Farm–Non-Farm Linkage in India: A Structuralist Perspective

Saumya Chakrabarti, Anirban Kundu and Alok Kumar Nandi*

I

INTRODUCTION

Since the early 1970s it has been argued that the ‘Lewisian’ path of development is ineffective so far as broad based employment generation is concerned. Consequently, the focus has shifted towards the informal sector in general and rural non-farm employment (RNFE) in particular as potential candidate capable of creating widespread income and employment. RNFE is no more considered as a residual segment. It is argued, instead of getting withered away through structural transformation, the RNFE sector is rather acting as a dispersed development engine. In fact, we witness a paradigm shift (Mellor, 1976; Saith, 1991; Ranis and Stewart, 1993; Bangasser, 2000; Lanjouw and Lanjouw, 2001; see also Sanyal, 2007 for a critique).

The need for nurturing RNFE has been recognised in India as well. Its dynamics and the pattern of its dependence on other sectors especially agriculture have become important issues of research. Substantial empirical work has been done on the question of farm–non-farm linkages in India. This literature may provide us with the requisite building blocks for our subsequent analysis. Hence, we take up a journey through the relevant writings (in this context we refer: Chakrabarti and Kundu, 2009a; Kundu and Chakrabarti, 2010 for the basic framework and some empirical support).

II

GREEN REVOLUTION VS LAND REFORMS

Vaidyanathan (1986) shows, where agriculture is unable to provide sufficient employment, RNFE picks up a part of the slack. Thus, an inverse relationship between farm and non-farm employment is proposed (see also, Bhaurik, 2002). However, contrary to this ‘residual sector’ hypothesis, there is a vast literature that

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proposes a positive relationship between farm and non-farm growth. These studies confirm Mellor’s (1976) hypothesis that the green revolution generates increased demand for locally produced labour-intensive RNF goods and services. But, the assertion that even the big farmer class could be the driving force for non-farm growth has been questioned (Dunham, 1991). Moreover, the importance of redistributive land-reforms in promoting localised RNF activities has been emphasised by several researchers (Saith, 1991, 1992; Ray, 1994).

In support of our argument that the labour-intensive RNFE is much more integrated with a small farm based agriculture concentrating on primary commodities or basic cereals production, we take up a simple empirical exercise. Using NSSO (Report 497) data we have constructed Table 1 for four representative states and for all-India.

TABLE 1. AVERAGE NUMBER OF PRODUCTIVE ASSETS FOR NON-FARM BUSINESS, POSSESSED PER 1000 FARMER HOUSEHOLDS BY SIZE CLASS OF LAND OWNED

<table>
<thead>
<tr>
<th>Items/size class</th>
<th>Up to 2 ha.</th>
<th>2.01 – 4 ha.</th>
<th>4.01 – 10 ha.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Machinery and equipment for non-farm business</td>
<td>West Bengal</td>
<td>158</td>
<td>12</td>
</tr>
<tr>
<td>- do -</td>
<td>Gujarat</td>
<td>53</td>
<td>28</td>
</tr>
<tr>
<td>- do -</td>
<td>Tamil Nadu</td>
<td>90</td>
<td>1</td>
</tr>
<tr>
<td>- do -</td>
<td>Punjab</td>
<td>99</td>
<td>81</td>
</tr>
<tr>
<td>- do -</td>
<td>All India</td>
<td>140</td>
<td>22</td>
</tr>
</tbody>
</table>


We have selected purposively the four states of India; these are West Bengal, Tamil Nadu, Gujarat and Punjab. Agriculture in these four states performed well during the 1980s and early 1990s. While Punjab's progress was based on growth of traditional foodgrain production (particularly wheat), Tamil Nadu and Gujarat agriculture were two of the most 'diversified'. Contrarily, West Bengal agriculture was small farm based though concentrating mainly on rice cultivation. From Table 1 it can be inferred that the marginal (up to 1.00 ha. of land) and small (1.01-2.00 ha. of land) farmers are much more attached with the non-farm sector across India as well as in all four states. The machinery and equipments meant for non-farm business are mainly used by the small and marginal farmers.

