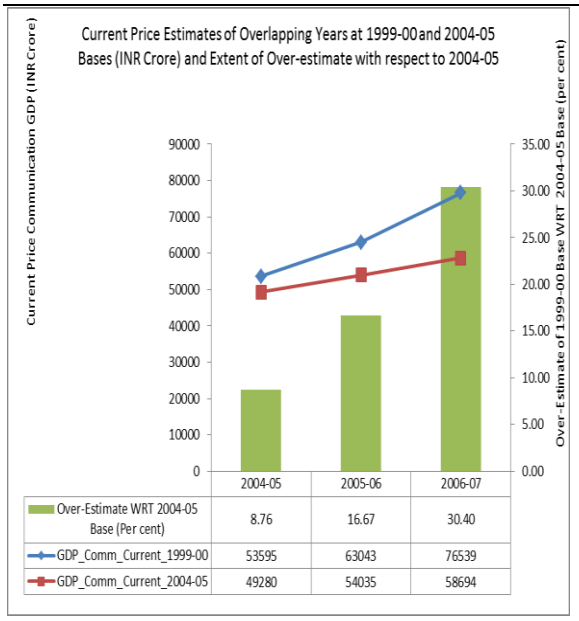
2.1 Wild Variation in estimates of overlapping periods under consecutive Base Years of 1999-00 & 2004-05

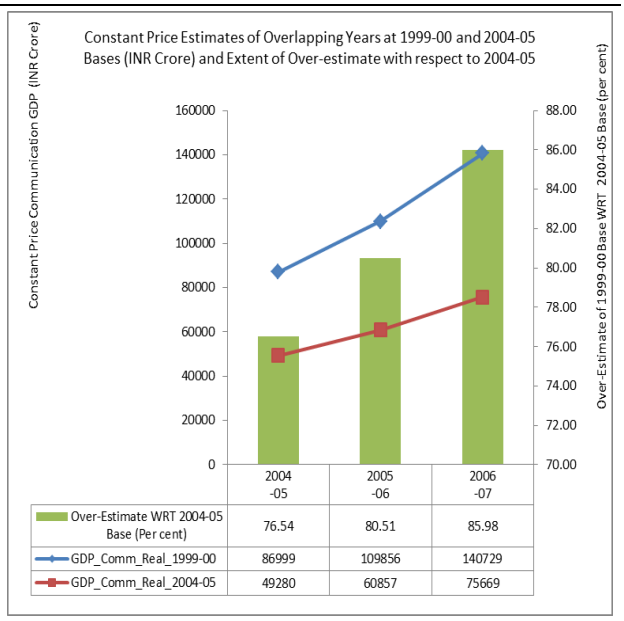
One of the key reasons to revise the base year for time series of national accounts more frequently (five year interval) is to capture the dynamics of product development, productivity, profitability, consumption behaviour and obsolesce without disrupting the time series violently. Within a short period of five years such changes are expected to be minimal and it is expected that revising the base year would produce a reasonably smooth series at current price values.

However, an examination of the overlapping period data with respect to communication sector indicates wild variation in both current price series as well as constant price series (Figure 1). Data for the overlapping periods of 2004-05 to 2006-07 indicate that the gap between 1999-00 base and 2004-05 has increasing trend. For 2006-07 the estimates at current price with 1999-00 base are 30.4 per cent higher than that estimated with 2004-05 as base year. More importantly this gap is 85.98 per cent with respect to constant price estimates.

The reason for such huge variation cannot be attributed to changes in economic structure alone. The corrections applied at the base years are also large. For example, for the period of 2004-05, the current price is adjusted to the extent of 8.76 per cent while constant price adjustment is of the order of 76.54 per cent. Clearly, it is hard to justify such adjustments.

FIGURE 1: DIVERGENCE IN ESTIMATES OF OVER-ESTIMATE OF COMMUNICATION GDP DURING OVERLAPPING PERIODS OF 1999-00 AND 2004-05 BASES





Source (Basic data): National Accounts Statistics, CSO (various)

2.2 Constant Price GDP Consistently Higher than Current Price GDP despite Positive Inflation

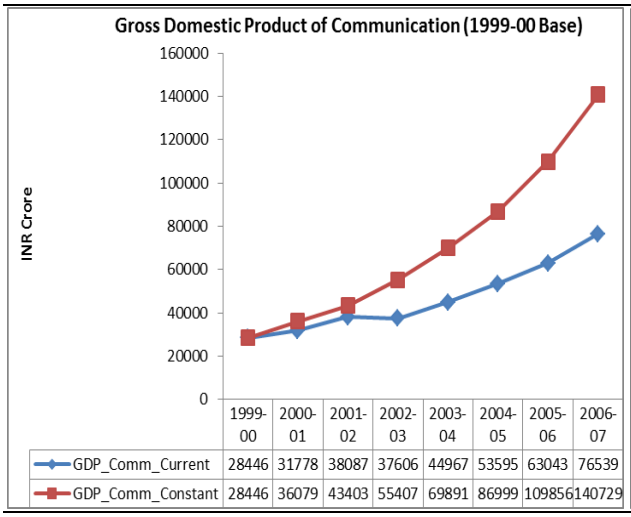
Figure 2 presents the reported time series estimates of communication GDP at current and constant prices corresponding to 1999-00 and 2004-05 base years. It is observed in both cases that the constant price series is much above the current price series. This is possible under situation where (1) general inflation in the economy is negative such that the real wages and real operating surpluses are increasing more than the nominal values; or (2) operating surpluses have negative downward trend while real wages have upward trend. In other words, the establishments are making losses year after year. Both possibilities are ruled out. Wholesale price index based and consumer price index based inflations in the country are positive. The two indices are rising for both the periods (Figure 3). It may be noted that these indices are used by the NAD to deflate the current price estimates in some of the components but not all. Therefore, possibility of error in computation and/ or selection of proxy variable for extrapolation of the base year estimate to subsequent years cannot be ruled out.

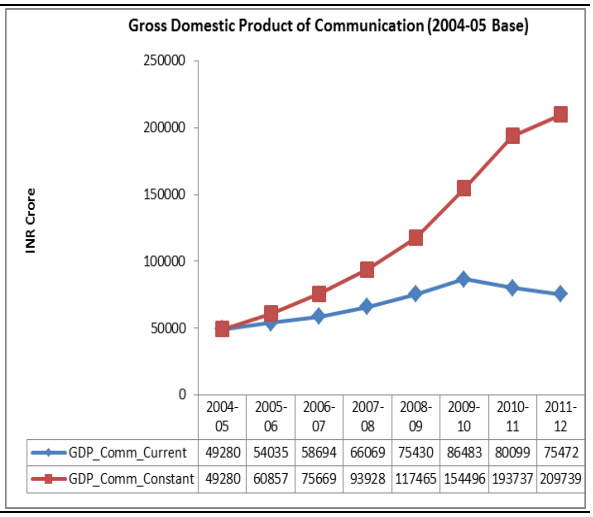
It is also observed that both private as well as public sector estimates suffer from the problem of higher constant value estimate as compared to current value estimates (Figure 3). This shows that the possibility of error may be more because of conceptual inconsistency that runs across various components of communication sector.

