ABSTRACT

Agricultural development in the developing countries assumes a greater importance in the context of current market-centred reforms. Every country is competing to increase their share in the international trade and developing countries find it difficult to gain ground in this race due to various factors. Developing countries have to confront an internal struggle of keeping pace with the increasing commercialization, inter-sectoral growth balances and aggregate sustainability of growth. It is widely recognized that the sustainable development of agricultural sector is linked with many variables that include living standards of the population, poverty levels, assured food security and the development of non-agricultural sector in the economy. Another challenge faced by the developing countries is to maintain the balance of growth and development across sectors. Even today, many countries among the developing world are struggling to maintain the inter-sectoral balances to sustain employment growth, direct investment in most deserving areas and also to meet the aggregate development goals. In India, despite a satisfactory growth of agricultural production and achievement of arithmetic food security, the concerns are expressed over a declining trend in the investment in agriculture, deceleration in the growth of agricultural output and per hectare productivity of major foodgrains leave alone the sectoral growth balances (Bhalla and Singh, 1997 and 2010; Chand et al 2007; Deshpande and Shah 2007; Gol 2007b; Narayananamoorthy 2007; Bathla 2014). This is also reflected in the trends of net income of the farmers (Sen and Bhatia 2004; Deshpande and Shah 2007; Tripathi 2013). Since the scope for expansion in area under cultivation is limited, a faster growth of agricultural production in future would critically depend on the acceleration of growth in productivity per hectare, attracting investment for technological advancement, creating productive employment and above all attend to the inter-sectoral growth divergences. This emphasizes the requirement of continuous upgrading of technologies for both rainfed and irrigated areas, better utilization of available land and water resources and in turn mobilization of adequate investment in agriculture sector.
Historically it is observed that the trends in net income of the farmers are not only influenced by the slow growth in productivity but also due to the sluggish price trends in the product market and market inefficiencies (Sen and Bhatia 2004; Dev 2009). The farmers’ movements during late seventies and early eighties have seen an ugly face of deteriorating Terms of Trade against agriculture. Initially, there was the hypothesis of deceleration claiming that the growth in Indian agriculture has decelerated (Sawant 1983; Sawant and Achuthan 1995). The impact of intersectoral Terms and Trade was initially brought forth by Thamarajakshi (1969 and 1977), but the salvo of the impact of the worsening of Terms of Trade against agriculture was first fired by the Farmers’ Movements in India. Among the prominent authors who brought forth this issue for discussion were Sharad Joshi, Nanjundaswamy, Nadkarni (1987), Tikait and Dhanagare (1990 and 1994) besides foreign scholars like Tom Brass (1994) (see Deshpande et al 2004a). The arguments about the generation of the relative sectoral incomes have clearly demonstrated that the rural sector income trends have not kept pace with those in the urban areas (Lipton 1977). This is accentuated by the rising prices of inputs and commodities purchased by the farmers (Nadkarni 1988, Sen and Bhatia 2004; Raghavan 2008; Dev 2009). The role of the price policy in this respect is quite crucial in promoting and encouraging the private investment in agriculture (Rao and Deshpande 1986; Rao 1989; Bhalla 1989 and 1995). In this respect, a number of studies have observed that the movement in the ratio of prices received by the farmers for the commodities sold by them to non-agricultural sector and prices paid by them for commodities purchased from the non-agricultural sector assumes a great importance in determining the investment in the sector and hence its future growth and development (Nadkarni 1993; Misra 1998 and 2004; Fan and Hazell 2000; Desai and Namboodiri 1999; Acharya 2001; Sharad Joshi Task Force 2002, Desai 2002; Rao 2003). Therefore, for monitoring the movements in the relative prices of commodities exchanged between agricultural and non-agricultural sectors, several countries use the concept of inter-sectoral Terms of Trade (hereafter ISTT).