Another interesting result is that this inclination is maximum in West Bengal followed by Punjab, Tamil Nadu and lastly, Gujarat. It supports the view that extensive employment-diversification as experienced in rural West Bengal is largely due to its particular type of land-distribution and cropping-pattern. Comparing Punjab and West Bengal with Tamil Nadu and Gujarat, we can propose that land reforms in
West Bengal and the green revolution in Punjab concentrating mainly on basic crop production may have created significant demand for minor non-farm implements, especially from the small and marginal farmers. Conversely, Gujarat and Tamil Nadu’s diversified agriculture could generate only moderate demand for such implements. In this context, we can refer to the study of Basant (1994) on Gujarat. It is noted that “growth of land productivity (or per capita output) based mainly on the cropping-pattern changes may not generate adequate impulses for the development of rural non-agricultural activities. It may be partly because, the processing of output is likely to be concentrated in urban areas and the techniques of production may be capital-intensive” (Basant, 1994, p.9).

A similar kind of inference could also be drawn if the average monthly (net) income from non-farm business per farmer household for the four states is compared. This is done in Figure 1. For the lowest size class of land holding, though Punjab shows a higher extent of rural employment-diversification, for all other size classes, West Bengal portrays a consistently robust trend. It is clear that with increasing crop-diversification across states, employment-diversification for farmer households declines. However, all four states show comparable fluctuations in non-farm income, which could perhaps be a mark of distress-led and prosperity-induced diversification across different size classes for each state.


Figure 1. Average Monthly (Net) Income from Non-Farm Business Per Farmer Household During the Agricultural Year (July 2002-June 2003).
CROP-DIVERSIFICATION AND RNFE

We now look into the probable impacts on RNFE due to crop-diversification of agriculture in India. We propose, contrary to the usual belief that the particular type of agricultural growth based on diversification towards high value crop (HVC) could rather affect the labour-intensive RNF activities adversely.

HVC farming could serve well for the current course of industrialisation by providing (processed) food to the relatively well-off population engaged in the modern sector and through the supply of raw material for sophisticated processing meant primarily for exports (Singh, 2004; Sidhu, 2005). On the other hand, HVC cultivation could be a better option for large farmers (Sen and Raju, 2006) either having access to modern storage – processing – transportation facilities or having the ability to get attached with the big agro-business firms through ‘corporate contract farming’. Thus, the whole chain of crop-diversification – processing – packaging – retailing could be organised through firm–farm contract. It is seen that generally large processing companies favour big farmers for undertaking contract farming, perhaps due to high transaction costs involved in case of the smaller counterparts (Singh, 2004; Dev and Rao, 2005; Kumar, 2006). Conversely, large farmers happen to use products produced in the formal sector for production and consumption purposes. Contract farming itself ensures the use of modern inputs and modern farm-services creating a diversion of agricultural purchasing power in favour of ‘big city’ products and thereby initiating substantial leakage of potential demand away from the labour-intensive non-farm sector (World Bank, 2007; 2009).

It is generally argued that rural and urban informal sectors are heavily dependent on agricultural produce for processing, grinding, milling and related activities. In order to capture this phenomenon we have divided the agro-processing, grinding and milling enterprises into two groups: enterprises which perform their production based on coarse crops and those that carry out their production operation based on HVCs. We have used the unit level macro-disaggregated data from the NSS 62nd Round (2005-2006) on the unorganised manufacturing sector in India and extracted a part of ‘informal manufacturing’. We try to understand whether the capital intensity of HVC processing, grinding and milling units is higher than that of coarse crop processing, grinding and milling units, which in turn would explain whether HVC processing, grinding and milling firms have been using considerably more labour or not. In Table 2 we have depicted the capital intensity of both the categories and found that on an average rural coarse crop processing, grinding and milling units are more labour intensive, except rural DME. Further, it is evident that a substantial number of rural OAMEs engaged in traditional crops for processing, grinding and milling activities are very much labour intensive in nature compared to all other categories.
TABLE 2. CAPITAL INTENSITY OF UNITS USING DIFFERENT RAW MATERIALS USING
UNIT LEVEL DATA