In the case of the 1999-00 series, the constant price estimates of private communication are prepared first and the current price estimates are derived by superimposing the price indicators. As such constant price estimates of the unorganized part cannot be more than the current price estimates.

Such inconsistent estimates have organisational implications also. The Compensation of Employees (CE) in Communication forms about 50 per cent of the GDP. To compensate for inflation Dearness Allowance is paid to the employees. Since at constant prices the GDP is more than the current prices, it can be argued that instead of compensating for inflation the salary and wages should be reduced every year because underlying inflation is negative for these activities.

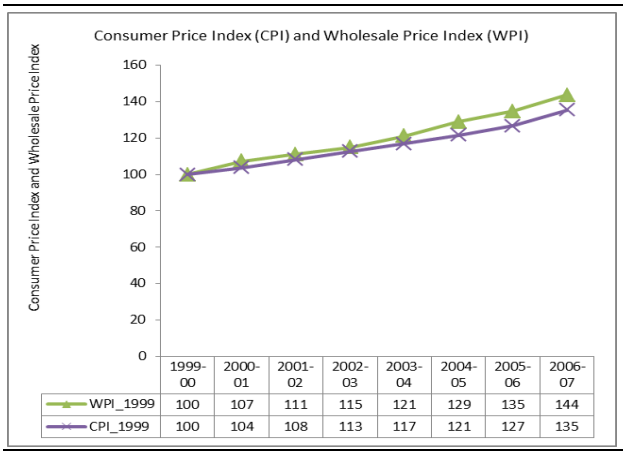
FIGURE 2: GROSS DOMESTIC PRODUCT OF COMMUNICATION SECTOR WITH 1999-00 AND 2004-05 BASE YEARS AT CURRENT AND CONSTANT PRICES AND ITS CONTRIBUTION TO TOTAL GDP



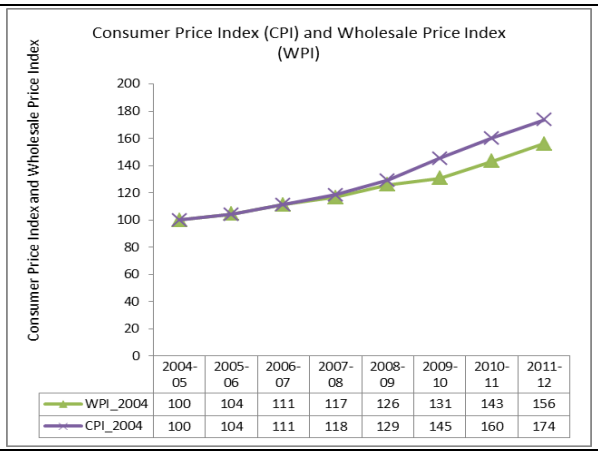


Source (basic data): National Accounts Statistics, CSO (various)

FIGURE 3: MOVEMENTS IN WHOLESALE AND CONSUMER PRICES INDICES DURING 1999-00 AND 2004-05 BASE YEARS



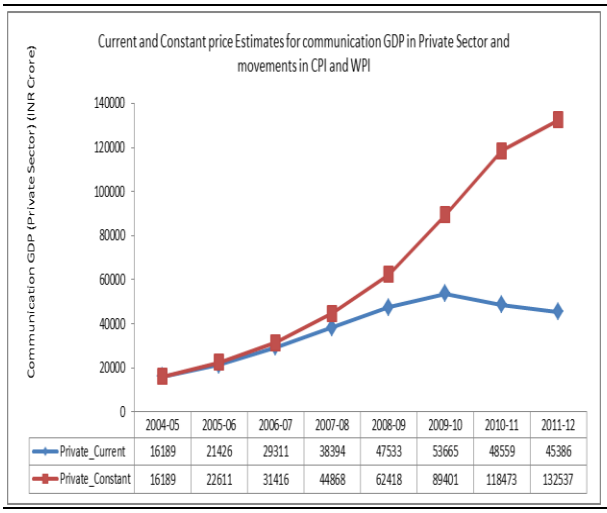
	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
WPI_1999	100	107	111	115	121	129	135	144
CPI_1999	100	104	108	113	117	121	127	135



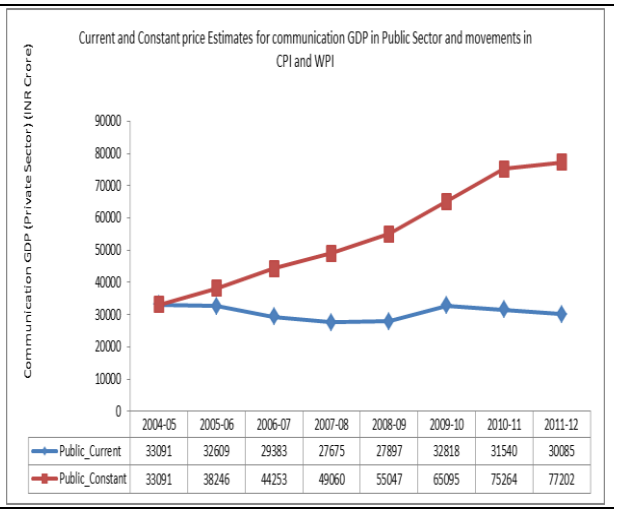
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
WPI_2004	100	104	111	117	126	131	143	156
CPI_2004	100	104	111	118	129	145	160	174

Source (basic data): RBI handbook (RBI 2013)

FIGURE 4: CURRENT AND CONSTANT PRICE ESTIMATES OF COMMUNICATION GDP IN PUBLIC AND PRIVATE SECTORS



	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Private_Current	16189	21426	29311	38394	47533	53665	48559	45386
Private_Constant	16189	22611	31416	44868	62418	89401	118473	132537