It was pointed out that the ISTT between agriculture and industry assumed significant importance in the context of economic development due to its direct linkages and income or welfare trade-off between farm and non-farm sector. This also presumes distribution of income between the two sectors, accumulation of wealth and rate of
growth of the economy (Thamarajakshi 1969, 1977 and 1994; Venktaramanan and Prahladachar 1978; Mungekar; 1992; Nadkarni 1993; Misra 2004). It is also widely recognized that the movements in the ISTT in favour of agricultural sector have a significant bearing on the economic well-being of the farmers. The question of whether ISTT moved in favor or against the agricultural sector has been extensively debated in both academic and policy making circles over the past decades in India. Considering its significance, the government of India included trends in the ISTT as one of the terms of references of the revised policy guidelines given while changing the nomenclature of Agricultural Prices Commission (APC) under the recommendation of S. R. Sen Committee (GoI 1980). It was mandated to evolve a balanced and integrated price structure in the perspective of the overall needs of the economy and with due regard to the interests of the producer and the consumer (GoI, 1980). The Commission continues to formulate the price policy for agricultural sector in India, presumably incorporating the trends in ToT.

CACP while arriving at ISTT gives importance to the base period and weights assigned. The base period used by the CACP for constructing the series of index of ISTT is the triennium ending (TE) 1971-72. Recognizing the need for updating the base period and refining the methodology above what was done by Thamarajakshi in 1994, the government of India appointed a Task Force to examine and suggest changes in the methodology for the construction of indices of ISTT (GoI, 1995). The Task Force in its report submitted to the Government of India, recommended that ISTT indices need to be constructed at the state level also. The need for state level estimates of ISTT arose because such estimates at the all India level conceal a great deal of variation across the states (Thippaiah and Deshpande, 1998; Acharya 2001). Large variation in the growth of the agricultural sector and capital formation and changes in poverty levels across the states may partly be attributed to the regional variations in ISTT.

Due to changes in the technology and resulting growth pattern, the inter-sectoral balances vary across regions and sub-sectors within agriculture. It is quite important to understand the trends in ISTT for agriculture vis-a-vis other sector in different regions of the country. The ever-perpetuating problem of regional divergences in agricultural performances and phases of stagnation can be understood with this
analysis. Many analysts have looked at the effect of growth initiatives during the last six decades on the inter-state divergences. There are two bold strands in the literature. First group of authors analyse the macro level data along with the performance of the States, to conclude that the inter-state growth disparities have narrowed. In technical language, they vouch about the convergence of growth across states (Dholkia 1994; Sarkar 1994; Cashin and Sahay 1996; Ahluwalia 2000 and 2002). Second group of researchers, however differ and demonstrate that the growth performance has resulted in divergence across states (Rao M G et. al 1999; Dasgupta et. al 2000; Kurien 2000; and Bhattacharya and Sakthivel, 2004, Ahmad and Varshney 2008). Besides, this, several measures being taken by the Government to liberalize the economy, including trade in various farm products, are found to influence welfare outcome for the farmers as not all farmers across the state will get equal opportunity to participate in the trade. In this regard, a few studies have found significant variations in the ISTT for agriculture across the states. Some have shown a declining, some upward trend in the 1980s and some highlighting a tendency of recovery in the 1990s (Acharya 2001; Misra 2004).

In the review of studies, we have observed numerous differences in the positions taken by scholars over whether or not inter-sectoral Terms of Trade has turned in favour of agriculture in India. The difference in the findings largely stem out of the differences in selection of commodity basket of traded goods, use of weighting diagrams, selection of different prices, selection of base year and aggregation problems. However, it is important to note that in spite of these and also a recent study by Deb (2002), do not find significant differences in the fundamental nature of long-term series of NBTT indices and that also with the index of implicit prices (GBTT). In fact, these series reflect almost similar attributes (similar mean, variance, overall movements, peaks and low and high degree of correlation) over comparable time periods. Moreover, the estimation exercise of ISTT is largely limited to All-India coverage except Thippaiah and Deshpande 1998 and Rao 2003, who have attempted to construct State-level ISTT for two states namely Karnataka and Andhra Pradesh respectively. The construction of State-level ISTT assumes a significant importance for two reasons: i) the estimates of All-India ISTT conceal a great level of variation that takes place among the states (Thippaiah and Deshpande 1998) and ii) the introduction of liberal economic policies and differential technological progress have
definitely changed the differential growth pattern noticed across the regions, sectors and subsectors within agriculture. Large variations in capital formation and changes in poverty levels across the states are also viewed to be the product of regional variations in the ISTT (Acharya 2001). Notably, even though these studies have attempted to estimate ISTT at the state level, no comparison is made to bring out how and why ISTT of one state differs with the others and what explains such differences. This study takes up these issues with the following objectives in mind. There are three significant gaps that remained in the literature. First, no one has attempted to meet the obvious criticism of the choice of year, prices and commodities. No common thread was followed so that one can maintain the comparability across time periods. Second, even though the all India level ISTT series irons out all the inter-state variations to a detrimental interpretation of the ToT, no significant attempt was made at the sub-national level to estimate ISTT. Three, the ISTT helps not only to compare the relative ToT between sectors but a wider use of it can be from the point of view of its impact on some of the macro-economic parameters. This has remained neglected issue altogether. Last, the attempt to explain the variations in ISTT series across the cross-section of the states and the time periods has not been attempted.

