Trends in agriculture-industry interlinkages in India: pre and post-reform scenario

Saikia, Dilip

Institute for Financial Management and Research

December 2010

Trends in Agriculture-Industry Interlinkages in India: Pre and Post-Reform Scenario♣

Dilip Saikia♠

Institute for Financial Management and Research (IFMR)
24 Kothari Road, Nungambakkam, Chennai- 600034 (India)
E-mail- dilip.saikia@ifmr.ac.in; dilip.gu@gmail.com

Abstract

Over the years the Indian economy has undergone a structural change in its sectoral composition: from a primary agro-based economy during 1970s, the economy has emerged as predominant in the service sector since the 1990s. This structural change and uneven pattern of growth of agriculture, industry and services sector in the post reforms period is likely to appear substantial changes in the production and demand linkages among various sectors, and in turn, could have significant implication for the growth and development process of the economy. This has triggered a renewed interest in studying the inter-relationship between agriculture and industry. The present paper is intended to examine the trends of interlinkages between the two sectors from a three sectoral perspectives for the pre- and post-reforms periods in India. The study observed that 'agriculture-industry' linkage has been deteriorating over the years and there has been directional change in the inter-linkages between the two sectors. Both the production and demand linkages were primarily from the industry to agriculture sector in the pre-reform period, which changed to from agriculture to industry in the post-reform period. Further, while the linkage was primarily through the production channel in the 1960s through 1980s, it translates primarily through the demand channel since 1990s.

Key Words: Agriculture, Industry, Sectoral linkages, Indian economy

First Draft: May, 2009. Revised Version: May, 2011

Trends in Agriculture-Industry Interlinkages in India: Pre and Post-Reform Scenario

1. Introduction

The inter-relationship between agriculture and industry has been a long debated issue in the development literature. In the Indian context the issue has acquired interest since industrial stagnation in the mid 1960s. Over the years the Indian economy has undergone a structural change in its sectoral composition: from a primary agro-based economy during the 1970s, the economy has emerged as predominant in the service sector since the 1990s. This structural changes and the uneven pattern of growth of agriculture, industry and service sector economy in the post reforms period is likely to appear substantial changes in the production and demand linkages among various sectors and in turn, could have significant implication for the growth process of the economy. At the same time the growing integration with the rest of the world in the post-reform period (post 1991 period) and the recent spurt of service sector led growth are also likely to have significant impact on the linkages between the agriculture and industry. This has triggered an interest in readdressing the interlinkages between the two sectors. The present paper is intended to examine the trends of interlinkages between the two sectors from a three sectoral perspectives for the pre- and post-reforms periods in India.

India being a predominantly agrarian economy and an agro-based industrial structure, the interrelationship between agriculture and industry has been one of the major issues for the researchers and policy makers since the beginning of the planning period. In the pre and early post-independence period, the industry sector had a close relationship with agriculture due to the agro-based industrial structure (Satyasai and Baidyanathan, 1997). Satyasai and Viswanathan (1999) found that the output elasticity of industry with respect to agriculture was 0.13 during 1950-51 to 1965-66. Rangarajan (1982) has found that a 1.0% growth in agricultural production increases industrial production by 0.5%, and thus, GDP by 0.7% during 1961-1972.

However, the industrial sector witnessed a slow growth, followed by stagnation since the mid 1960s, which was largely attributed to the stunned agricultural growth and favourable agricultural TOT, among other factors (Patnaik, 1972; Nayyar, 1978 and Bhatla, 2003).[1] In fact the interdependence between the two sectors has found to be weakened during the 1980s and 1990s (Bhattacharya and Mitra, 1989; Satyasai and Viswanathan, 1997). For instance, Bhattacharya and Rao (1986) have found that the partial output elasticity of industry with respect to agriculture has declined from 0.15 during 1951/52 –1965/66 to 0.03 during 1966/67-1983/84. Contradictorily, Satyasai and Viswanathan (1999) found that the output elasticity of industry with respect to agriculture has increased from 0.13 during 1950/51-1965/66 to 0.18 during 1966/67–1983/84, and then remained at the same level 0.18 during 1984/85-1996/97. The deteriorating linkages between agriculture and industry have been primarily credited to the deficiency in demand for agricultural products, decline in share of

---

[1] However, Ahluwalia (1985) denied the wage good constraint argument for the industrial stagnation of the mid sixties and contested presence of any relationship between agriculture and industry. Instead he argued for the supply constraints owing to poor infrastructure and poor productivity performance as the major reasons for stagnant industrial growth.

agro-based industries coupled with slow employment growth (Rangarajan, 1982; Bhattacharya and Rao, 1986; and Chowdhury and Chowdhury, 1995). Sastry et al. (2003), for the period 1981-82 to 1999-2000, found that the forward production linkage between agriculture and industry has declined, whereas backward production linkage has increased. They also found significant impact of agricultural output on industrial output, and that agriculture's demand linkage to industry has declined, while that of from industry to agriculture has increased.

That most of the studies in India have followed the traditional "two-sector" model in a closed economy, it raises question about the methodological reliability and the comprehensiveness of the findings. It is reasonable to argue that neither the "two-sector" model nor the close economy framework are appropriate to analyze sectoral linkages in India, because India has been becoming more and more open since the reforms of 1990s, and since then (or even before), the growth of the economy has been led by the services sector. That the services led growth is the most prominent feature in the post-reform era, any sectoral linkages analysis which circumvents the services sector does not provide comprehensive empirical findings. The unscrupulous part of using a two-sector framework and keeping the services sector away from the analysis is that it underestimates the actual linkages between the sectors, since all the sectors of the economy are interrelated to each other, either directly and indirectly. Unlike the two-way linkages between agriculture and industry, the linkages between agriculture and services sector is one-way and this linkage is mainly backward linkage, rather forward linkage. Studies show that with the increase in the productivity of agriculture, demand for post-harvest facilities such as processing, storage, transport, communication and market, etc. has increased over the years. There are considerable evidence that investments in some special services such as transport and communication, storage, building of rural roadways, banking and financial facilities, trade and hotels, social services such as education, hospitals and other infrastructure, etc. increases agricultural productivity. The growth in specialized services can enhance higher rates of economic growth, and is also likely to strengthen 'agriculture-industry' linkages. Similarly, with the increase in per capita income, demand for specialized services that act as inputs in agriculture will increase, because the demand for services is highly income elastic. This, in turn, will induce industrial growth, and stimulates agricultural output through increased demand for farm commodities and value added agri-products (Bhatla, 2003). Unlike agriculture, industry has two-way linkages with the services sector and the level of linkage is much higher than that of in case of agriculture (Singh, 2007 and Gordon and Gupta, 2004). Further, services sector has stronger backward linkages compared to forward linkages with both agriculture and industry. Hansda (2001) applied the input-output analysis at a much disaggregated level (115 activities - 22 in agriculture, 80 in industry and 13 in services) for 1993-94 and confirmed that the Indian economy is quite service-intensive and industry is the most service-intensive sector. Banga and Goldar (2004) found that services input contributed for about 25% of output growth of registered manufacturing during 1990s (as against 1% during 1980s), and that increasing use of services in manufacturing has significant favouralbe impact in total factor productivity (TFP) growth of organised manufacturing sector. Using input-output matrices for four time points (1968-69, 1979-80, 1989-90 and 1993-94), Sastry et al. (2003) observed that over the years agricultural production became more industry- and services-intensive, whereas

industrial production became less agriculture-intensive and more services-intensive. These observations, in turn, imply that excluding the services sector from the analysis understates the 'agriculture-industry' linkages. Given these linkages and the recent services sector boom, the apparent question is how to interlink the services sector with agriculture and industry, and how it is going to impact the 'agriculture-industry' linkages.

The rest of the paper is organised in the following sections. The next section explains the nature of agriculture-industry interlinkages. Section 3 provides a review of the theories underlying the linkages. Section analyses the trends of sectoral linkages, specifically agriculture-industry interlinkages. Finally, section 5 concludes our discussion.

2. Nature of Agriculture-Industry Linkages

Theoretically, sectoral linkage describes a sector's relationship with the rest of the economy through its direct and indirect intermediate purchases and sales (Miller and Lahr, 2001; cited in Gemmell, 2000). The concept of linkages has evolved from Hirschman's theory of 'unbalanced growth'. The sectors with the highest linkages should be possible to stimulate a more rapid growth of production, income and employment than with alternative allocations of resources (Hirschman, 1958 and Polenske and Sivitanides, 1990). The linkage concept has been recognized as playing a crucial role and providing substantial contributions towards guiding the appropriate strategies for future economic development.