<table>
<thead>
<tr>
<th>(1)</th>
<th>Sector</th>
<th>Mean (2)</th>
<th>Median (3)</th>
<th>Estimated Number of Enterprises (4)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital-Labour ratio of enterprises using coarse crops as raw materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAME Rural</td>
<td>1048.78</td>
<td>0</td>
<td>329675</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>6430.47</td>
<td>2000</td>
<td>33619</td>
<td></td>
</tr>
<tr>
<td>NDME Rural</td>
<td>12217.10</td>
<td>266.67</td>
<td>16965</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>20825.74</td>
<td>9000</td>
<td>11145</td>
<td></td>
</tr>
<tr>
<td>DME Rural</td>
<td>68148.93</td>
<td>18181.82</td>
<td>4937</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>44415.41</td>
<td>20271.29</td>
<td>3368</td>
<td></td>
</tr>
<tr>
<td>Capital-Labour ratio of enterprises using diversified crops as raw materials</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAME Rural</td>
<td>2336.36</td>
<td>0</td>
<td>1697</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>2441.42</td>
<td>266.67</td>
<td>4584</td>
<td></td>
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<tr>
<td>NDME Rural</td>
<td>7894.72</td>
<td>4175</td>
<td>762</td>
<td></td>
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<tr>
<td>Urban</td>
<td>18030.66</td>
<td>1666.67</td>
<td>1406</td>
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<tr>
<td>DME Rural</td>
<td>13956.52</td>
<td>5000</td>
<td>217</td>
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<tr>
<td>Urban</td>
<td>16684.06</td>
<td>10100</td>
<td>433</td>
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</tr>
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</table>

Note: Capital is considered as value of plant and machinery of enterprise. Labour is considered as total workers.

Figure 2.

Organised sector data (ASI-India) tell a similar story (as captured through the set of Figure 2.) Industry group 151 (production, processing and preservation of meat, fish, fruit, vegetables, oils and fats) is much more capital-intensive compared to industry group 153 (manufacture of grain mill products, starches and starch products, and prepared animal feeds) and the difference is increasing sharply.
Agricultural diversification may jeopardise local and household level food security. It could be a problem for the petty producers both in agriculture and in RNFE. Food insecurity makes the farmer households dependent on external resources. However, as the non-farm households lose their work, they are doubly affected. They neither have access to local food supply nor do they have sufficient entitlement to exchange with.

That crop-diversification may lead to erosion of micro food security especially for small and marginal farmers could be hypothesised given the following observations. Lanjouw and Shariff (2004) note that the marginal expenditure on local products is about eighty per cent in all Asian countries surveyed. Of this, forty five per cent is spent on local food. The remark of NSSO Report 424 should also be noted: Proportion of growers’ consumption out of own produce is found to be 64 per cent for rice, 69 per cent for wheat, 53 per cent for jowar and bajra and 68 per cent for maize considering India as a whole. For each of these crops, the proportion of growers’ consumption of ‘other cereals’ from home produce works out to about 55-65 per cent at the all-India level. Similarly, NSSO Report 474 points that the proportion of all rural households consuming only from homegrown stock is relatively high for rice (24 per cent) and wheat (30 per cent) and it is also noted (NSSO Report 512) that, in rural areas, the households self-employed in agriculture show the lowest percentage of seasonal inadequacy of food.

One may argue that macro-food-security may take care of micro-food-security as well. But micro-food-security is different from macro-food-security that may improve with increased productivity under crop-diversification and farm-firm contract. As surplus rises in diversified agriculture, it could be exchanged with basic food. But the non-farm population is unable to do so, as their productivity is not rising and hence they are devoid of appropriate entitlement. Furthermore, it is seen that local food-supply and also many locally available agro-inputs are crucial for the survival of the petty non-farm sector. This supply gets constricted under corporate driven/supported crop-diversification (Kundu and Chakrabarti, 2010, p. 22). However, a well-orchestrated public distribution system may mitigate this problem of food insecurity at the household level. But for that, the availability of cheap food is a requirement. If there is mass-exodus from coarse-crop production, such macro-arrangements of food-distribution may crumble.

Here we can note an observation by Ramesh Chand: he notes that, “(d)espite dietary diversification involving a sharp decline in per capita direct consumption of foodgrains, the demand for cereals and pulses is projected to grow at about 2 per cent per year on account of the increase in population and the growth in indirect demand. This growth rate is almost four times the growth rate experienced in the domestic production of foodgrains during the last decade”. This problem of macro-food-security may lead to a significant extent of pauperisation for the informal sector as well threatening its very existence (Kundu and Chakrabarti, 2010, p. 24).
IV
LAND-CONVERSION AND RNFE

There are many studies which confirm that access to land is a crucial factor explaining the access to rural non-agricultural activities/employment opportunities (Saith, 1991; Ray, 1994). The rural households owning small plots of land or sharing land ownership (or cultivation) rights can diversify to different other localised petty activities over and above basic farming, using the benefits of agricultural growth itself. Micro food security ensured through access to land plays an important role for rural employment diversification. In fact, such diversification enables the households to neutralise the seasonal fluctuations of agricultural production (Government of West Bengal, 2004). On the other hand, job diversification by the farmer households reduces the pressure on land as agriculture is managed more efficiently. Thus, small farm based agriculture on the one hand, and employment diversification by these farmer households on the other, sustain a mutually reinforcing endogenous growth process. Nevertheless, the present debate in India hovering around the issue of agricultural land conversion for industrialisation is not paying sufficient attention to the probable impacts on RNFE. Land conversion may seriously affect micro food security shaking the very foundation of non-farm growth.