OBJECTIVES OF THE STUDY

In the light of this, we undertook the study with the following objectives–

1. To provide a critical review of the issues associated with inter-sectoral Terms of Trade and the empirical estimation of long-term agricultural Terms of Trade for India. There shall be three sub components here:

   i. To analyze the methodology of ISTT used by different authors and their impacts on the results.

   ii. To compare and analyse the changes in the series over years and across studies.

   iii. To review major issues associated with the functional relationship between ISTT and policy related variables.

2. To assess agricultural development in the major states of India by analysing the role of market and role of commercialization in agriculture in widening
regional differences in growth and development of the sector; mainly through factors inducing relative price differential and changes in Terms of Trade.

3. To estimate the ISTT for agricultural sector for major states of India, identify phases of growth in ISTT and analyse the various phases of growth in agricultural sector and connect the two.

4. To verify the changes in agricultural different Terms of Trade series estimated in India and understand why these differ from one another. Also to analyse possible reasons behind the differences, and

5. To investigate into the factors governing the variations in ISTT across the major states and the nexus and growth implications of ISTT for agricultural growth, investment, poverty and income distribution in the selected states.

In our overall analysis of ISTT, we used simple descriptive statistics, percentages, regression models with dummy variables, graphical trends and average annual compound growth rates. In chapter five, while explaining the factor determining the fluctuations in ISTT for agricultural sectors of the states, we used panel regression models with three major alternative specifications- pooled OLS, random effect and fixed effect modeling. In the three equations, based on availability of data, we have selected 13 indicators for analysing the behaviour of ISTT. The diagnostic result of the test suggested us to choose fixed effect model, implying that the differences among coefficients are systematic and highly statistically significant and the fixed effect estimates are more appropriate to its random effect counterpart. Since our fixed effect model estimates indicated the specification bias including group wise heteroskedasticity, autocorrelation and cross-sectional dependence, to address these problems, we used Driscoll and Kraay (1998) standard errors to correct the biases. The Driscoll and Kraay standard errors are robust to all the three specification problems and are far better than their counterparts (OLS, white, Rogers, and Newey-West standard errors).

**FINDINGS, CONCLUSIONS AND POLICY IMPLICATIONS**

- The inter-sectoral Terms of Trade studies in India broadly deal with two aspects of the subject matter; i) identifications of functional relationship
between Terms of Trade and a few explanatory variables; and ii) issues pertaining to methodological and data related aspects. Our investigation into former aspect indicated that though most of the theoretical and empirical literatures on Terms of Trade began with focus on international trade, development economist during the course of time completely sidelined it in their pursuit of discovering growth and development through sectoral realignment. There are hardly any studies on international Terms of Trade for agriculture on India and most of the studies pertain to intersectoral Terms of Trade and that too at the all India level. Even though some studies have attempted to estimate ISTT at the state level, no comparison is made to bring out how far ISTT of one state differs from others and what explains such differences.

- The movement in ISTT for agriculture has also been one of the important components of the policy debate on inter-sectoral growth, poverty, food security, technological adoption, capital formation and agricultural price policy in India. The impact of Terms of Trade for agriculture on agriculture-industry growth; rural wage and poverty; technology (HYV) adoption, spread of irrigation, private investment, government expenditure and total factor productivity growth in agriculture is also examined quite extensively. The agricultural price policy analysis also points out various implications of change in ISTT on the economy. It was also interesting that the ISTT also matches the fluctuations in the Growth behaviour, though not with one to one correspondence.