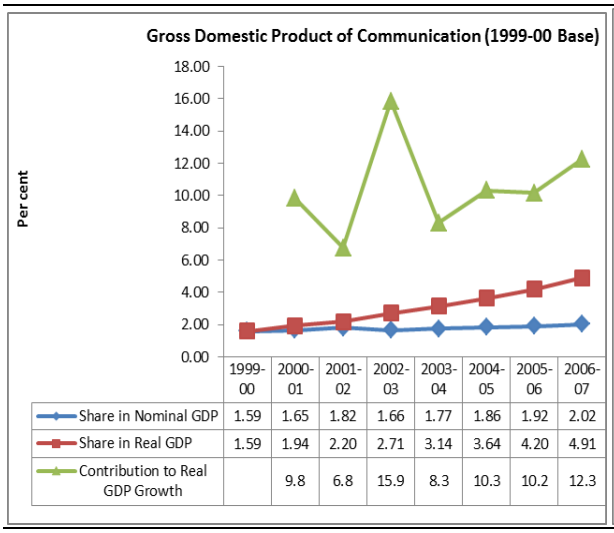
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Public_Current	33091	32609	29383	27675	27897	32818	31540	30085
Public_Constant	33091	38246	44253	49060	55047	65095	75264	77202

Source (basic data): National Accounts Statistics, CSO (various)

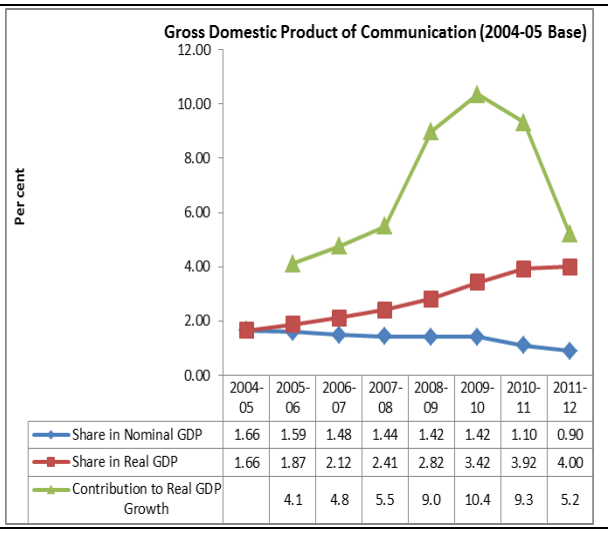
2.3 Disproportionate Contribution to Total Growth at Constant as well as Current Price

It is not only that the constant price estimates is higher than the current price estimates, the growth of the constant price estimates also seems to be extra-ordinary. During the base years the contribution of communication GDP to total GDP is about 1.6-1.7 per cent, which very quickly increases to 4-5 per cent and as a result the estimated contribution of communication sector in total growth of the economy rises to the extent of 10 per cent (Figure 5). This is too high for a small sector. The adjustment done for the 2004-05 base year is again very obvious where share of this sector is brought down to 1.66 per cent from a level of 3.4 per cent reported in the data with 1999-00 base. These reasons for corrections are not documented transparently.

FIGURE 5: CONTRIBUTION TO TOTAL GDP GROWTH FROM COMMUNICATION SECTOR WITH 1999-00 AND 2004-05 BASE YEARS AT CURRENT AND CONSTANT PRICES



	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Share in Nominal GDP	1.59	1.65	1.82	1.66	1.77	1.86	1.92	2.02
Share in Real GDP	1.59	1.94	2.20	2.71	3.14	3.64	4.20	4.91
Contribution to Real GDP Growth		9.8	6.8	15.9	8.3	10.3	10.2	12.3



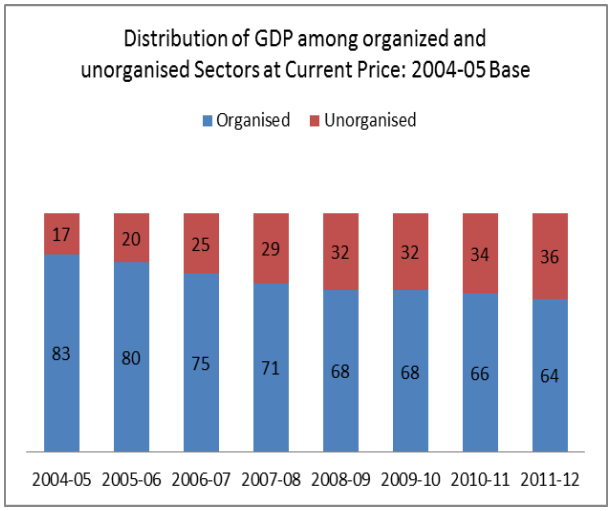
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Share in Nominal GDP	1.66	1.59	1.48	1.44	1.42	1.42	1.10	0.90
Share in Real GDP	1.66	1.87	2.12	2.41	2.82	3.42	3.92	4.00
Contribution to Real GDP Growth		4.1	4.8	5.5	9.0	10.4	9.3	5.2

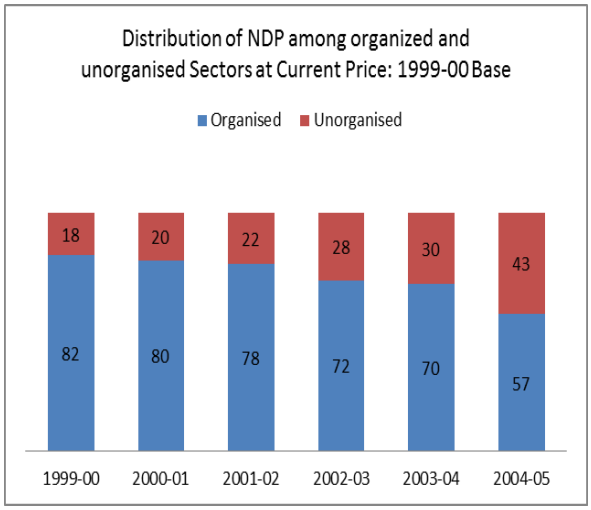
Source (basic data): National Accounts Statistics, CSO (various)

2.4 Problem of Inconsistency exist in distribution of GDP across Organised and Unorganised sector estimates

Communication being high technology sector, it is expected that the contribution of organized sector would be dominant. However, the data on reported estimates indicates that the growth of unorganized sector is much higher than the organised sector. The distribution of current price estimates across organized and unorganized sectors is plotted in Figure 6. It can be observed that starting with low share of about 17-18 per cent in the base year, the unorganized sector quickly captures a high share of as much as 36 to 43 per cent. This requires a very high growth in unorganized sector, which is predominantly related to courier services. All mobile phones and land lines are in organized sector. Postal services are also mainly in organized sector. In such a situation, it is difficult to appreciate the data which shows 43 per cent share of the communication sector in unorganized sector.