That agriculture and industry being integral component of development process due to their mutual interdependence and symbiotic relationship, the contribution of agriculture to the economy in general and to industry in particular is well known in almost all the developing countries. However, the degree of interdependence may vary and also change over time. In the theory and empirical literature, the inter-relationship between agriculture and industry has been discussed from different channels. First, agriculture supplies food grains to industry to facilitate absorption of labour in the industry sector. Secondly, agriculture supplies the inputs like raw cotton, jute, tea, coffee etc. needed by the agro-based industries. Thirdly, industry supplies industrial inputs, such as fertilizer, pesticides, machinery etc. to the agriculture sector. Fourthly, agriculture influences the output of industrial consumer goods through demand. Fifthly, agriculture generates surpluses of savings, which can be mobilized for investment in industry, and other sectors of the economy. Sixthly, fluctuations in agricultural production may affect private corporate investment decisions through the impact of the terms of trade on profitability (Ahluwalia, 1986 and Rangarajan, 1982). Whereas some of these channels emphasize the 'agriculture-industry' linkage on the supply side or production side, others stress the linkages through the demand side. The production linkages basically arise from the interdependence of the sectors for meeting the needs of their productive inputs, whereas the demand linkage arises from the interdependence of the sectors for meeting final consumption. Further, the linkages between the two sectors can also be categorized into two groups based on the direction of interdependence. One is the backward linkage, which identifies how a sector depends on others for their input supplies and the other is the forward linkage, which identifies how the sector distributes its outputs to the remaining economy. More importantly, these two linkages can indicate a sector's economic pull and push, because

the direction and level of such linkages present the potential capacity of each sector to stimulate other sectors and then reflect the role of this sector accordingly.

The demand for industrial products from agriculture sector is influenced either by agricultural output changes or the terms of trade (here after TOT) between agriculture and industrial output. Therefore, a distinction between the output effect and the TOT effect of the demand for industrial products from agriculture is worth emphasizing. The effect of an increase in food prices on the demand for non-food items by different expenditure groups in rural areas can be broken into two parts. First, there is the negative cross elasticity of demand, and second, there is the positive income effect, which depends on the increase in total expenditure from a rise in prices and on the expenditure elasticity of demand for non-food items of that expenditure group (Rangarajan, 1982). Further, given the contrasting forces between that low food price being good for industrial supply and high food prices being good for industrial demand, it is the TOT between agricultural and industrial products that provides the equilibrating mechanism ensuring that supply and demand grow at the same rate in each other. If the prices of agricultural products are 'too' high in relation to the industrial products then industrial growth is either demand constrained or supply constrained (Ahluwalia, 1985 and Rangarajan, 1982).

3. A Reprise of Theory

The early writers, for example Rosestein-Rodan (1943), Lewis (1954), Scitovosky (1954), Hirchman (1958), Jorgeson (1961), Fei and Ranis (1961) and others emphasized the role of agriculture only as a primary supplier of wage goods and raw materials and abundant labour supply to industry. The role of agriculture in the transformation of a developing economy was seen as ancillary to the central strategy of accelerating the pace of industrialization (Vogel, 1994). The Lewisian "two-sector" growth model emphasized the crucial role of capitalist surplus in the development process. Assuming unlimited supply of labour in the subsistence sector, the model predicted that cheap surplus labour from traditional rural subsistence sector would speed the accumulation of capital and development of high productivity modern sector.[2] Hirschman (1958) pointed out agriculture for its failure to exhibit strong forward and backward inter-industry linkages needed for development.[3] In contrast, Fei and Ranis (1961) advocated 'balanced-agricultural-industrial growth' path as the strategy of development. Kuznets (1968) also observed that for a successful development strategy technological advancement must support both industrialization and improvements in agricultural productivity.[4] Recognizing that economic growth is (not) just a matter of easy transfer of labor from subsistence agriculture to progressive industry, Kuznets emphasized the increase in agricultural productivity as an indispensable base of modern economic growth.

---

[2] For Lewis (1954), development is largely matter of capital formation, of income distribution in favour of the saving class, and more important of a quantitative growth in the saving rate.

[3] According to Hirschman (1958) the weak backward linkages of agriculture failed to induce capital formation, and hence, agriculture could not become the leading sector in the big push.

[4] Kuznets (1968) pointed out that, while the shifts away from agriculture and agricultural employment are the basic stylized results of industrialization, they themselves are more the consequences of technological change in the industrializing economy. Industrialization ideally provides the technological basis for the transformation of agriculture, such that a coincident revolution in agricultural productivity releases human resources to industry (Vogel, 1994).

Kalecki (1976) also pointed out the importance of investment and technological advances in agriculture for the rapid development of industry. Emphasizing agricultural development as essential for a successful industrialization, Kalecki remarked that 'balanced investment in the production of wage goods and capital goods forms the basis of the sustainable long-run growth path'. However, unlike Lewis, Kalecki assumes the existence of excess capacity in the industrial sector, and thus, cost-determined industrial prices (Jha, 2010), due to which the Lewisian conclusions are radically altered in Kalecki model.

However, it was only since the mid-1970s that economists (like Kaldor, 1975; Mellor, 1976; Singer 1979; Adelman, 1984; Ranis, 1984 and others) have recognized the potential of agriculture to generate sufficient demand to stimulate industrialization. Emphasizing the demand constraint of industrial output, Kaldor (1975) neglected the supply side TOT link between agriculture and industry, and maintained that the equilibrium level of industrial output is determined by the level of autonomous surplus generated in the agricultural sector (Jha, 2010). In an earlier work, Johnston and Mellor (1961) put agriculture at the centre of the policy stage by pointing out the strategic possibilities opened up by the surplus accounting to successful farmers from green revolution.[5] Johnston and Mellor (1961) countered the Lewisian 'two-sector' model by substituting a 'general transformation model' in place of Lewisian view that development is a process of sectoral reallocation of labour through capitalist expansion. Mellor (1976) emphasized the possibility of endogenous demand-led growth, on the one hand, and productive reinvestment from agriculture surpluses (supply side), on the other. Adelman (1984) put forward the Agricultural-Demand-Led-Industrialization (here after ADLI) strategy, which highlights the role of increased agricultural productivity through technological innovation and increased investment in raising rural incomes. Adelman contends that because of agriculture's productive and institutional links with the rest of the economy, stimulating agriculture produces strong demand incentives (increased rural household consumer demand) and supply incentives (increased food supply without rising prices) fostering industrial expansion.[6] As Vogel (1994) observed, "By stressing the production, income and consumption demand linkages inherent in a developing economy, the ADLI strategy attempts to steer a low-income economy toward a more equitable and self-sustaining growth path."

These theoretical literatures broadly highlighted the place of agriculture and non-agriculture sector, especially industry in the development process and contribution of each in augmenting growth of output and employment. Most of the theoretical literature has largely focused only on one side of the 'agriculture-industry' linkages, i.e. either the supply side linkages or demand side linkages. However it is both the demand side and supply side linkages that work together in an inter-sectoral framework, which determines the interlinkages between the two sectors. In this respect Bhaduri (2003) and Bhaduri et al.

---

[5] The crux of the argument was that under certain macro conditions, a booming food grain production would not only stimulate growth in agriculture and agriculture related sectors (such as trade, transport and services etc.), it could even dictate the pace and pattern of industrial expansion.

[6] This strategy represents a departure from past economic growth policies that have focused primarily on trade strategies such as import substitution industrialization or export promotion (Vogel, 1994).

(2007) are two important contributions in the literature. Bhaduri (2003) extends Kaldor's model by considering the role of the agricultural surplus from the supply side as well as the importance of the demand side effect for industrial goods. Emphasizing the role of effective demand as well as the role of the TOT between agriculture and industry, Bhaduri recognized the fact that agricultural surplus is realized as purchasing power to serve as effective demand for industrial goods. Here the role of effective demand is considered in the process of adjustment of industrial growth related to agricultural growth. In this set up, both the sectors grow in tandem, reinforcing and reinvigorating each other's growth impulse, by resolving each other's potential realization problem (Jha, 2010). Further, Bhaduri et al. (2007) have extended the Kaldor's model by contrasting between the supply side and demand side linkages of the two sectors from the TOT point of view. He pointed out that TOT might impact on the supply side of industry through the cost of production, while at the same time it might also influence the level of aggregate demand. Here, the supply side impact is due to the Lewisian view, which states that a shift in the TOT in favour of agriculture squeezes industrial profit and growth, whereas the demand side impact is due to the Kaldor's view, which states that a shift in the TOT in favour of agriculture stimulates the industrial demand, and thus, growth of the industrial sector.