- Much of the methodological debate on estimation of ISTT in the present literature pertains to dispute over selection of representative prices, coverage of commodity baskets and the method of aggregation. In fact, Kahlon and Tyagi’s (1980, 1983) criticisms on the methodology and database adopted by Thamarajakshi (1969 and 1977) dominated the major source of academic debate behind on whether or not ISTT moved in favour of agriculture or not (Fig.6.1a). The debate, despite of being controversial has continued to influence the subsequent attempts of estimating ISTT in India. This is clearly reflected in the Government of India’s initiatives for setting up one Task Force
(1995) and Working Group (2012) on Terms of Trade during the last two decades to address methodological issues involved in the estimation of ISTT (Fig 6.1b). Whether or not inter-sectoral Terms of Trade turned in favour of agriculture in India has been a focal point of the debates in the studies dealing with methodological issues of estimation of ISTT. But none tried to get at the hypothesis that Terms of Trade has an influence on the performance of agriculture sector. Even there are three major approaches for estimation of ISTT in India, Net Barter Terms of Trade (NBTT) remains to be the most preferred and closest indicator of prices used for inter-sectoral exchange of goods and services. It is strange that the major debate on methodological issues of ISTT revolves around estimation of NBTT. The differences in the movement of ISTT estimates (Figs.6.1a and 6.1b) largely stem due to the differences in selection of commodity basket of traded goods, use of weighting diagrams, selection of different prices, selection of the base year and aggregation issues. Recently, a study by Deb (2002) while analysing different series of ISTTs strikingly pointed out that not much significant difference in the fundamental nature of long-term NBTT indices and that of Gross Terms of Trade (GBTT). In fact, the attributes of NBTT and GBTT indices (mean, variance, overall movements, peaks and low and high degree of correlation) were found to be quite similar to each other over a long and comparable period. This reassures that GBTT index is quite akin to NBTT (also see Figs 6.1a and 6.1b). Moreover, GBTT index can easily stand as a proxy for NBTT and one could construct and analyse the trends of ISTT at the state level without worrying about the cost and time to collect the information. The estimates of ISTT based on GBTT are not only fair estimates of state-level ISTT for agriculture but also likely to aid in explaining the variation in Terms of Trade across the states.

- The process of commercialization, technology, extent of capital formation and the markets / prices are the major determinants of growth in the agricultural sector. These are the factors playing significant role in influencing the movements in the relative prices of commodities within a sector as also between sectors and in turn dictate the growth performance of the agricultural sector. The link between these relative price differentials and agricultural
growth brings us to the question of existing regional differences in agricultural development and the alleged role of these factors in narrowing or perpetuating these. In Chapter three, we took this question and attempted to explore how the market, process of commercialization in agriculture and augmentation of resources play their crucial roles in widening the existing regional differences in agricultural development through relative price differentials. The differential behaviour in agricultural growth is brought out by looking at the growth behaviour of crops across regions as well as the extent of differences existing in resource augmentation in agricultural sectors. Overall observations suggest that India’s growth experience across the regions is quite heterogeneous and has been pointed out by many. The emergence of market and the process of commercialization have set differently in different states. Moreover, priorities and selective interventions of the state concerning agriculture and overall economy have added a new historical dimension to agricultural development, giving rise to relative price differentials within and between agricultural and non-agricultural sectors. This conspicuously gets reflected in the stark differences in the development of agricultural sector across the states. The process of commercialisation is quite active in a few states and shows great inclination towards horticultural crops. The area allocation to food crops although is steadily declining, fortunately it has not affected the aggregate food production. The introductions of new crops and tilt towards horticulture have undoubtedly strengthened the market forces and the market transactions across sectors. This has a strong influence on the behaviour and movements in ISTT.