V
A MODEL ON FARM – NON-FARM INTERACTION

Though linkages between the RNFE and other sectors of a less developed country have been the subject of intense research, macroeconomic modelling incorporating such issues is really scanty. Hence, we go for a simple modelling exercise along Kaleckian lines which may help us in capturing more precisely the farm–non-farm linkages under alternative policy regimes. In fact, this formal analysis will help us in expressing the propositions discussed above in more rigorous forms (in this context we refer to Chakrabarti, 2005, 2009; also see: Chakrabarti and Kundu, 2009b).

1. Basic Features and Notations of Our Economy

1. (A) The features are as follows:

(a) Three sectors: a vertically integrated capitalistic formal sector, an agricultural sector and a non-capitalistic RNFE.
(b) Contrary to the formal sector with capital-labour dichotomy and accumulation-motive as the driving force for production, RNFE is characterised by consumption-motive, self-employment and absence of (fixed) capital. Moreover, there is surplus-labour in RNFE.
(c) RNFE is self-sufficient in terms of both implements and non-food consumption. However, like formal sector it has to depend on agriculture for ‘food’ which is obtained with the proceeds received through sale of surplus to agriculture itself.

(d) Aggregate agricultural income is earned by selling marketable surplus in the (undifferentiated) food market, which is purchased by the agents of both formal and non-farm sectors at a single open market price. This income, in turn, is spent on the products of both the formal and non-farm sectors. The division depends on the relevant terms of trade, cropping-pattern and land-distribution pattern.

(e) We have balanced trade between agriculture and RNFE.

(f) We restrict it to a short-run static analysis and a closed economy set-up.

1. (B) Notations to be used:

   (i) \( \alpha_u \): Fraction of aggregate agricultural income or that of aggregate marketable surplus of food transacted with RNFE.

   (ii) \( Y_u \): Level of production in RNFE.

   (iii) \( p_u \): Price of output of RNFE.

   (iv) \( L_u \): Employment in RNFE.

   (v) \( l_u \): Labour-output ratio in RNFE.

   (vi) \( \beta_u \): Fraction of RNFE output used for self-consumption and production.

   (vii) \( S_u \): Aggregate surplus of RNFE.

   (viii) \( D_u \): Aggregate demand for RNFE output.

   (ix) \( a_{fu} \): Per capita food demand in RNFE.

   (x) \( F \): Aggregate marketable surplus of food.

   (xi) \( p_f \): Price of food.

2. Working of Our Model

   The features (a) to (f) of section (1. A) imply the following formulations:

   First, from the condition of labour-surplus RNFE, we can specify the constancy of food requirement rate at the minimum subsistence level. Hence, \( a_{fu}=a_{fu}^0 \). Moreover, the absence of fixed (limiting) capital implies, \( l_u = l_u^0 \), a constant. We also assume, \( \beta_u = \beta_u^0 \), a constant.

   All these combined together indicate that the real average cost of production in RNFE due to food and non-food consumption and implements and raw materials use is constant. Hence, price formulation in RNFE can be expressed as,

   \[
   p_u = p_f a_{fu}^0 l_u^0 + p_u \beta_u^0
   \]

   Rearranging, \( (1-\beta_u^0) p_u = p_f a_{fu}^0 l_u^0 \).