4. Trends of Agriculture-Industry Interlinkages in India
4.1 Sectoral Composition of Indian Economy

Prior analyzing the trends in the sectoral linkages in the Indian economy, it would be useful to review the changes in the sectoral composition of the gross domestic product, in terms of share of agriculture, industry and services sector. Figure 1 and Table 1.A presents temporal behaviour of the share of economic activities, clubbed under primary, secondary and tertiary sectors in the national income for the period 1950- 51 to 2007-08. Over the years, the share of real income primary sector (agriculture and allied activities) has declined from 55.0% in 1950-51 to 17.75% in 2007-08. In contrast, manufacturing's share together with electricity, gas, water, sanitation and construction activities considered under the secondary sector has accelerated from 10.16% in 1950-51 to 20% in 2007-08. Tertiary sector has witnessed a continuous expansion with a share in total national income rising from 34.27% in 1950-51 to 62.87% 2007-08.

A decade-wise annual trend growth rates in each sector indicates a shift towards higher growth only from the early eighties (Figure 2 and Table 2.A). Before that, primary sector growth rate was below 2.0% in the sixties and seventies compared to a higher growth rate of 2.74% during the fifties. Secondary sector too witnessed a similar picture of high output growth in the fifties (6%) and a comparatively lesser rate (5.15% and 5.07%) in the subsequent decades. Further, higher rates of growth achieved in the primary and secondary sectors at 3% and 6.41% during the eighties remained unchanged in the decade that followed. In contrast, it is the tertiary sector that has witnessed phenomenal growth from 4.40% in the fifties to 6.35% in the eighties and 7.32% in the nineties.
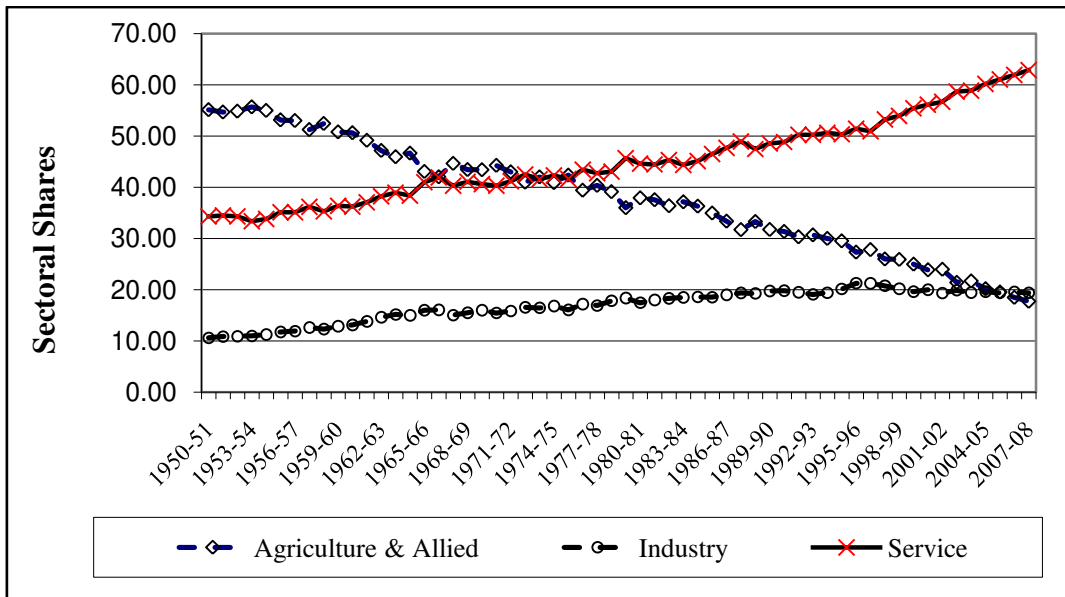
7

Figure 1: Sectoral Share of GDP at FC (at 1999-2000 prices)
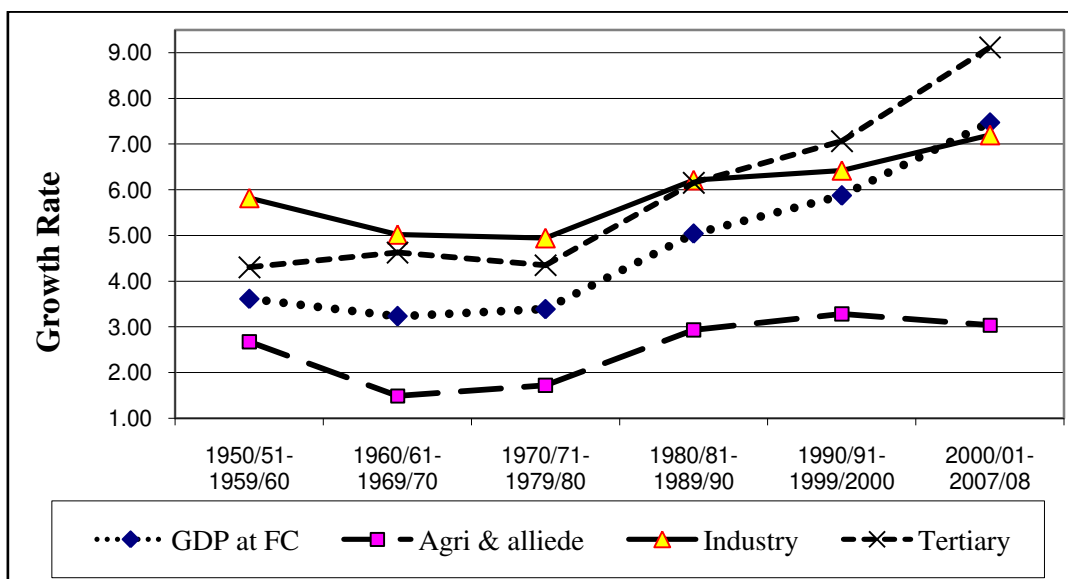Source: Handbook of statistics on Indian economy, 2007-08

Figure 2: Sector Wise Trend Growth Rate of GDP (at 1999-00 prices)
Source: Handbook of statistics on Indian economy, 2007-08

This sectoral composition of national income has tried to capture the inter-sectoral linkages and likely structural shifts, if any, in the economic development of India. At a glance, the declining contribution of agriculture to GDP gives an indication that the role of agriculture in the national economy has become less and less important. The share of agriculture in GDP, however, does not reflect adequately the role of agriculture growth has played and will continue to play in Indian economy (Vyas, 2004). While the share of agriculture in national income has been declining, the workforce engaged in agriculture has exhibited only a marginal decline: whereas 75.9% of the total workforce was engaged in agriculture in 1961, the figure declined to 59.9% in 2000-01 and then to 52.0% in 2006-07. In

absolute terms, agriculture provided employment to 237.8 million persons in 2000-01 (Economic Survey, 2007-08). This is due to the fact that studies by Vogel (1994) and Bhatla (2003) argue that agriculture continues to be an important sector in terms of absorbing two-third of the total work force and positively influencing development of manufacturing and overall economy despite a deceleration in its share in total income. Bhatla (2003) also remarked that despite of differential growth across the sectors, agriculture is still seen to stimulate industrial and overall economic growth. Further, the existence of forward and backward production linkages means that the importance of the agricultural sector cannot be simply implied just from the value of its direct output.

4.2 Inter-Sectoral Linkages in India

The discussion of the earlier section suggests that there has been a structural change in the sectoral composition of Indian economy over the years: the share of agricultural sector in the national income has declined, whereas that of services sector has increased considerably over the years. At the same time the decadal trend growth rates in each sector indicates a shift towards higher growth since the early eighties. Various studies have argued that this structural change and the uneven pattern of growth of agriculture, industry and services sector of the economy in the post reforms period is likely to appear substantial changes in the production and demand linkages among various sectors and in turn, could have significant implication for the growth and development process of the economy. Sastry et al. (2003) and Bhatla (2003) observed that the dependence of agriculture on industry for modern agricultural inputs like fertilizers, pesticides and machine tools has increased over the years. In this light, a discussion of the sectoral interdependence will give us some primary insights on the dependence and will help us to support our argument.