- The discussions throughout the earlier chapters demonstrated that agricultural growth and commercialisation trends are not secular across states. Some states in fact have been able to take advantage of the situation, whereas others states are still lagged behind. Inter regional differentials in the growth performance have been a historical reality in India and despite long concerted efforts, we have achieved only marginal success in bringing slogging regions into the mainstream growth. The failure in increasing investment in agriculture and also provoking new technological inputs in backward and poor regions appear to be critical factors behind such state of affairs. The question, however,
remains why these regions, crops and enterprises do not attract investment despite strong trends in commercialisation and horticulture? It is true that investment is attracted only if the expected value addition and returns are sufficiently good and that needs good demand for the products of the sector. Adverse Terms of Trade against agriculture suppress the incentive and thereby the adoption of new technology or fails to attract incremental investment. It is quite discouraging that most of the studies have been silent in their approaches on this aspect and happy at focusing on macro level economic scenarios. The aggregate country level ISTT for the agricultural sector in fact has a little use in explaining the decentralised growth behaviour due to large variations in ISTT and agricultural growth rates at the state level. Even though there were only sporadic attempts to arrive at the State level Terms of Trade and that has vindicated the hypothesis that movements in Terms of Trade actually provoke investment and thereby growth, this is reflected by the movements in time series of ISTT. The adverse ToT estimates in preceding year have caused a slump in growth in a succeeding year. Therefore, the explanation of the differential growth behaviour has strong relevance with the relative ToT.

- Our results of the state level analysis (using trends and econometric and statistical measures) of ISTT series for the agricultural sector show significant difference in their behavior and the extent of fluctuations across the states (also see Figs 6.2a to 6.2f). These imply that the aggregated inter-sectoral Terms of Trade fail to account inter-regional changes in the movement of relative prices of agriculture and non-agricultural commodities. The policies based on such misleading indicator may induce further fluctuations and could harm the agricultural growth and welfare of farmers in a few states.

- The inter-sectoral Terms of Trade for agriculture show non-linear trends across the states. In the last 32 years, ISTT for agriculture in Madhya Pradesh, Rajasthan, Haryana, Maharashtra and Uttar Pradesh were better position as compared to the other states. The ISTT in these states found to be in favour of agriculture 17-19 times in the overall period, a success rate of 53 to 60 percent. Following these, the ISTT in Punjab, Gujarat, Himachal Pradesh and Tamil Nadu, were in 7-10 years (21-31 percent) favourable to agriculture. On
the other hand, the ISTT in Andhra Pradesh, Assam, Bihar, Orissa, Karnataka and West Bengal were favourable to agriculture merely 4-5 times (13-15 percent) in the total period. In this groupwise analysis, the third group (Maharashtra and MP), and fourth (Gujarat & Rajasthan) as also the first group (Punjab, Haryana, and HP) found to be in a relatively better position in having ToT favourable to agriculture (15-11 times, respectively) as compared to states in sixth, (Bihar, UP & Orissa) fifth (Assam and West Bengal) and second (Andhra Pradesh Karnataka and Tamil Nadu) groups. The groups were hardly able to maintain ISTT in favour of agriculture, 4-7 times in overall period. These results indicate – i) the Terms of Trade for agriculture across the states have largely been unfavourable for the most of the period under observation; and ii) even within favourable periods, ISTT cannot be taken for granted for many states since a few years were marked with high food inflation, droughts, poor agricultural growth and farm sector distress. Apart from these, the ISTT for agriculture across the states need to be subjected to the explanation of variations in input cost to validate whether widely held input cost stability assumption still holds true. Given the reports of increasing cost of cultivation for many agricultural commodities, the favourable estimates of ISTT for agriculture could be highly misleading.

- Even though during most of the years under observations ISTT appears to be unfavourable to agriculture, we found that in many states ISTT for agriculture sector is improving over the years. That is, the ISTT for agriculture showed increasing trends from early 1980s to late 1990s. These include Andhra Pradesh, Karnataka, Tamil Nadu, Assam, West Bengal and Bihar. In case of Gujarat, wherein ISTT showed improving trends up to 1992-93, and from 1985-86 to 1997-98 for Assam. The period between late the 1990s to 2004-05, was not good for agriculture and for almost all the states, ISTT showed declining trends. It is important to note that during this period Indian agriculture was aggressively exposed to international competition and import surges thereafter. Interestingly, this was also the period in which many states affected by droughts in 2001-02 to 2003-04. 2004-05, causing lower yield, less area under crops and witnessing negative rates of growth in the agricultural sector.
In our exercise, we found that average annual compound growth rates of ISTTs for many states even though statistically significant, suffer from lower level of goodness of fit ($R^2$). In our analysis of ISTT for agriculture, West Bengal, Assam, Gujarat and Andhra Pradesh reported significant growth rates between 1.16 to 1 per cent per annum, whereas Karnataka, Orissa, Tamil Nadu report, these were less than one per cent per annum. Rajasthan and Bihar reported negative growth rates and these were statistically significant. The growth rates reported by Maharashtra, Madhya Pradesh, Haryana, Punjab and Uttar Pradesh were statistically insignificant. In terms of the broader group, except fourth and sixth groups all reported positive and statistically significant growth rates.