FIGURE 6: DISTRIBUTION OF COMMUNICATION GDP AMONG ORGANIZED AND UNORGANIZED SECTORS AT CURRENT PRICES FOR 2004-05 AND 1999-00 BASE





Source (basic data): National Accounts Statistics, CSO (various)

3. CRITIQUE OF THE CURRENT METHOD

The foregoing discussion indicates that there are issues with the time series estimates of communication GDP. While computational errors cannot be ruled out, the focus of this paper is on methodological issues of estimation. To make the discussion more transparent and meaningful, the reported method of estimation published in sources and methods of national accounts is presented in Appendix Table 1 (2004-05 base year) and Appendix Table 2 (1999-00 base year) after breaking down the components as far as possible. Both the tables provide information with regards to formulae used for the base year and the mechanism used for obtaining estimates for subsequent year at current prices and constant prices. Information of the key variables that are used to proxy the main variables in base year formula and its source are also provided. Clearly, there is substantial difference in proxy variables for 1999-00 base year method and 2004-05 base year method. But, the methods are broadly similar. Therefore, for the benefit of clarity, discussion is made with respect to 2004-05 base year method, while discussion on 1999-00 base year method is restricted to key elements only.

While estimates of base year are less controversial, the main problems arise with the estimates of subsequent years, which are leading to distorted growth in constant price estimates across components of communication sector. Examination of information in Table 1 leads to following observations:

(1) There is minimal use of actual data for estimating the current price values. It is restricted to public sector only. This means most of the estimates for this sector are obtained through extrapolation of proxy variables which run the risk of being subjective exercise.

(2) In the case of major components, the estimation procedure for current price and constant price values are independent and there is no nominal anchor such as price. Almost 92 per cent of the GVA is estimated like this. The public sector current values are estimated using actual data while constant price value is estimated using a combined index of physical output. Similarly, growth rate of sales of RBI corporate sector sample companies is used to project current price estimates of organised private sector but constant price estimate is obtained from growth in cellular subscribers and landline connections.

(3) In the 2004-05 series the unorganised private sector communication the other (than courier and cable operators) component, which constitutes about 12 per cent of total GVA of communication in base year (CSO Boucher), the current price estimate is obtained from the constant price estimates (obtained by moving the base year estimates with the indicator of cellular subscribers and landline connections) by superimposing the implicit deflator of the estimated current and constant price estimates of corporate private sector, while constant price estimate is obtained from growth in cellular subscribers and landline connections. Again both these estimates would reflect progress in corporate sector leading to disproportionate contribution from unorganized sector.

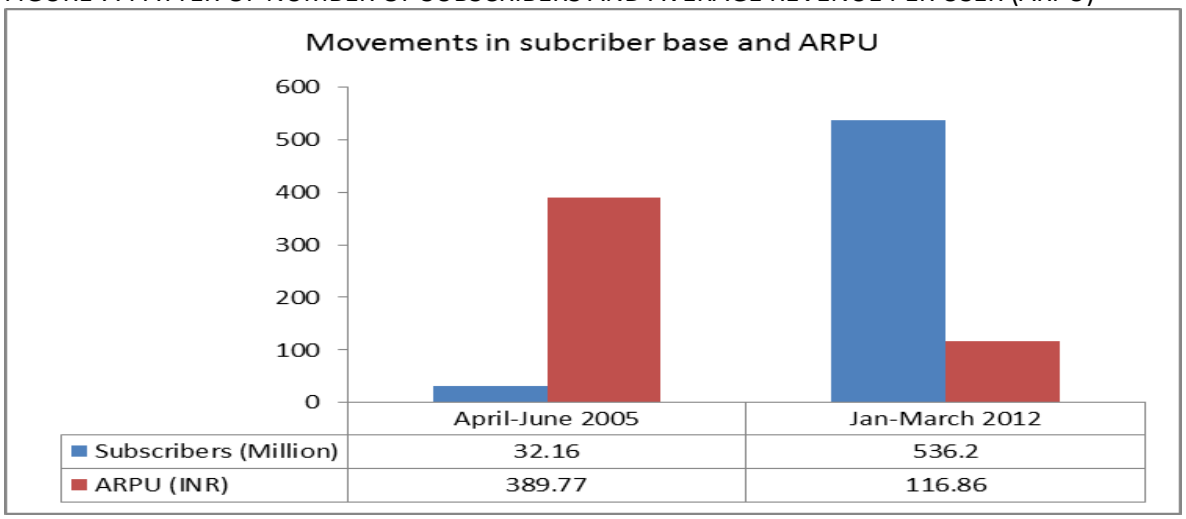
(4) The value added per worker for rural and urban unorganized sectors are projected using consumer price index and then it is multiplied by work force projected on the basis of past trend to obtain current price estimates of GVA for cable operators and couriers. For estimating the constant price values, the current price values are divided by the same consumer price indices. Thus, the constant price value is simply past trend of work force multiplied by the base year data. Thus the real estimates are not at all any indicator of present activities. The present activities would be reflected in next round report. In addition, if current value is divided by price indices which are numbers greater than one then how can the quotient be higher than dividend? It appears there are mistakes in worksheet in addition to concept.

(5) In the 1999-00 series, the estimates of private communication are first worked out at constant prices and the current price estimates are then obtained from the constant price by superimposing the price indicators. As such the current price estimates can in no circumstances be less than the constant price estimates for any of the years with positive inflation. This leads to doubt of plausible inherent error in national accounts worksheets. Importantly, this error continues in 2004-05 series as well.

3.1 Problem in using index of physical units or number of subscribers for extrapolating real estimate for subsequent Years

Use of physical unit of service as indicator of real activity has an implicit assumption that during the period of its use the unit value of the physical unit would remain constant and the product would be identical across time period. This is a very strong assumption. Consider for example, the progress in cellular subscriber base and unit revenue per subscriber. Between early 2005 and end of 2011-12 the subscriber base has increased from 32.16 million to 536.2 million but at the same time the ARPU has gone down from INR 389.8 to INR 116.9 (Figure 7). Thus, from the revenue point of view one subscriber in 2005 was equivalent to about 3.3 subscribers in 2012. In other words the characteristic of the product has changed. The Physical unit is no more identical across time period. Therefore, it is not an appropriate proxy.

FIGURE 7: PATTER OF NUMBER OF SUBSCRIBERS AND AVERAGE REVENUE PER USER (ARPU)



Source (basic data): COAI: http://www.coai.com/Statistics/ARPU-and-Revenue-Report (24-02-2013)

The value added to output ratio also must have undergone change. Therefore, the basic formula used in the base year does not hold for subsequent periods with proxy variables. The real GVA estimated by proxy variable does not represent the real values of factor income. What is obtained is simply growth in physical units with some multiple, which is bound to over-estimate the constant price GVA.

With the advent of cell phones the structure of communication has changed drastically. Telegrams have been discontinued and money orders have given way to electronic transfers. Even number of postal articles handled per employee would have undergone c due to technology.

In addition, choices available with consumers are enormous in all applications of the cell phone and land lines including broadband connections, incentives in call duration and call charges based on traffic conditions (lean hours), which have nothing to do with the physical number of subscriber base.

The communication sector tends to maximize the revenue/profits as most of the operators are either in private sector or they are public sector undertakings. Particularly the communication companies are ensuring maximum utilization of the lean traffic in the morning, evening and night by reducing tariffs and offering incentives to minimize the wastage of available talk time/internet time.