4.2.1   Production Linkages

As we have explained in the earlier section, the production linkages among the various sectors basically arise from the interdependence of agriculture on industry and industry on agriculture for meeting the needs of their productive inputs. The output of agriculture provides inputs for many industries, such as sugar, cotton textiles, jute textiles, sugarcane, and tobacco.[7] Similarly, agriculture also absorbs the outputs of other sectors as inputs required in the production process. The major industrial outputs coming under this category are fertilizers, pesticides, machine tools and electricity. The share of the agro-based industries in terms of value of gross output, net income, total inputs and net profit has declined over the years (Table 3.A). Further, the share of agro-based industries in the number of factories has marginally declined from 44.66% in 1980-81 to 40.37% in 2003-04, whereas that of in employment has increased marginally from 44.35% in 1980-81 to 47.48% in 2003-04. Over the years, however, the share of the agro-based industries in the gross capital formation has increased from 12.47% in 1980-81 to 26.88% in 2003-04. Thus, it indicates that the

---

[7] The proportion of the value of agricultural inputs to the total value of output in these industries varies from 20% in matches to 95% in 'gur' and 'khandsari', which are both forms of brown sugar (Rangarajan, 1982).

importance of the agro-based industries, which depends on agriculture sector for meeting input requirements, has declined over the years.

Looking at the agriculture's purchase from the non-agriculture sector it is revealed that agriculture's purchase of the final consumption has increased considerably over the years, while that of intermediate consumption has increased marginally (see Figure 1.A). In terms of the share of agriculture's final and intermediate consumption the share of agriculture's intermediate consumption to total consumption has remained as low as 12.13% in 1997-98 as against 11.63% in 1970-71 (see Table 4.A). This also suggests that the demand linkage between agriculture and industry is stronger than the production linkage in the Indian economy.

The share of modern inputs in agriculture, which includes fertilizers, electricity, diesel, etc., has increased during 1952/53-1997/98 (see Table 5.A). This implies that agriculture's dependence on industry for inputs has increased over the years, particularly since the 1980s. This justifies the arguments made by Satyasai and Viswanathan (1999), who observed that the share of value of purchase of inputs (such as fertilizers, electricity, diesel, irrigation and pesticides) in the value of total inputs (excluding labour) used in agriculture increased from 5.28% in 1950-51 to 39.15% in 1970-71 and then 87.0% in 1995-96.

The consumption of fertilizers (N+P+K) has increased from 0.69 lakh tones in 1950-51 to 167 lakh tones in 2000-01 and then 249.09 lakh tones in 2008-09 (see Table 6.A). Similarly, the consumption of pesticides (technical grade materials) has increased from 2.35 thousand tones in 1950-51 to 75 thousand tones in 1990-91 and then declined to 43.58 thousand tones in 2000-01 and 37.56 thousand tones in 2006-07. In terms of per hectare consumption the consumption of fertilizers (N+P+K) has increased from 53.2 kg per hectare of gross cropped area in 1950-51 to 9138 kg per hectare of gross cropped area in 2000-01 (see Table 7.A). On the other hand the consumption of pesticides has increased from 1.8 kg per hectare of gross cropped area in 1950-51 to 41.0 kg per hectare of gross cropped area and then declined to 23.8 kg per hectare of gross cropped area in 2000-01. Studies by Satyasai and Viswanathan (1999) observed that the share of fertilizers in increasing food grain production in India has been about 50-55% in the recent past. They also pointed out that the real spurt in fertilizer use came only after the introduction of HYV seeds in the late sixties. Chauhan (1998) found that annual consumption of pesticides has increased by 20-25 times after the introduction of HYV varieties for a variety of crops and intensive cultivation (cited in Satyasai and Viswanathan, 1999). The production of tractors and power tillers has increased by more than three times between 1985-86 and 1997-98. The production of tractors rose from 75550 to 257449 and that of power tillers from 3,706 to 12,750 during the same period (Satyasai and Viswanathan, 1999).

The above reveals that the use of modern inputs in agriculture has increased considerably since the 1980s. This gives an abstract idea that agriculture's dependence on industry for modern inputs has increased over the years. On the other hand, the industry's dependence on agriculture for meeting inputs has declined over the years suggesting a weak production linkage.

Further evidence on the inter-sectoral interdependence between the sectors can be obtained from the analysis of I-O tables. The sectoral share matrix of I-O tables in Table 1 explains the production linkages among various sectors of the economy. With these tables, it is

possible to examine the nature and the extent of changes in the inter-dependence of various sectors over the years. It is obvious that during 1968-69, to produce one unit of agricultural output 0.182 unit of input was required from agriculture itself, 0.043 units from industry and another 0.016 units from the services sector. In 1993-94 to produce one unit of agricultural output, inputs from industry and services sector were 0.140 units and 0.048 units respectively. This input requirement from the industrial to agriculture further increased to 0.195 units in 1998-99 and then decline to 0.180 units in 2003-04, whereas that of from the services to agriculture declined to 0.029 units in 1998-99 and then marginally increased to 0.045 units in 2003-04. This increase in the input proportion from industry to agriculture almost by three times in during 1968-69 to 1993-94 indicates the modernization of agriculture, and thereby enhancing the dependence of agriculture on the industry for inputs. However, the increase is not much remarkable in the post-reform period, as there has been only around 40% increase during 1993-94 to 1998-99 and there is marginal decline during 1998-99 to 2003-04. This is quite surprising because as we will see in the next section that agriculture has a favourable TOT with industry sector during this period (Figure 4), which means income from the farm sector has been increased but it is not realised in the consumption of industrial products. However, this could also be a case that farm sector's consumption from industry has increased during this period, but the increase is for the consumer goods rather than the production goods, so that it is not realised in the input-output relationship. However, it requires further enquiry to know the causes and consequences of such development.

On the other hand, in respect to industry to produce one unit of output, input requirements from agriculture and services sectors were 0.127 and 0.135 units respectively in 1968-69. However, the input requirement from agriculture has declined to 0.035 units in 1993-94, whereas that of from services sector has increased to 0.213 during the same time. By 2003-04, the industry's input requirement from agriculture further declined to 0.028 units and that of from services sector also declined to 0.108 units. The decline in industry's input requirement from agriculture reflects the fact that over the years the Indian industrial sector has become broad based and diversified with different manufacturing activities; and the agro- and resource based industries no longer continue their dominance position in Indian industrial scenario.

Considering the services sector, the input requirements to produce one unit of services in 1968-69 were 0.017 units from agriculture, 0.132 units from industry and 0.096 units of its own, which increased to 0.034 units from agriculture, 0.150 units from industry and 0.195 units of its own in 1993-94. By 2003-04, service sector's inputs requirements from agriculture has declined to 0.029 units, while that of from industry increased to 0.216 units. Thus, as we have argued in an earlier section, services sector has stronger production linkages with industry and the linkages is both way. On the other hand, the sector's linkages with agriculture are not stronger from any of the sides and it has become weaker in the post-reform period. This is against our expectation as in an earlier section we have argued that agriculture sector's investment in some special services such as transport and communication, storage, building of rural roadways, banking and financial facilities, trade and hotels, and social services such as education, health care, etc. will increase in the post-reform period, which can enhance higher rates of agricultural growth, and thereby, strengthen the linkages between the two sectors.