The overall size of fluctuations witnessed in ISTT across States has been quite high during 1980s, low in 1990s and high with the increasing trend during the last decade. The fluctuations witnessed during the 1980s may be contributed to some special policy initiatives to reduce inter-state disparities by promoting agricultural growth in poor states. These initiatives included dissemination of improved agricultural technology, introduction of new crop varieties for rainfed regions, provision of input and price support. Even though these initiatives were taken to bridge the gap between developed and poor states, a study of Chand and Chauhan (1999) showed that regional divergence in agricultural productivity and income in fact continued to increase during this period as some agriculturally underdeveloped states progressed at a faster rate (Sawant and Achutan 1995; Bhalla and Singh 1997). Apart from these, the increasing withdrawal of state from public investment also appears to have contributed towards the fluctuations in ISTT. The fluctuations observed during the last decades are largely determined by successive droughts witnessed in many parts of country, liberalization of agricultural trade and recent food inflation crisis.

The ISTT series of Madhya Pradesh, Karnataka, Uttar Pradesh, Haryana, Himachal Pradesh and Rajasthan showed less variation as compared to ISTT of other states during 1980-81 to 2011-12. These states are largely food crop growing economies and cereals contribute a significant proportion in the
cropping pattern system. These crops exhibit stability in the prices as compared to others commercial crops.

- The state-specific characters have a role in explaining a large share of fluctuations/ variations in the ISTT series. The fixed or state-specific effect is quite strong and contributes almost 0.9495 percent of the total variation. Apart from these, per capita income and industrial demand for agricultural raw material, market (agricultural GDP, land productivity and area under commercial foodgrains and non-foodgrains), technological progress (cropping and irrigation intensity and per hectare fertilizer consumption), weather (rainfall and distribution of rainfall in terms of surplus/deficit), and state policy (minimum support prices) play a great role in influencing the behaviour of ISTT at the state level. Both per capita income and GSDP from manufacturing sector show a positive association with ISTT, but only per capita income emerges with a statistically significant coefficient. The results indicate that the growth in manufacturing sector does not influence ISTT partly because agricultural raw material accounts a small proportion of its total output. However, per capita income appears to be the best indicator of aggregate demand for agricultural commodities and does influence their prices. With the increase in per capita income by one percent, ISTT increases by 0.283 percent.

- Among the major representative of market, the growth in agricultural GDP and area under major commercial foodgrains brings out adverse outcomes for ISTT. Our empirical results, in fact, indicate that (keeping other variable constant) one percent increase in the former causes a decline in ISTT to the extent of 0.257 and 0.192 percent respectively. The land productivity and area under major commercial non-foodgrains on the contrary do not show any conclusive results. Their coefficients turn out to be statistically insignificant. Despite an increase in the share of area under commercial non-foodgrain crops in the recent periods, its adverse impact on ISTT seem to have been moderated by the higher level of relative profitability of these crops, keeping the incentives of the farmers to allocate more area under these crops. The unit prices of major commercial crops over 1970-71 to 2011-12, although showing
a declining trend, their relative prices appear to be far better to the counterparts.