In such situation, the estimates of domestic product for communication at constant prices being more than the corresponding estimates at current prices need reconsideration.

3.2 Problem in using CPI as Proxy for VAPW

CPI(IW) and CPI(AL) have been freely used to proxy VAPW for communication in urban and rural sectors. Unfortunately, the consumer price indices are heavily loaded with food basket and they represent economy wide effect of supply and demand of consumption goods. Therefore, assumption that factor incomes of communication would move with all India consumer price index is far-fetched assumption. However, sector-wise indices may be better proxy provided GVA/GVO ratio for the product is constant.

4. RE-ESTIMATED GDP AT CONSTANT PRICES

The foregoing discussion indicates gross problem in methodology for estimating communication GVA both at current price as well constant price. However, the problem of estimates at constant price is acute and alarming. In order to demonstrate how a realistic estimate, which may still look like a crude attempt is made to estimate constant price value under the assumption that current price values can be adopted with caveats.

The constant price estimates of GVA can be prepared by two Alternate (but still very simplistic) approaches using wholesale and consumer price indices as deflators for the years beyond 2004-05 as follows:

Alternative I (GDP_COM_Real-KK1): The current price estimates of GDP of Communication are deflated by the wholesale price index altogether to obtain constant price estimate.

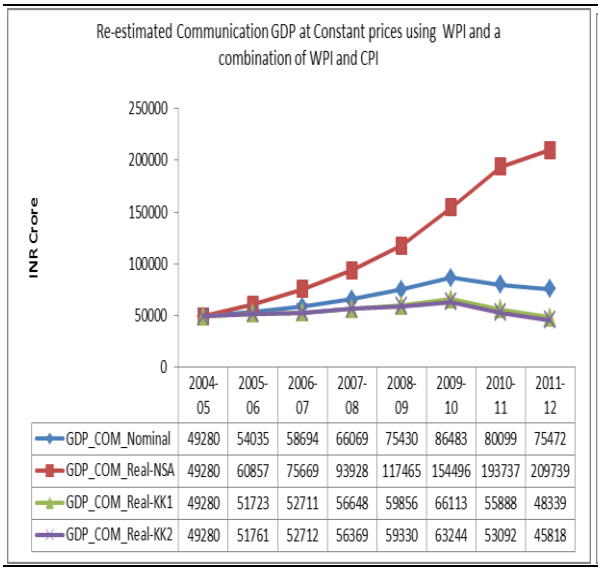
Alternative II (GDP_COM_Real-KK2): The Compensation to Employees at current prices is deflated by CPI of Industrial Workers, while Consumption of Fixed Capital and operating surplus are deflated by WPI.

The two estimates are presented in Figure 8, which are very close and therefore rest of the discussion is based on alternative – I estimates only. From the re-estimates the following observations are worth notice:

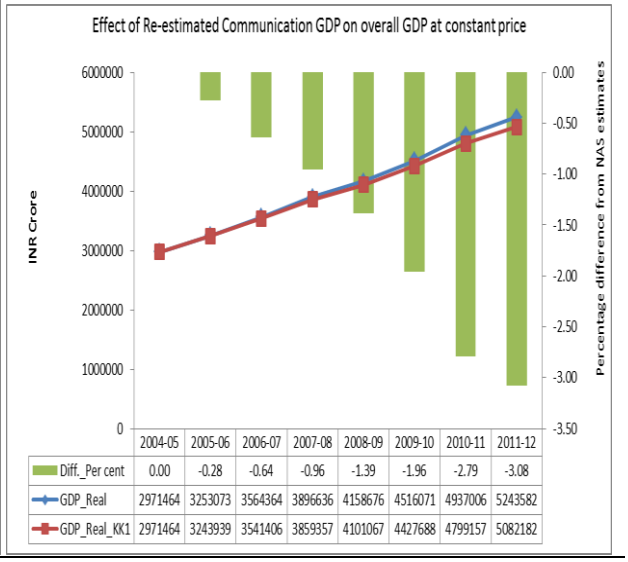
(1) Re-estimated communication GDP is much lower than reported. In fact it seems to have contracted from INR 49280 crore to INR 48339 crore. The effect of this contraction is reflected in reduction of re-estimated real GDP by almost 3 per cent in total GDP (Figures 8). The trend follows the current price estimates, which is now more than the constant price estimates.

2. Growth of re-estimated series is way below the reported growth and its contribution to total GDP growth is now much lower (Figure 9). With revised series, the average annual real growth in communication sector works out to be almost zero instead of about 23 per cent as reported in National Accounts Statistics during 2004-12. As a result, the contribution of communication sector to overall growth during this period is also moderated to almost zero.

FIGURE 8: RE-ESTIMATED COMMUNICATION GDP AT CONSTANT PRICE USING WPI AND A COMBINATION OF CPI AND WPI IN COMPARISON TO EXISTING ESTIMATES AND ITS EFFECT ON REAL GDP OF THE ECONOMY



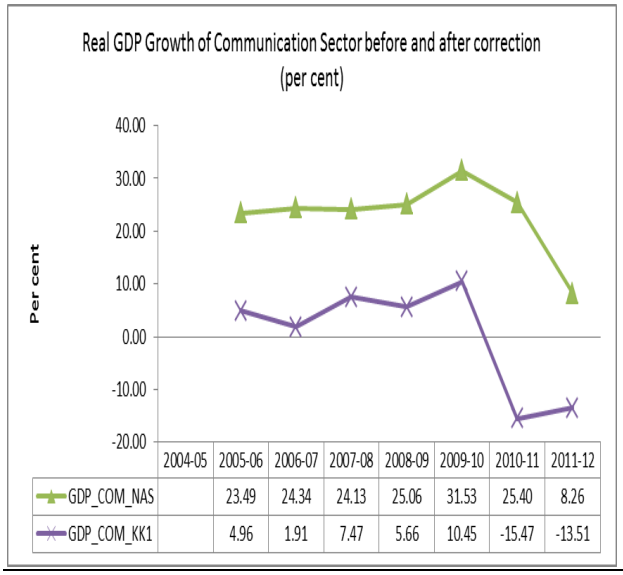
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
GDP_COM_Nominal	49280	54035	58694	66069	75430	86483	80099	75472
GDP_COM_Real-NSA	49280	60857	75669	93928	117465	154496	193737	209739
GDP_COM_Real-KK1	49280	51723	52711	56648	59856	66113	55888	48339
GDP_COM_Real-KK2	49280	51761	52712	56369	59330	63244	53092	45818