Table 1: Sectoral Share Matrices (Production Linkages)

	Agriculture	Industry	Services
1968-69			
Agriculture	0.182	0.127	0.017
Industry	0.043	0.333	0.132
Services	0.016	0.135	0.096
1979-80			
Agriculture	0.160	0.130	0.039
Industry	0.068	0.345	0.105
Services	0.020	0.149	0.096
1989-90			
Agriculture	0.166	0.042	0.035
Industry	0.144	0.373	0.172
Services	0.047	0.188	0.185
1993-94			
Agriculture	0.145	0.035	0.034
Industry	0.140	0.365	0.150
Services	0.048	0.213	0.195
1998-99			
Agriculture	0.118	0.033	0.025
Industry	0.195	0.421	0.211
Services	0.029	0.101	0.132
2003-04			
Agriculture	0.196	0.028	0.029
Industry	0.180	0.455	0.216
Services	0.045	0.108	0.129

Source: Data up to 1993-94 are from Sastry et al (2003) and for 1998-99 and 2003-04 are from Kaur et al. (2009)

Now, a comparison of the I-O table for 1993-94 with 1968-69 and that of for 2003-04 with 1993-94 reveals the shifts in industry's production linkages in favour of agriculture moderately and services sector sharply during 1968-69 to 1993-94, while there is a halt in the production linkage with agriculture and a significant decline with services sector during the post-reform period (1993-94 to 2003-04). Sastry et al (2003) remarked that at India's present stage of development; it is only natural that the production linkages are not strong. The Asian Development Bank's *Second Asian Agricultural Survey* also found that the inter-sectoral linkages were weak in several Asian countries including India (cited in Sastry et al, 2003).

4.2.2 Demand Linkages

The demand linkage between agriculture and industry operates through agricultural income. As agricultural income increase, this brings about an increase in the demand for industrial consumer goods and some producer goods, such as pumps, tractors, fertilizers, pesticides, etc. As Ahluwalia (1985) pointed out the there are certain consumer goods such as clothing, footwear, sugar and edible oils, which accounts for about a fourth of the value added in the consumer goods sectors, for which rural consumption is over three times than the urban

consumption. Rangarajan (1982) observed that the rural demand in India for industrial consumer goods account for as much as two-thirds of the total demand for them. At the same time there is also demand for producer goods also increase. As we can see from Table 5.A through Table 7.A the share of modern inputs in agriculture and the consumption of fertilizers and pesticides has been increasing over the years.

The TOT between agriculture and industrial products plays very important role in enhancing the demand linkages between the two sectors. The TOT is defined as the relative price ratio of agricultural and industrial goods. A favouralbe TOT for agriculture leads to higher income of the agricultural sector, and thus, creates more demand for industrial goods. On the other hand, the same favouralbe TOT will squeezes industrial growth by reducing the profit margins through increase in the product wage rate. Different economists like Thamarajakshi (1965 and 1990), Kahlon and Tyagi (1980), Tyagi (1987 and 1988), Mungekar (1992 and 1993), Palanivel (1999) and others have calculated the TOT series at different times for India using different method (Deb, 2002). However, all the TOT series have shown more or less same trend (Figure 3).
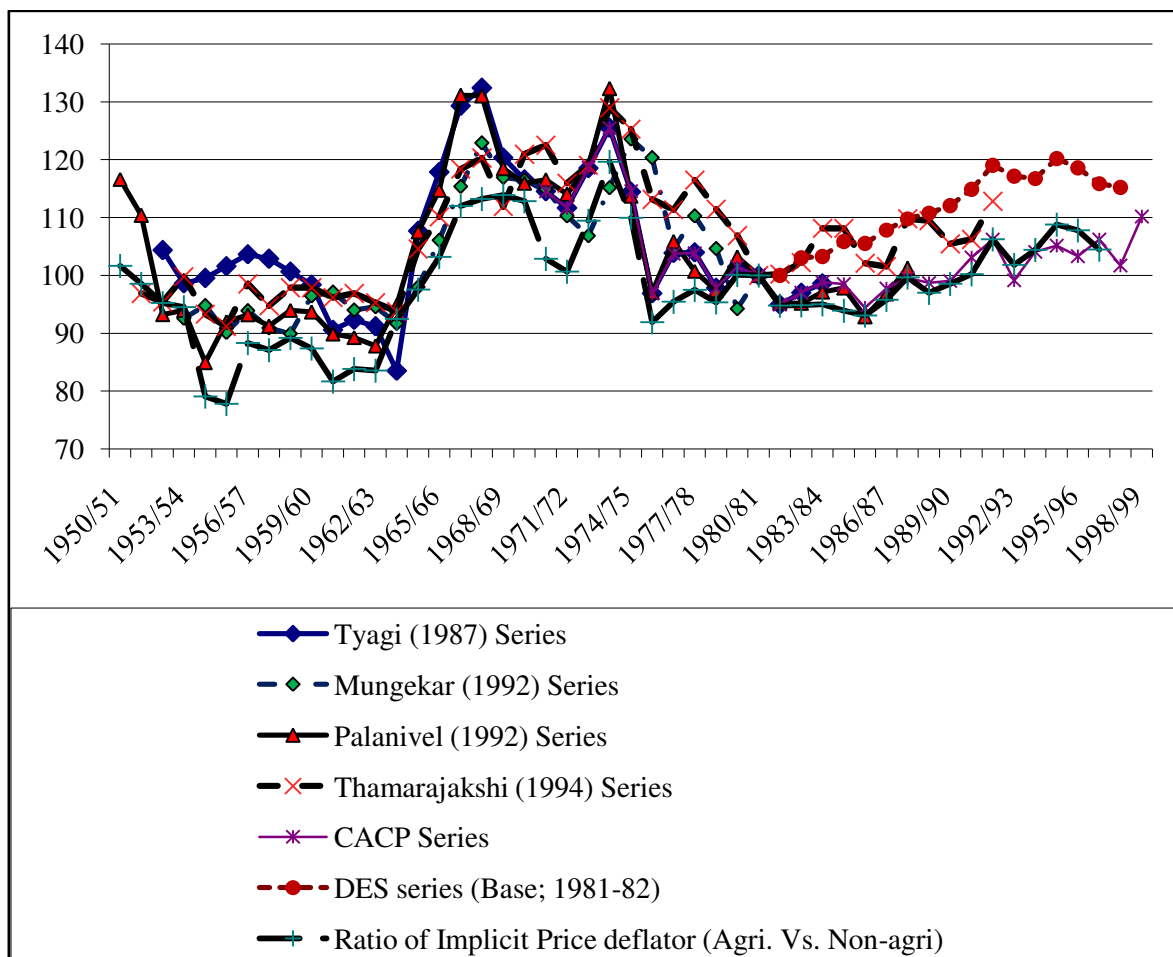

Figure 3: Comparison between different TOT Series
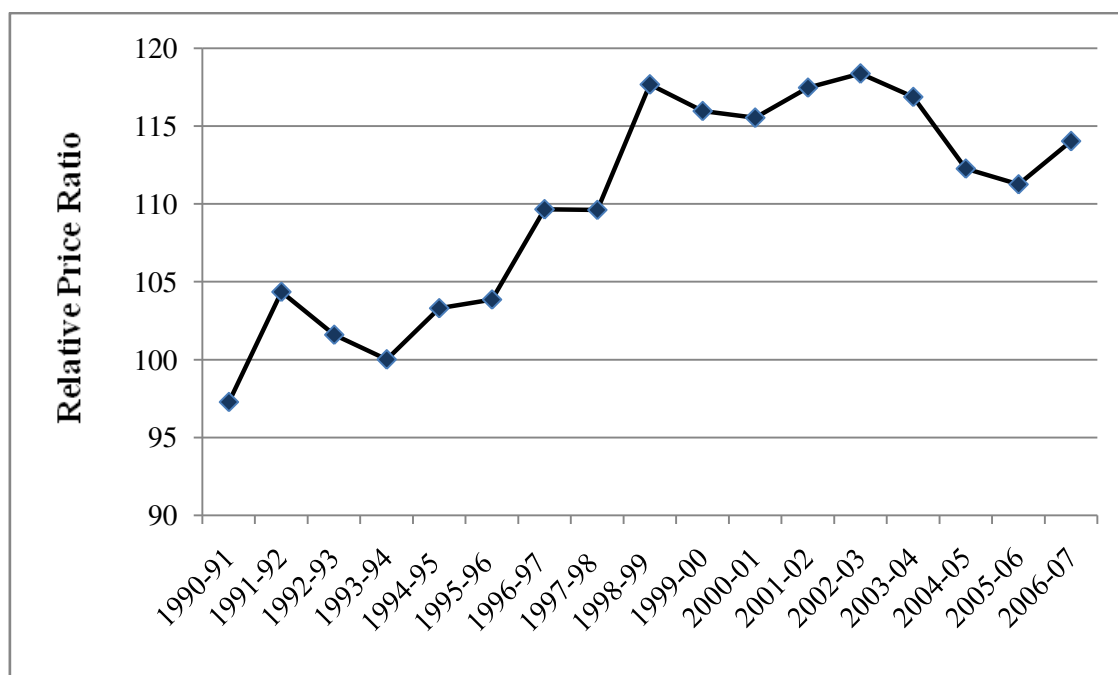Source: Dev (2002)

Figure 4 Relative Prices of Agriculture and Industry (1993-94 prices
Source: Economic Survey, 2007-08 and various issues

The TOT for agriculture in India has found to be favouralbe since the mid 1960s, except the unfavourable TOT for the period 1977-78 to 1983-84. Figure 4 shows the favouralbe TOT for agriculture (defined as the relative prices of agricultural to industrial products) for the period 1990-91 to 2006-07. Examining the implications of agricultural TOT on Indian industries, based on the linkages through food grain supply, Chakravarty (1974) postulated that beginning from 1964/65, a favorable agricultural TOT was instrumental in squeezing the profit margins of the industrial sector through an increase in the product wage rate. Rao and Maiti (1996) also observed that the impact of a rise in relative food grain price on the demand for industrial consumer goods was significantly negative during 1952-90 (cited in Deb, 2002).