- The role of technology having a positive influence on ISTT is prominently recognized in the past. In our empirical study, we, however, found that the technology *per se* in not homogeneous units and therefore can influence the behaviour of ISTT both positively and negatively. Our results pertaining to per hectare fertilizer consumption (PHFC) and cropping intensity in fact show positive impact on ISTT, whereas it appeared to be negative in the case of irrigation intensity. Moreover, the sporadic studies in the past exploring the relation between technology and ISTT or that with agricultural output and investment use area under HYV crops as an indicator of technology. That is an unstable indicator. The variable even though important covers the area of only a few crops, mainly paddy, wheat and maize and jowar. Besides, it is arrived at by dividing the seeds sold divided by the prescribed seed rate than the actually sown area. Whereas, in the last four and half decades, we have witnessed several technological improvements on the front of seed of coarse cereals, pulses, oilseeds, cotton, sugarcane, condiments and spices and fruits and vegetables. This undoubtedly appears to be a limited indicator of technology and its adoption. Even though, a few studies (Hazell et al 1995 and Misra 2004) have used the area under irrigation as an indicator of technology, it also suffers from errors of inclusion of crops that are not witnessing any technological intervention or progress and exclusion of crops, which do. As compared to area under HYV, the use of per hectare fertilizer consumption, irrigation and cropping intensity ratios appear to be far more appropriate indicator for technological progress. In fact, our results make a strong case for evaluating the impact of technology by differentiating it into constituents.

- The Minimum Support Price index (MSPI) shows a positive influence on ISTT for agriculture. The extent of impact, however, is less than proportional (0.3959 percent) to change in the MSPI (1 %). This could be due to fact that a limited number of crops and farmers are able to take the benefits of price support measures. The results of a recent situation assessment survey of agricultural household amply demonstrate this.
Any good monsoon often resulted into bumper agricultural production, causing agricultural prices to fall. Whereas, bad monsoon created shortages of agricultural produce and propelled higher prices, but yield loss caused during these periods often deprived the agricultural sector from taking any additional advantage. Our empirical results on the extent of rainfall and percentage deviations (surplus/deficit) from their historical averages provide enough support to maintain these hypotheses. Our empirical results clearly suggest the adverse impact of an increase in actual rainfall on ISTT for the agricultural sector. We, however, like to exercise constraint, as it could also be subjected to serious misinterpretations. A moderate increase in the actual rainfall on the wider geographic region may in fact be good for higher agricultural production (causing agricultural prices and ISTT to fall), but the same logic does not hold in the case of an extreme amount of rainfall. This could therefore, be supplemented by the distribution of rainfall in terms surplus and deficit events and its implication for ISTT.

Since agricultural production is quite vulnerable to extreme weather events, such deviations (actual rainfall from its historical averages) in general must represent bad outcomes for both agriculture and farmers due to loss of yield/production and that exercises upward pressure on agricultural prices. Our results suggest that 1 percent deviation in actual rainfall from historical mean causes on an average increase in ISTT by 0.00162 percent. It is miniscule, but still has an influence. Even though the size of effects of rainfall is marginal, if we factored out rainfall from countervailing factors such as assured irrigation might give us more meaningful results. Nevertheless, we believe that a marginal increase in rainfall may result in an increase in the agricultural production and thereby affect ISTT negatively by posing a downward price risk. Further, increase in surplus or deficit in the rainfall may also increase ISTT, but at the cost of yield loss driven by weather risks.

A brief review on Terms of Trade, investment (public and private) and growth in agricultural GDP revealed a few phases of ups and down in the trends. In the first phase (1981-82 to 1994-95), both ISTT and GBTT at all India level remained unfavourable to the agricultural sector. Nevertheless, significant
growth in productivity and production seems to have helped in raising higher investment in the sector despite of negative growth in the public investment. In the second (1995-96 to 2006-07) ISTT even though turned out to be in favour of the agricultural sector, the agricultural sector witnesses deceleration in the growth of agricultural GDP. Both NBTT and GBTT reported negative growth. In the third phase (2007-08 to 2011-12), GBTT, private investment and agricultural GDP showed a sharp increase in their growth rates. The overall results indicate a close association between agricultural growth performance and private investment and ISTT (GBTT). This, however, does not seem to be true in the case of public investment, agricultural GDP and ISTT. The public investment decisions in the agricultural sector are not driven by ISTT considerations, but agricultural growth in particular.