   Thus, the value of net output in RNFE is determined only by the subsistence cost.
Now assuming, \( I_u^0 = 1 \) (for simplicity), \( p_u/p_f = a_{u0}/(1-\beta_u^0) \) \( \ldots(1) \)

Thus, the absence of fixed capital and the assumption of surplus-labour along with the fixity of the fraction of the intra-sectoral utilisation of output in RNFE jointly imply a given terms of trade (t-o-t) between RNFE and agriculture. Moreover, at this given t-o-t the supply of net output, \( S_u \) will be perfectly elastic. Consequently, the \( S_u \) curve will be horizontal on the ‘\( S_u \) – \( p_u/p_f \)’ plane (Figure 2). Hence, the demand for food from RNFE is also perfectly elastic. Agriculture is not facing any demand problem so far as the non-farm sector is concerned. The perfectly elastic \( S_u \) and hence, \( Y_u \) and \( L_u \) are demand-determined. The equilibrium values are solely set by the portion of marketable surplus of food or more precisely, that of agricultural income transacted with RNFE. Furthermore, whatever be the supply of food to RNFE, it is absorbed at the given t-o-t simply through exchange with the non-farm output. Agricultural surplus, as a whole, is supplied to the aggregate food market with the intention of the realisation of income and purchase of both formal and non-farm products. A portion of this supply simultaneously generates potential demand for RNFE output. This potential is realised through exchange as production in RNFE is induced by this increased food supply and consequently, agricultural income is earned through sale of food to the former.

**Proposition I:** Interaction between agriculture and RNFE is found to be distinctly different from that between agriculture and the formal sector. While in the latter case, there remains a possibility of a realisation crisis for agriculture (Chakrabarti, 2001; Bhaduri and Skarstein, 2003), the former relation is free from any such problem. Thus, RNFE acts as a ‘vent for surplus’ for the agricultural sector.

From the preceding analysis we know that the value of aggregate demand for RNFE output is equal to the part of agricultural income spent on it or the value of marketable surplus of food transacted with RNFE. Hence, \( p_u.D_u = \alpha_u.p_f.F \) \( \ldots(2) \)

Now from the interactions of agriculture with the formal as well as RNFE sectors and extending our preceding analysis through incorporation of the issues of land-distribution and cropping-pattern we can formulate: \( \alpha_u = \alpha_u(p_f/p_u, p_f/p_i, n_1, n_2) \) \( \ldots(3) \)

with \( \alpha_{u1} > 0 \), \( \alpha_{u2} < 0 \) and \( \alpha_{u3} > 0 \), \( \alpha_{u4} > 0 \).

Here the exogenous factor ‘\( n_1 \)’ is the land-distribution parameter, an improvement of which implies a more equitable pattern. Due to this, the small farmers’ share in both the marketable surplus of food and aggregate agricultural income rises. Moreover, if we assume that the demand for RNFE output originates mostly from these small farmers, redistribution implies a rise in the value of \( \alpha_u \) at the given t-o-t. However, for the time being, we assume that the historically evolved pattern of land-distribution is kept undisturbed and thus \( n_1 \) is set (say) at \( n_{10} \).
On the other hand, ‘n2’ signifies cropping pattern. To be precise, higher the extent of crop-diversification lower is the value of n2. We have argued above that RNFE and the coarse crop-producing segment of agriculture generate an endogenous growth process. Hence, higher is the extent of crop-diversification, lower is the link between agriculture and RNFE. This is captured by the positive relation between n2 and \( \alpha_u \). However, for the time being, we assume a historically evolved cropping pattern and thus, n2 is set (say) at n2^0.

Moreover, following the literature^20 we assume that the radical redistribution of income between agriculture and the formal sector is not feasible. Accordingly, \( p_f/p_i \) is assumed to be fixed at the historically settled (evolved) level, say, \( \theta^21 \).

Hence from equation (3), \( \alpha_u = \alpha_u^0(p_f/p_u, 0, n_1^0, n_2^0) = \alpha_u^0(p_f/p_u) \) \( \ldots(4) \), with \( \alpha_u^0 > 0 \).

Rearranging equation (2) and using equation (3) we get,
\[
D_u = (p_f/p_u) \cdot \alpha_u(p_f/p_u, p_f/p_i, n_1, n_2) \cdot F \ldots(5)
\]

Hence, generalising we get, \( D_u = D_u(p_f/p_u, p_f/p_i, n_1, n_2) \cdot F \ldots(6) \)
with \( D_{u1} < 0, D_{u2} > 0 \) and \( D_{u3} > 0 \).

Using equation (4) and the assumption of a given marketable surplus of food grain^22, say, \( F^0 \) we have from equation (6), \( D_u = D_u^0(p_f/p_u, \alpha_u^0, F^0) = D_u^0(p_f/p_i) \ldots(6)' \) with \( D_u^0 < 0 \).