As in the case of production linkages, the demand linkage can also be examined by using the Leontief inverse matrices, i.e. the $(I-A)^{-1}$ matrix, where 'A' is the input-output coefficient matrix. Such inverse matrices are given in Table 2. It reveals from the table that a rise in the demand in agriculture by one unit was likely to raise demand for industrial goods by 0.087 units and demand for services by 0.035 units in 1968-69. In 1993-94, one unit of rise in the agricultural output was likely to enhance the demand for industrial goods by 0.297 units and that of for services by 0.149 units. Agriculture's demand linkages to industry further increased to 0.446 units in 2003-04, while that to services declined to 0.123 units during the same.

Unlike the agriculture's demand linkages to industry, the industry's demand linkages to agriculture has been weakened during both the pre- and post-reform period, whereas industry's demand linkages to services became almost double become double in 1993-94 and then it returned to the initial position in 2003-04. In 1968-69 one unit of rise in industrial output was likely to enhance demand for agriculture commodities by 0.247 units, which declined to 0.087 by 1993-94 and then further declined to 0.077 units in 2003-04. On the other hand,

14

one unit of rise in industrial output was likely to enhance demand for services by 0.237 units in 1968-69, which considerably increased to 0.457 units in 1993-94 and then declined to 0.247 in 2003-04.

The services sector's demand linkages to the agriculture sector have remained more or less over the pre- and post-reform period, barring some marginal increase during 1979-80 and then started falling. On the other hand, the sector's demand linkages to industry sector increased by about 44% during 1968-69 to 1993-94 and by about 52% during 1993-94 to 2003-04.

Table 2: Sectoral Demand Matrices [(I - A)$^{-1}$] (Demand Linkages)

	Agriculture	Industry	Services
1968-69			
Agriculture	1.230	0.247	0.059
Industry	0.087	1.562	0.230
Services	0.035	0.237	1.141
1979-80			
Agriculture	1.214	0.260	0.083
Industry	0.135	1.601	0.191
Services	0.049	0.269	1.139
1989-90			
Agriculture	1.220	0.104	0.074
Industry	0.319	1.729	0.378
Services	0.144	0.404	1.318
1993-94			
Agriculture	1.187	0.087	0.066
Industry	0.297	1.704	0.330
Services	0.149	0.457	1.334
1998-99			
Agriculture	1.152	0.075	0.051
Industry	0.420	1.831	0.457
Services	0.087	0.216	1.207
2003-04			
Agriculture	1.265	0.077	0.061
Industry	0.466	1.958	0.501
Services	0.123	0.247	1.213

Source: Data up to 1993-94 are from Sastry et al (2003) and for 1998-99 and 2003-04 are from Kaur et al. (2009)

Thus, the above discussion reveals the inter-linkages among the major three sectors of Indian economy have undergoing a number of directional changes during the pre- and post-reform periods. Table 3 summarises these directional changes. It reveals that both the production and demand linkages from agriculture to industry have increased during both the pre- and post-reform periods, whereas both the production and demand linkages from industry to agriculture have declined for both the periods. This implies that while agriculture's dependence on industry

for modern inputs has increased, industry's dependence on agriculture for inputs has declined during the same period. Also agriculture's income elasticity to industrial goods has been considerably increased, while of industry to agriculture has been weakened at the same time. However, as we have discussed in the earlier section, the agriculture sector of Indian economy has undergone significant structural changes in the rate of growth and composition of agriculture sector. The shift from food grain production to commercial crops, fruits and vegetables, flower and horticulture etc. within the agriculture sector and the increasing consumption preferences for processed and differentiated food products, combined with the development of contract farming and vertical linkages in agri-food supply chains etc. in recent years have raised the possibility of enhancing the 'agriculture-industry' inter-dependence in recent years. In the light of these trends, it is likely that in recent years the dependence of industry on agriculture would have been further increased.

Table 3: Changes in Sectoral Linkages: Summery

Direction	1993-94/1968-69	2003-04/1993-94	2003-04/1968-69
Production Linkages			
Agriculture to Industry	Considerably Increase	Increase	Considerably Increase
Agriculture to Services	Increase	Marginally decline	Increase
Industry to Agriculture	Considerably Decline	Decline	Considerably Decline
Industry to Services	Increase	Considerably Decline	Decline
Services to Agriculture	Increase	Decline	Increase
Services to Industry	Increase	Increase	Increase
Demand Linkages			
Agriculture to Industry	Considerably Increase	Considerably Increase	Considerably Increase
Agriculture to Services	Considerably Increase	Decline	Considerably Increase
Industry to Agriculture	Considerably Decline	Decline	Considerably Decline
Industry to Services	Considerably Increase	Considerably Increase	Marginally Increase
Services to Agriculture	Marginally Increase	Marginally Decline	Constant
Services to Industry	Considerably Increase	Considerably Increase	Considerably Increase

Source: Based on Table 1 and Table 2

5. Conclusion

The structural changes and uneven pattern of growth of agriculture, industry and service sector in the post reforms period, has triggered an interest in readdressing the inter-relationship between agriculture and industry. The paper primarily focuses on underpinning the theoretical and methodological issues underlying the 'agriculture-industry' interlinkages and the trends in sectoral linkages during the pre- and post-reform periods. Most of the studies have provided a partial analysis of the linkages existed between the two sectors. There is a need for a macro-economic framework that could measure the potential direct and indirect impact of agricultural growth in the economy and its different sectors. However, the problem of a reliable and accurate long run time series database on agricultural statistics always stands as a stumbling block for the researchers to conduct a rigorous analysis of the inter-sectoral linkages in India.

Notwithstanding many argued that 'agriculture-industry' linkage is no longer exist and that the share of agriculture in the economy's gross domestic product has declined; it need not necessarily imply that the sector has no meaningful implication for India's economic growth and industrialization. Even now, agriculture sector accounts for approximately one-fifth of national income and supports more than 52% of the population in the country. Though the 'agriculture-industry' linkage has been deteriorating over the years, it still plays important role in determining the overall growth of the economy. The only thing is that the dimension of the linkages between the two sectors has changed. Both the production and demand linkages were primarily from the industry to agriculture sector in the pre-reform period, which changed to from agriculture to industry in the post-reform period. Further, while the linkage was primarily through the production channel in the 1960s through 1980s, it translates primarily through the demand channel since 1990s. The contribution of agriculture sector in generating demand for the other sectors, especially the industrial sector, has become more pronounced in recent years. Further, in view of the structural shift from food grain production to commercial crops, fruits and vegetables, flower and horticulture etc., and the increasing consumption preferences for differentiated food products, combined with the development of contract farming and vertical linkages in agri-food supply chains we can predict the possibility of improving the 'agriculture-industry' inter-dependence in recent years.

References

Adelman (1984): "Beyond Export-Led growth", *World development*, Vol. 12, No. 9, pp. 937-49.

Ahluwalia, I. J. (1985): *"Industrial Growth in India: Stagnation since the Mid-Sixties",* Oxford University Press, Delhi.

Ahluwalia, I. J. (1986): "Agriculture-Industry Inter-Relationship", *The Indian Economic Journal,* Vol. 33, No. 4, pp. 183-86

Ahluwalia, *I. J.* (1979): "An Analysis of Price and Output Behaviour in the *Indian Economy*: 1951-1973", *Journal of Development Economics*, No.6, pp.363-90.