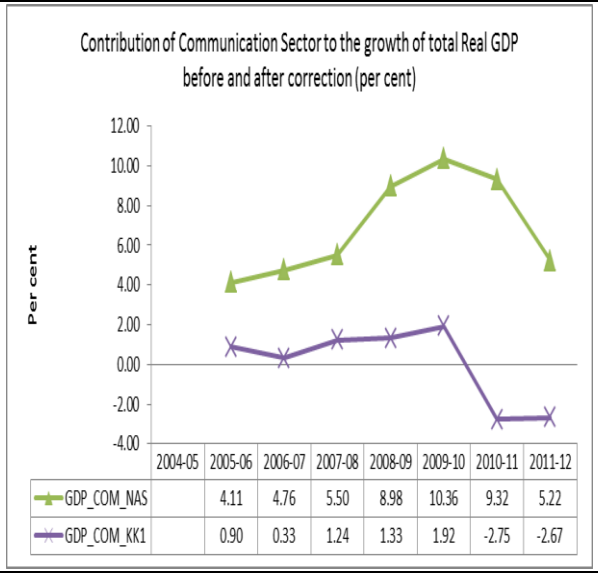
	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Diff._Per cent	0.00	-0.28	-0.64	-0.96	-1.39	-1.96	-2.79	-3.08
GDP_Real	2971464	3253073	3564364	3896636	4158676	4516071	4937006	5243582
GDP_Real_KK1	2971464	3243939	3541406	3859357	4101067	4427688	4799157	5082182

Source (Basic Data): National Accounts Statistics, CSO (various) & RBI (2013)

FIGURE 9: GROWTHS OF NAS AND RE-ESTIMATED COMMUNICATION GDP AND ITS CONTRIBUTION TO TOTAL GDP AT CONSTANT PRICE WITH RESPECT TO NAS AND RE-ESTIMATED TOTAL GDP



	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
GDP_COM_NAS		23.49	24.34	24.13	25.06	31.53	25.40	8.26
GDP_COM_KK1		4.96	1.91	7.47	5.66	10.45	-15.47	-13.51

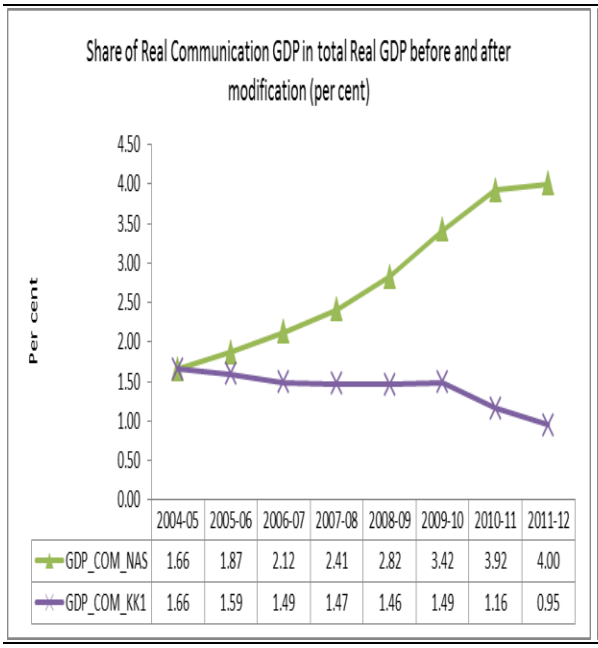


	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
GDP_COM_NAS		4.11	4.76	5.50	8.98	10.36	9.32	5.22
GDP_COM_KK1		0.90	0.33	1.24	1.33	1.92	-2.75	-2.67

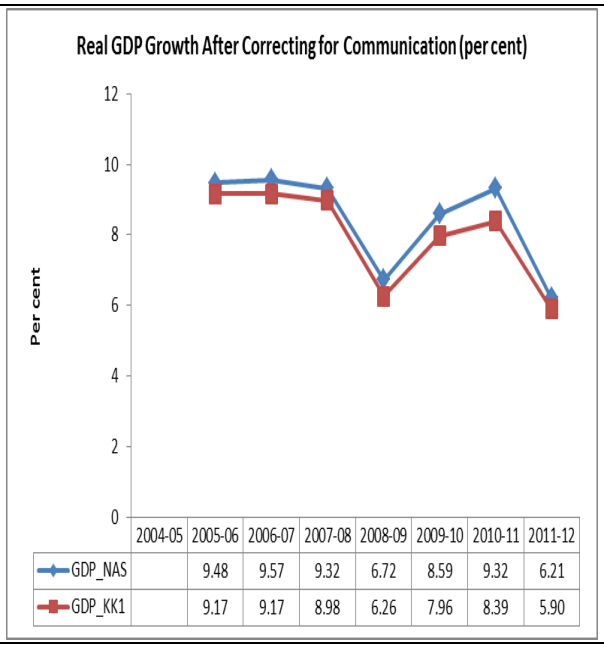
Source (Basic Data): National Accounts Statistics, CSO (various) & RBI (2013)

3. Share of communication GDP in total GDP at 2004-05 prices has fallen from 1.66 per centto 0.95 per cent, which is in contrast to rise in share from 1.66 per cent to 4.00 per cent as per NAS (Figure 10). The resulting GDP growth is now moderated by 0.3 percentage points to 1.0 percentage points during intermittent years (Figure 10).

FIGURE 10: GROWTHS OF RE-ESTIMATED COMMUNICATION GDP AND CORRECTED TOTAL GDP AT CONSTANT PRICE USING WPI AND A COMBINATION OF CPI



	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
GDP_COM_NAS	1.66	1.87	2.12	2.41	2.82	3.42	3.92	4.00
GDP_COM_KK1	1.66	1.59	1.49	1.47	1.46	1.49	1.16	0.95



	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
GDP_NAS		9.48	9.57	9.32	6.72	8.59	9.32	6.21
GDP_KK1		9.17	9.17	8.98	6.26	7.96	8.39	5.90

Source (Basic Data): National Accounts Statistics, CSO (various) & RBI (2013)