This gives a downward sloping \( D_u^0 \) curve on the ‘\( D_u – p_f/p_i \)’ plane (Figure 2).

Now, we consider the determination of equilibrium values of the variables, that is, \( (p_f/p_i)^*, \alpha_u^0^*, D_u^0^*, S_u^*, Y_u^* \) and \( L_u^* \).

It is to be noted that \( (p_f/p_i)^* \) is effectively determined from the supply-side conditions prevailing in RNFE and hence from the equation (1) we get,
\[
(p_f/p_i)^* = a_{i0}^0 / (1-\beta_u^0) \ldots(1)'
\]

Putting equation (1)’ in equation (4) we get, \( \alpha_u^0^* = \alpha_u^0^*[(p_f/p_u)^*] \ldots(7) \)

From our characterisation of \( S_u \) (as demand-determined) and equation (6)’ we can find out \( S_u^* \) by solving the following equation: \( S_u = D_u^0 \ldots(8) \)

Putting equations (1)’, (7) and \( F = F^0 \) in expression (5) and then using equation (8) we get,
\[
S_u^* = D_u^0^* = [(1-\beta_u^0)/a_{i0}^0]. \alpha_u^0^* \cdot F^0 \ldots(9)
\]
This equilibrium is shown graphically in Figure 3.

![Figure 3. RNFE Equilibrium](image)

Furthermore, using \( l_u = 1 \) equation (9) gives:

\[
Y_u^* = L_u^* = \left[ \frac{S_u^*}{(1-\beta_u^0)} \right] = \left[ \frac{(\alpha_u^0, F^0) / a\nu^0}{a\nu^0} \right] \quad \ldots(10)
\]

On the other hand, in the presence of RNFE only, \((1-\alpha_u)\) fraction of the aggregate food supply is directed to the formal sector. Thus, the formal sector faces shrinkage of food supply to \([(1-\alpha_u^0).F^0] \) from \( F^0 \) (which would have been the supply of food to the formal sector in the absence of RNFE). This supply-side squeeze reduces the formal sector’s potential employment and output.

**Proposition II:** Thus, we have a basic conflict between the formal and RNFE sectors in terms of employment and output in the presence of the agricultural (supply) constraint.

We try to test the hypothesis that, given the agricultural and overall macroeconomic constraints, expansion of the formal sector induces a contraction of RNFE. We try to do this by using Indian manufacturing data. Our hypothesis gets validated through the following two regressions (Regression Table 1).

The data on Indian unorganised manufacturing are provided by NSSO at three time-points: 1994-95, 2000-01 and 2005-06 in the post-1991 situation with minimal problem of comparability. Data on organised manufacturing are provided by the ASI for these years. NSDPs are collected from Centre for Monitoring Indian Economy (CMIE). All these data are collected for the major thirteen states of India. We run pooled data regressions which qualify the requisite tests for multicollinearity, heteroscedasticity and parameter stability. We have data on enterprise number in rural unorganised manufacturing (entunrl), in urban unorganised manufacturing (entunun), in organised manufacturing (entorg), nsdp, nsdp from agriculture as a share of nsdp (nsdpagr_nsdp), aggregate net value added in organised manufacturing calculated with 1993-94 wholesale price index of manufactured products as the base price\(^23\) (vaorg; we did not get data of gross value added for the year 2005-06 and hence we took net value added for all the years), aggregate gross value added in rural and urban unorganised manufacturing calculated with 1993-94 consumer price index of industrial workers as the base price (vaunrl and vaunun respectively).
**REGRESSION 1.**

<table>
<thead>
<tr>
<th></th>
<th>Entunrl</th>
<th>Const.</th>
<th>entunun***</th>
<th>entorg***</th>
<th>Nsdp</th>
<th>nsdpagr_nsdp</th>
<th>Adj R-squared</th>
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<td>(.5145774)</td>
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<th>Vaunrl</th>
<th>Const.</th>
<th>Vaunun</th>
<th>vaorg***</th>
<th>nsdp***</th>
<th>nsdpagr_nsdp</th>
<th>Adj R-squared</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>3.39e+09</td>
<td>.2557348</td>
<td>-0.089749</td>
<td>.0188179</td>
<td>-1.38e+09</td>
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<tr>
<td>(2)</td>
<td>(4.14e+09)</td>
<td>(.1552423)</td>
<td>(.0199324)</td>
<td>(.0044769)</td>
<td>(1.03e+10)</td>
<td>(.1552423)</td>
<td>(.0199324)</td>
<td>(.0044769)</td>
</tr>
</tbody>
</table>

*** implies 1 per cent level of significance. Standard error values are in brackets.

With the help of our above framework on farm–non-farm linkage let us now try to capture the effects of certain crucial agricultural strategies on the RNFE of India. We take up four such strategies in our subsequent analysis.