Ahluwalia, I. J. and C. Rangarajan (1986): "Agriculture and Industry: A study of Linkages the Indian Experience", Mimeo, *World Economic Congress of International Association*, December

Banga, R. and B. N. Goldar (2004): "Contribution of Services to Output Growth and Productivity in Indian Manufacturing: Pre and Post Reform", ICRIER Working Paper No. 139, August.

Bathla, Seema (2003): "Inter-sectoral Growth Linkages in India: Implications for Policy and Liberalized Reforms" *Institute of Economic Growth*, University Of Delhi Enclave, Delhi. URL: www.ccssr.org.cn/new/uploadfile/2008680718733.pdf

Bhaduri, A (2003): "Effective Demand and the Terms of Trade in a Dual Economy: A Kaldorian Perspective", *Cambridge Journal of Economics*, Vol. 27, 583-95.

Bhaduri, A., Ashok Parikh and Rune Skarstein (2007): "The Dual Role of the Terms of Trade: The Indian Experience of Agriculture-Industry Interaction, 1950-1 to 2000-1", in A. Vaidyanathan and K. L. Krishna (edt.) *Institutions and Markets in India's Development: Essays to K. N. Raj*, Oxford University Press, New Delhi

Bharadwaj, K. (1978): *"Towards a Macroeconomic Framework for a Developing Economy"*, Manchester School

Bharadwaj, K. (1985): "A View of Commercialisation in Indian Agriculture and the Development of Capitalism", *Journal of Peasant Studies*, July

Bharadwaj, K. (1987): "Analytics of Agriculture-Industry Relation", *Economic and Political Weekly*, Vol. 22, No. 19/21, pp. AN15-20

Bhattacharya, B. B. and C. H. H. Rao (1986): "Agriculture-Industry Interrelations: Issues of Relative Prices and Growth in the Context of Public Investment", Theme 18, Eighth World Economic Congress of the International Economic Association, New Delhi.

Bhattacharya, B. B. and Arup Mitra (1989): "Industry-Agriculture Growth Rates: Widening Dsparity", *Economic and Political Weekly*, Vol. 24, No. 34, pp. 1963-70

Chowdhury, K. and M. B. Chowdhury (1995): "Sectoral Linkages and Economic Growth in Asia: Evidence from Granger Causality Test", *The Indian Economic Journal, Vol.* 42, pp. 59-75.

Deb, Surajit (2002): "The Debate on Agriculture-Industry Terms of Trade in India", Working Paper No. 109, *Centre for Development Economics*, Department of Economics, Delhi School of Economics

Deb, Surajit (2006): "Domestic Terms of Trade in a Three-Sector Framework Analysis for All-India and States", *Economic and Political Weekly*, April 29, pp. 1713-22

Dhawan, S. and K. K. Saxena (1992), "Sectoral Linkages and Key Sectors of the Economy", *Indian Economic Review*, Vol. 27, No. 2, pp 195-210

Dunham, David (1991): "Agricultural Growth and Rural Industry: Some Reflections of the Rural growth Linkages Debate", *Institute of Policy studies,* Working paper No. 114, Colombo

Fei, J. C. and G. Ranis (1961): "A Theory of Economic Development", *American Economic Review,* Vol. 514, pp. 533-65.

Gemmell, N., T. A. Lloyd and M. Mathew (2006): "Agricultural Growth and Inter- Sectoral Linkages in a Developing Economy", *Journal of Agricultural Economics*, Volume 51, No.3, pp. 353-70

Ghosh, A. (1958): "Input-Output Approach to an Allocation System", *Economica,* Vol. 25, No. 1, pp. 58-64

Ghosh, Jayati (1988): "Inter-sectoral Terms of Trade, Agricultural Growth and the Pattern of Demand", *Social Scientist*, Vol. 16, No. 4, pp. 9-27

Gordon, J. and P. Gupta (2004): "Understanding India's Services Revolution", IMF Working Paper WP/04/171, September.

Hansda, S. K. (2001), "Sustainability of Services-led Growth: An Input-Output Analysis of Indian Economy", RBI Occasional Working Paper, Vol. 22, No. 1, 2 & 3.

Hirschman (1958): *"A Strategy for Economic Development"*, Yale University Press, New Haven

Jha, Rajiv (2010): "The Analytics of the Agriculture-Industry Relationship in a Closed Economy: A Case Study of India", *Economic and Political Weekly*, Vol. 45, No. 17, pp. 94-98.

Johnston, Bruce F and J. W. Mellor (1961): "The Role of Agriculture in Economic Development", *The American Economic Review,* Vol. 51, No. 4, pp. 566-93

Jorgenson, D. G (1961): "The Development of a Dual Economy", *Economic Journal*, Vol. 71, pp. 309-34.

Kaldor, N (1975): "What Is Wrong with Economic Theory", *Quarterly Journal of Economics*, Vol. 89, No. 3, pp. 347-357

Kalecki, M (1976): *"Essays on Developing Countries",* Harvester Press, Sussex, UK

Kuznets, S (1968): *"Toward a Theory of Economic Growth with Reflections on the Economic growth of nations",* New York: Norton.

Lewis, A W (1954): "Economic Development with Unlimited Supply of Labour", *The Manchester School of Economic and Social Studies*, Vol. 22, No. 2, pp. 139-91.

Mellor, John W. (1973): "Accelerated Growth in Agricultural Production and the Inter-sectoral Transfer of Resources", *Economic Development and Cultural Change,* Vol. 22, No. 1, pp. 1-16

Mellor, John W. (1976): *"The New Economics of Growth: A Strategy for India and the Developing World"*, Cornel University Press, Ithaca, New York.

Misra, V. N. (2004): *"State of the Indian farmer",* Vol. 15, Academic Foundation, New Delhi

Nayyar, D. (1978): "Industrial Development in India: Some Reflections on Growth and Stagnation", Economic and Political Weekly, Vol. 13, No. 31/33, pp. 1265-78

Pani, P. K. (1984): "A Macro Model of Indian Economy with Special Reference to Output, Demand and Prices: 1969-70 to 1981-82", *Reserve Bank of India Occasional Papers,* No.5, pp. 113-239.

Patnaik, P. (1972): "Disproportionality Crisis and Cyclical Growth: A Theoretical Note", Economic and Political Weekly, Vol. 7, No. 5/7, pp. 329-36

Polenske, K. R. and Sivitanides, P. (1990): "Linkages in the Construction Sector", *The Annals of Regional Science,* Vol. 24, No. 2, pp. 147-61.

Rakshit, M. (2007): "Services-Led Growth: The Indian Experience", *Money and Finance*, pp. 91-126.

Rangarajan, C. (1982): "Agricultural Growth and Industrial Performance in India", Research Report 33, *International Food Policy Research Institute*, October

Ranis, G (1984): "Typology in Development Theory: Retrospective and Prospects", *In* M. Syrquin, L. Taylor and L. Westphal (eds) *Economic Structure and Performance: Essays in Honor of Hollis B. Chenery,* New York, Academic Press.

Rasmussen, P. N. (1956): *"Studies in Inter-sectoral Relations",* Amsterdam, North Holland.

Rosenstein-Rodan, P. N (1943): "Problems of industrialization of Eastern and South-Eastern Europe", E*conomic Journal*, Vol. 53, pp. 202-11.

Sastry, D. V. S., B. Singh, K. Bhattacharya, N. K. Unnikrishnan (2003): "Sectoral Linkages and Growth Prospects: Reflections on the Indian", *Economic and Political Weekly,* Vol. 38, No. 24, pp. 2390-97

Satyasai, K. J. S. and K. U. Viswanathan (1997): "Commercialisation and Diversification of Indian Agriculture", Occasional Paper No. 5, *National Bank for Agriculture and Rural Development*, Mumbai.

Satyasai, K. J. S. and K. U. Viswanathan (1999): "Dynamics of Agriculture-Industry Linkages", *Indian Journal of Agricultural Economics,* Vol. 54, No. 3, pp. 394-401

Scitovsky, T. (1954): "Two Concepts of External Economies", *Journal of Political Economy,* Vol. 62, pp. 143-51.

Singer, H. (1979): "Policy Implications of the Lima target", *Industry and Development,* Vol. 3, pp. 17-23.