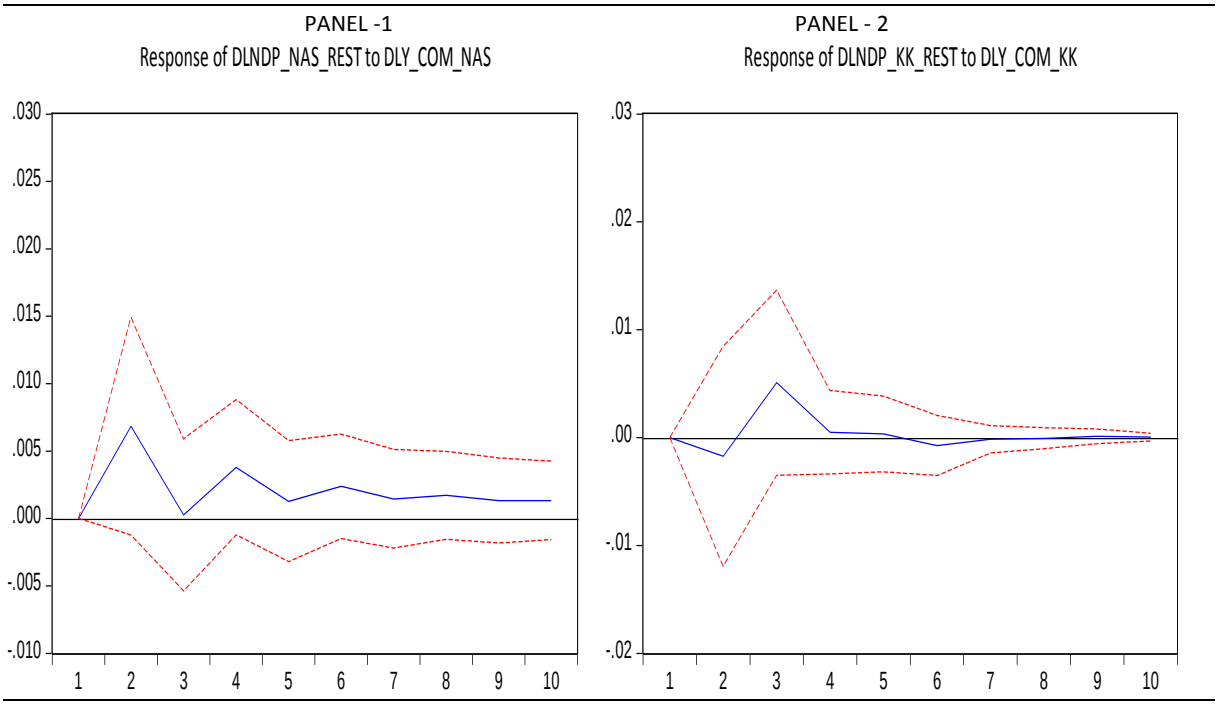
Causal Relationship of Communication NDP with Rest of the aggregate Economy (with and without modification)

Having estimated a modified series for the communication sector it may be interesting to examine the behaviour of the new and the old series on communication GDP with respect to the rest of GDP. For this purpose a longer series has been created from 1991 to 2011 and causality has been examined to investigate whether growth in communication GDP (DLY_COM_NAS and DLY_COM_KK1 in Figure 11) has any driving force on the growth of rest of GDP (DLNDP_NAS_REST (Panel-1) and DLNDP_KK1_REST in Figure 11). For this purpose four times series have been constructed in first difference namely: (1) DLY_COM_NAS: growth in communication GDP reported in NAS; (2) DLY_COM_KK1: growth in communication GDP modified as above; (3) DLNDP_NAS_REST: growth in rest of GDP reported in NAS; and (4) DLNDP_KK1_REST: growth in rest of GDP obtained by subtracting modified GDP- communication. Using these variables two-variable VAR (vector auto-regression) models have been estimated and relevant impulse responses of these models are presented in Figure 11 for examination.

Panel-1 shows the impulse response of growth in rest of GDP (NAS) to unit shock in growth in communication sector GDP (NAS) and panel-2 shows the impulse response of growth in rest of GDP (KK1) to unit shock in growth in modified communication sector GDP (KK1). The following observations can be made:

Growth in the reported communication GDP has positive and significant impact on the rest of the GDP but growth in modified communication GDP does not have any effect on corresponding rest of GDP. This is an interesting result. From the available information on the estimation procedure of communication GDP (Table 1 and 2), it is clear that real GDP of the communication sector is dominantly estimated by projecting the base year estimates by growth in number of subscribers. Thus, the result of Panel-1 in figure 11 is basically saying that growth in cellular subscribers has positive impact on the growth of rest of the economy. This can be attributed as effect of technology and not of sector. When growth in corrected value added of the communication sector is used for the impulse response, there is no effect.

FIGURE 11: RESPONSE OF DLNDP_NAS_REST (PANEL-1) AND DLNDP_KK1_REST TO CHOLESKI ONE SD INNOVATION (±2 S.E.) IN DLY_COM_NAS AND DLY_COM_KK1 RESPECTIVELY



CONCLUDING REMARKS AND SUGGESTIONS

This paper has examined the estimation procedure of domestic product for communication sector in India at constant prices. It is observed that the methods used for estimating domestic product at constant prices suffer from serious flaws as well as plausible error in worksheets. When corrected by using a simplified method, it is found that the growth in real terms in communication sectors during 2004-12 is much lower than the reported values and there is no evidence that value added in communication sector is key driver of the aggregate economy. However, based on reported series it can be interpreted that communication technology does drive economy.

There is need to revise the methodology to remove anomalies and thoroughly check the plausible errors. In particular, independent methods to estimate current and constant price values should be avoided.

Once a reliable estimate at current price is obtained, wholesale price index or a component of it can be used to deflate the current price estimate to obtain constant price estimate.

There is also a need to avoid extrapolation using growth rates of past data or price indices. This almost overlooks the current developments in the sector. In fact, a better alternative would be to use ratios with more reliably estimated components of the sector. For example unorganized sector can be estimated as some fraction of organized sector. Such ratios should be updated more frequently using sample surveys.

Given such problems in estimates, need is also felt to constitute a system of statistical audit for national account as well as other statistics generated by different agencies in the economy

Every time estimates are produced particularly during switching of base years the results should be vetted by a standing committee and attempt should be made to develop a chain based system of national accounts to ensure consistency across time period

REFERENCES

CSO_GOI (2007), National Accounts Statistics: Sources and Methods, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India

CSO_GOI (2010), New Series of National Accounts Statistics (Base Year 2004-05), Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India

CSO_GOI (2012), National Accounts Statistics: Sources and Methods, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India

RBI (2013), Handbook of the Statistics on Indian Economy, Mumbai, Reserve Bank of India