- The growth in ISTT for the agricultural sector differs across the states and phases. The growth rates reported in the third phase, although are higher than those of first and second phases, these have largely overshadowed by the growth rate of Maharashtra, and Gujarat (8-12 percent) followed by Tamil Nadu, West Bengal, Uttar Pradesh and Punjab (6-8 percent). In the first phase, annual compound growth rates of ISTT varied between 0.1 to 2 percent. In the second phase except Madhya Pradesh and Gujarat, almost all the states reported negative growth rates. The growth performance even of these two states not praise worthy (less than 1 percent). The impact of ISTT on agricultural GDP despite being positive, it is not statistically significant. In fact, in the overall growth matrix of ISTT and agricultural GDP, we observe almost in 39 percent (Assam) to 68 percent (Maharashtra) cases, ISTT has been inversely related to agricultural GDP. Out of the total 31 years reported cases, we find only 7 to 15 cases in which growth in ISTT led to higher growth in agricultural GDP and in 3 to 6 cases decline in growth of ISTT led to negative growth in agricultural GDP.

- The relation between ISTT for the agricultural sector, poverty and income (monthly per capita consumption expenditure) inequality in India has undergone serious changes over last four decades. The rural and urban poverty ratios in India have come down, but the economic growth with inclusive policies of the states in the recent period has reduced a large number
of poor from SC/ST and OBCs. The targeted programmes like MNREGA, subsidized food and housing and other empowering initiatives of course have contributed significantly in poverty reduction. In fact, in the recent past, we have witnessed a lower level of poverty outcomes despite of a significant increase in GBTT. These changes, of course, have come about due to the declining share of expenditure on food, which has reduced an adverse influence of higher prices on poverty, and the diversification of income within the agricultural household. Income inequality in rural area, though show some marginal increase in the recent period, in urban areas it has continued to increase over time. The growing concentration of wealth and capital in a few hands, a large influx of poor into the urban locations and low level of human capital are some of the major reasons causing continuous rise in urban income inequality.

- The ISTT, poverty and inequality at the state level, even though more or less reflect all India level trends, the correspondence between these, however, appear to be weak due to variations across the states. These variations largely come from historical differences in resource endowment and policy responses, putting them at different growth trajectories. In the first phase (1983-84 to 1993-94), the ISTT for agricultural sector show significant rates of growth across the states ranging from 0.25 to 3.41 percent. Notably, many states despite having Terms of Trade against agriculture benefited immensely from the improvement in their ISTTs and the positive impact of this was felt on reduction in consumption inequality and poverty. In the subsequent phases (1993-94 to 2004-05), the ISTT reported negative growth rates across the states. Moreover, the consumption inequality increased in both the rural and urban areas with a significant decline in the poverty ratios. During the third phase (2004-05 to 2011-12), on the contrary, ISTT has not only shown improvement in favour of agriculture and reported significant rates of growth across the states except in a few like Karnataka, Maharashtra, Rajasthan, Assam and Bihar. The rural and urban poverty ratios during this period reported s remarkable decline with the simultaneous increase in the consumption inequalities. It is not that the increase in ISTT did not influence income of a large number of poor, particularly agricultural casual labourers and marginal farmers, it had also shown a strong influence through social
security programmes and declining share of food items in the total consumption expenditure. It was noticed that increased employment opportunities and agricultural wages have compensated the loss incurred due to the price effect. Most importantly, the incidence of inequality within and across the states and regional variations in rural poverty has increased sharply in the post economic reform period. The widening the rate of growth within and across the sectors seems to have increased the structural inequalities. In rural areas, these inequalities to some extent were managed by increasing the employment opportunities in non-farm sector, but urban areas it appears to have utterly failed. The variations in rural poverty in fact have been closed associated with the agricultural performance and more recently with the expansion of employment generated through various schemes.

- The correlation matrix of ISTT, with poverty and income inequality indicated higher levels of ISTT scores are positively associated with higher levels of rural consumption inequalities but negatively with that of urban. Moreover, higher levels of ISTT scores are also associated with the lower level of rural poverty ratios and higher level of urban poverty ratios. Of course, there are a few some exceptions to this, but in a large number of cases, these observations hold true. As far as the association of ISTT levels with that of consumption inequality and poverty is concerned, these were observed to be ranging from very weak to average level. This in fact suggested that the ISTT does influence the poverty and inequality outcomes, but its strength to affect the outcomes is quite weak. In an alternative scenario, the correlation matrix considering the long period does indicate higher levels of growth in ISTT positively associated with higher levels of change in rural consumption inequality and negatively with that of urban and net changes in poverty in general. The strength of the association in case of the latter, however, appears to be quite on shaky ground to make some conclusive statements.