Singh, N. (2007): "Services-led Industrialization in India: Assessment and lessons", in *Industrial Development for the 21st Century: Sustainable Development Perspectives*, Department of Economic and Social Affairs, United Nations, New York.

Sivakumar, S. D., R. Balasubramanian and N. Srinivasan (1999): "Growth Linkage Effects of Agro-Industrialisation", *Indian Journal of Agricultural Economics,* Vol. 54, No. 3, pp. 412-19

Sonis M., J. J. M. Guilhoto, G. J. D. Hewings and E. B. Martins (1995): "Linkages, Key Sectors, and Structural Change: Some New Perspectives"*, The Developing Economies*, Vol. 33, pp. 233-70.

Storm, S. (1997): "Trade Liberalization, Terms of Trade and Agricultural Growth: The Example of India", in Amit Bhaduri and Rune Skarstein (edt): *Economic Development and Agricultural Productivity*, Edward Elgar, Cheltenham.

Tyagi, D. S. (1987): "Domestic Terms of Trade and Their Effect on Supply and Demand of Agricultural Sector", *Economic and Political Weekly*, Vol. 22, No. 13, pp. A30-36

Vogel, S. J. (1994): "Structural Changes in Agriculture: Production Linkages and Agricultural Demand-Led Industrialization", *Oxford Economic Papers,* New Series, Vol. 46, No. 1, pp. 136-56

Vyas, V. S. (2004): "Changing Contours of Indian Agriculture", in Uma Kapila and Raj Kapila (edt) *Indian Agriculture in the changing Environment*, Vol. 1, Academic foundation, New Delhi

Zakariah, A. R. and E. E. Ahmad (1999): "Sources of Industrial Growth Using the Factor Decomposition Approach: Malayasia, 1978-87", *The Developing Economies*, Vol. 37, pp. 162-96.

Appendix: Table and Graphs

Table 1.A: Sectoral share of GDP at FC (at 1999-2000 prices)

(in percent)

Year	Agriculture & allied	Industry	Services
1950-51	55.11	10.62	34.27
1960-61	50.62	13.13	36.25
1970-71	44.26	15.45	40.30
1980-81	37.92	17.45	44.63
1990-91	31.37	19.80	48.83
2000-01	23.89	19.99	56.12
2007-08	17.75	19.38	62.87

Source: Source: Handbook of Statistics on Indian economy, 2007-08

Table 2.A: Sector Wise Trend Growth Rate of GDP (At 1999-2000 Prices)

Year	GDP at FC	Industry	Services
	Agriculture & allied		
1950/51-1959/60	3.68	2.71	5.99	4.40
1960/61-1969/70	3.29	1.51	5.15	4.74
1970/71-1979/80	3.45	1.74	5.07	4.45
1980/81-1989/90	5.17	2.97	6.41	6.35
1990/91-1999/00	6.05	3.34	6.63	7.32
2000/01-2007/08	7.76	3.09	7.46	9.55

Note: Trend Growth rate is estimated using equation $\ln(Y) = a + b(Time)$ at 1999-2000 prices.

Source: Handbook of Statistics on Indian economy, 2007-08

Table 3.A: Share of Agro-based and Non agro-based Industries (Factory sector)

(in percent)

Variable	1980-81		1990-91		2000-01		2003-04	
	Agro-based	Non Agro	Agro-based	Non Agro	Agro-based	Non Agro	Agro-based	Non Agro
Value of Gross Output	32.91	67.09	29.79	70.21	32.12	67.88	26.59	73.41
Net Income	29.72	70.28	27.44	72.56	23.01	76.99	18.02	81.98
Total Inputs	34.44	65.56	31.19	68.81	33.07	66.93	27.87	72.13
Net profit	24.36	75.64	27.75	72.25	24.3	75.70	11.19	88.81
Number of Factories	44.55	55.45	42.18	57.82	40.11	59.89	40.37	59.63
Total Employment	44.35	55.65	39.82	60.18	47.61	52.39	47.48	52.52
Gross Capital Formation	12.47	87.53	21.90	78.10	20.64	79.36	26.88	73.12

Source: Annual Survey of Industries, 2003-04, CSO, Government of India

Table 4.A: Share of Agriculture's Final and Intermediate Consumption

(in percent)

Year	Final consumption	Intermediate Consumption
1970-71	88.37	11.63
1975-76	88.67	11.33
1980-81	86.80	13.20
1985-86	84.50	15.50
1990-91	83.69	16.31
1994-95	85.08	14.92
1997-98	87.87	12.13

Source: V. N. Misra (2004), "State of the Indian farmer", Vol.15

Table 5.A: Share of Modern and Traditional Inputs in agriculture

(in Percent)

Year	Modern inputs*	Traditional inputs
1952/53-1967/68	2.58	97.42
1967/68-1977/78	16.83	83.17
1978/79-1990-91	29.18	70.82
1991/92-1997/98	38.28	61.72

* Fertilizer, pesticides, electricity and diesel

Source: V. N. Misra (2004), "State of the Indian farmer", Vol.15

Table 6.A: Consumption of Fertilizers and Pesticides

Year	Consumption of Fertilizers (N+P+K) (Lakh tones)	Consumption of Pesticides ('000 tones)
1950-51	0.69	2.35
1960-61	2.92	8.62
1970-71	21.77	24.32
1980-81	55.16	45.00
1990-91	125.46	75.00
2000-01	167.02	43.58
2001-02	173.60	47.02
2002-03	160.94	48.30
2003-04	167.99	41.00
2004-05	183.98	40.67
2005-06	203.40	39.77
2006-07	216.52	37.56
2007-08	225.70	-
2008-09	249.09	-

Source: Handbook of Statistics on Indian economy, 2007-08 & 2009-10

Table 7.A: Per Hectare Consumption of Fertilizers and Pesticides

Year	NPK use (kg. per ha. of GCA)	Pesticides use (kg. per ha. of GCA)
1950-51	53.2	1.8
1960-61	194.2	5.7
1970-71	1334.1	14.9
1980-81	3246.4	26.5
1990-91	6862.7	41.0
2000-01	9138.0	23.8

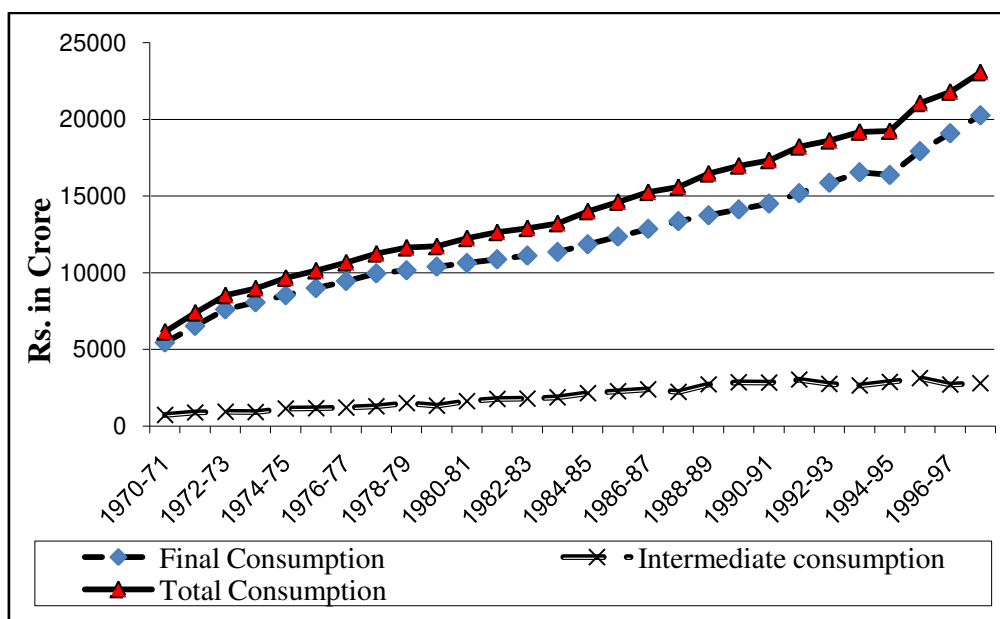Source: Handbook of Statistics on Indian economy, 2007-08

Figure 1.A Agriculture's Purchase from Non-agricultural Sector (at 1971-72 prices)
Source: V. N. Misra (2004), "State of the Indian farmer", Vol.15