Appendix

TABLE 1: SOURCES AND METHODS (SUMMARIZED) FOR 2004-05 BASE YEAR NATIONAL ACCOUNT OF COMMUNICATION SECTOR

Sources and Methods (Summarized) for 2004-05 Base Year National Account of Communication Sector													
Communication Sector			Base Year Estimate							Subequent year Projection Method			
			Value		Formula	Variable		Source		Current		Constant	
1	**Public Sector**		33088		Income Method (GVA= CE+OS+CFC)	GVA	a	Annual Reports &Central Budget		GVA=CE+OS+CFC		Index_Com	b
2	**Private_ Organized**												
2.1	Courier services		1231		GVA=WF*VAPW					RBI_Growth	e	Current/WPI	
						WF	c	EUS + Census	f				
						VAPW	d	ES	g				
	Rural		NR	q	GVA=WF*VAPW					RBI_Growth		Current/WPI	
						WF		EUS + Census					
						VAPW		ES					
	Urban		NR		GVA=WF*VAPW					RBI_Growth		Current/WPI	
						WF		EUS + Census					
						VAPW		ES					
2.2	Cable operators		50		GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF		EUS + Census					
						VAPW		ES					
	Rural		NR		GVA=WF*VAPW					RBI_Growth		Current/WPI	
						WF		EUS + Census					
						VAPW		ES					
	Urban		NR		GVA=WF*VAPW					RBI_Growth		Current/WPI	
						WF		EUS + Census					
						VAPW		ES					
2.3	Other	o	6601		ARPU * N *(GVA/GVO)					RBI_Growth		Growth in "N"	
						ARPU	h	NR					
						N	i	NR					
						GVA/GVO	j	RBI_CORP	k				
3	**Private_Unorganised**												
3.1	Courier services		1330		GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF		EUS + Census					
						VAPW		ES					
	Rural		NR		GVA=WF*VAPW							Current/CPI_AL	
						WF		EUS + Census		EUS_Growth	l		
						VAPW		ES		CPI_AL	m		
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		EUS + Census		EUS_Growth	l		
						VAPW		ES		CPI_IW	n		
3.2	Cable operators		914		GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF		EUS + Census					
						VAPW		ES					
	Rural		NR		GVA=WF*VAPW							Current/CPI_AL	
						WF		EUS + Census		EUS_Growth			
						VAPW		ES		CPI_AL			
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		EUS + Census		EUS_Growth			
						VAPW		ES		CPI_IW			
3.3	Other		6348		GVA=WF*VAPW					ID_CORP (?)	p	Growth in "N"	
						WF		EUS + Census					
						VAPW		ES					

	Notes
a	GVA: Gross Value Added
b	Index_Comd: Combined Index formed by numbers of money orders, telegrams, telephones and postal articles; Weight = earnings in the base year
c	WF: Work Force: Employment Unemployment Survey EUS_NSS-61 proportion of Census 2001 Work Force)
d	VAPW: Value Added Per Worker
e	RBI_Growth: RBI Corporate Sector Sales Growth in Communication Sector Sample
f	EUS: Employment Unemployment Survey EUS_NSS-61
g	ES: Enterprise Survey: ES_NSS-63
h	ARPU: Average Revenue per User
i	N: Number of Cellular Subscribers
j	GVA/GVO: Ratio of Gross Value Added to Gross Value of Output of Sample Companies of RBI Database in Communication
k	RBI_CORP: RBI Corporate Sector Sample data on Communication Sector
l	EUS_Growth: Inter-Survey Growth of Past Surveys
m	CPI_AL: Consumer Price Index for Agriculture Labour
n	CPI_IW: Consumer Price Index for Industrial Worker
o	Other: activities of cellular & basic telecom services, and the activities of PCO/STD/ ISD booths
p	ID_CORP: Implicit Deflator of Corporate Sector
q	NR: Not Reported

Source (Basic Data): CSO 2004-05 Brochures on sources and methods

TABLE 2: SOURCES AND METHODS (SUMMARIZED) FOR 1999-00 BASE YEAR NATIONAL ACCOUNT OF COMMUNICATION SECTOR

Sources and Methods (Summarized) for 1999-00 Base Year National Account of Communication Sector												
Communication Sector			Base Year Estimate							Subequent year Projection Method		
			Value		Formula	Variable		Source		Current		Constant	
1	**Public Sector**		23854		Income Method (GVA= CE+OS+CFC)	GVA	a	Annual Reports &Central Budget		GVA=CE+OS+CFC		Index_Com	b
2	**Private_ Organized**												
2.1	Courier services		NR		GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF	c	DGE&T	s				
						VAPW	d	ES	g				
	Rural		NR	q	GVA=WF*VAPW							Current/CPI_AL	
						WF		DGE&T		EUS_Growth			
						VAPW		ES		CPI_AL			
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		DGE&T		EUS_Growth			
						VAPW		ES		CPI_WI			
2.2	Cable operators				GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF		DGE&T		Pop_Growth	t		
						VAPW		ES		CPI_AL			
	Rural		NR		GVA=WF*VAPW							Current/CPI_AL	
						WF		DGE&T		Pop_Growth			
						VAPW		ES		CPI_WI			
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		DGE&T					
						VAPW		ES					
2.3	Other	o			ARPU * N *(GVA/GVO)							Rural+Urban	
						WF		DGE&T					
						VAPW		ES					
	Rural		NR		GVA=WF*VAPW							Current/CPI_AL	
						WF		DGE&T		NN	u		
						VAPW		ES		CPI_AL			
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		DGE&T		NN			
						VAPW		ES		CPI_WI			
3	**Private_Unorganised**												
3.1	Courier services				GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF		ES	s				
						VAPW		ES	g				
	Rural		NR		GVA=WF*VAPW							Current/CPI_AL	
						WF		ES		EUS_Growth	l		
						VAPW		ES		CPI_AL	m		
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		ES		EUS_Growth	l		
						VAPW		ES		CPI_IW	n		
3.2	Cable operators				GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF		ES					
						VAPW		ES					
	Rural		NR		GVA=WF*VAPW							Current/CPI_AL	
						WF		ES		EUS_Growth			
						VAPW		ES		CPI_AL			
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		ES		EUS_Growth			
						VAPW		ES		CPI_IW			
3.3	Other		6348		GVA=WF*VAPW					Rural+Urban		Rural+Urban	
						WF		ES					
						VAPW		ES					
	Rural		NR		GVA=WF*VAPW							Current/CPI_AL	
						WF		ES		NN			
						VAPW		ES		CPI_AL			
	Urban		NR		GVA=WF*VAPW							Current/CPI_IW	
						WF		ES		NN			
						VAPW		ES		CPI_WI			

	Notes
a	GVA: Gross Value Added
b	Index_Comd: Combined Index formed by numbers of money orders, telegrams, telephones and postal articles; Weight = earnings in the base year
c	WF: Work Force: DGE&T data proportion of Census 2001 Work Force)
d	VAPW: Value Added Per Worker
f	EUS: Employment Unemployment Survey EUS_NSS
g	ES: Enterprise Survey: ES_NSS-57
i	N: Number of Cellular Subscribers
l	EUS_Growth: Inter-Survey Growth of Past Surveys
m	CPI_AL: Consumer Price Index for Agriculture Labour
n	CPI_IW: Consumer Price Index for Industrial Worker
o	Other: activities of cellular & basic telecom services, and the activities of PCO/STD/ ISD booths
q	NR: Not Reported
s	DGE&T: Director General of Employment and Training Data
t	Pop_Growth: Population Growth
u	NN: Number of Cellular and landline subscribers

Source (Basic Data): CSO