3. **Green Revolution**

Green revolution implies a rise in agricultural productivity. But in many cases it has caused land alienation for the small farmers leading to the concentration of ownership. On the other hand, green revolution because of its technological specificity invariably reduces the indigenous crop-diversity of traditional agriculture. All these imply, a rise in marketable surplus of food, F and an increase in n2 representing change in cropping-pattern towards specialisation. But, green revolution may also reduce n1 as ownership concentration rises.

Thus, F0 and n20 rise to say, F’ and n2’, respectively, while n10 falls to say, n1’. Hence, equation (4) is modified as,

\[ \alpha_u' = \alpha_u'(p_u/p_f, \theta, n_1', n_2') = \alpha_u'(p_u/p_f) \]  

Now, using equations (4)’ and F = F’, we have from equation (6),

\[ D_u = D_u'(p_u/p_f, \alpha_u', F') = D_u'(p_u/p_f) \]  

Comparing equations (4) and (4)’ we can summarise:

even if, n2’ > n20, \( \alpha_u' >, =, or < \alpha_u \) as n1’ < n10. Hence, in spite of F’ > F0, comparison between equations (6)’ and (6)'’ generates an ambiguous result. Thus, D_u’ >, =, or < D_u0. Consequently, the direction and extent of shift of the D_u0 curve (Figure 2) is ambiguous and it depends on the variations of F, n1 and n2.

Given equation (6)'’, the equilibrium condition (8) is modified as, S_u = D_u’  

Putting equations (1)', (4)' and F = F’ in expression (5) and then using equation (8)' we get a modification of equation (9) and the new S_u* as, \[ Su* = D_u* = [(1-\beta_0)'/a_{fu0}]. \alpha_u'*.F' \]

Consequently, modifying equation (10) with F = F’ we have, \[ Y_u* = L_u* = [(\alpha_u'*.F')/a_{fu0}] \]

As, \( \alpha_u' > =, or < \alpha_u \), the resultant impacts on S_u, Y_u and L_u are ambiguous. Only if the effects of a rise in F and n2 dominate the contractionary effect of a fall in n1, the agricultural supply constraint gets relaxed. Consequently, the demand for RNF products rises as well. This demand and supply side boosts help RNFE to grow.
However, contrarily, if the effects of rise in F and n₂ are dominated by the contractionary effect of fall in n₁, the RNFE even contracts.

As the effect on αᵤ is ambiguous, the value of (1-αᵤ) is also not certain. Hence, even if F rises with the introduction of green revolution, the level of supply of agricultural commodities to the formal sector, that is, [(1-αᵤ).F] remains uncertain. Consequently, the effect of green revolution on the formal sector is ambiguous.

Proposition III: Rise in agricultural productivity initiated through a policy of the green revolution will have ambiguous effects on both RNFE and formal sectors.

4. Land Reforms

Let us assume that the government introduces a re-distributive land-reforms programme. Moreover, we also assume that agricultural productivity is improved through land redistribution coupled with other complementary measures (such as, technological and institutional rearrangements). It is quite likely this redistribution of land induces a shift of cropping-pattern towards basic cereals. All these changes are captured in the following way:

Suppose, F, n₁ and n₂ rise from F₀ to F', n₁₀ to n₁'' and n₂₀ to n₂'' respectively.

First, for n₁ = n₁'' and n₂ = n₂'' equation (4) is modified as,

\[ α_u'' = α_u''(p_f/p_u, n_1'', n_2'') = α_u''(p_f/p_u) \] ....(4)''

As n₁' > n₁₀ and n₂' > n₂₀, comparing equations (4) and (4)'' we can say unambiguously, αᵤ'' > αᵤ₀. Now putting αᵤ₀ = αᵤ'' and F = F'' in equation (6) we get,

\[ D_u'' = D_u''(p_u/p_f, α_u'', F'') = D_u''(p_u/p_f) \] ....(6)''''

Furthermore, as αᵤ'' > αᵤ₀ and F'' > F₀, comparing equations (6)' and (6)'''' we can unambiguously say, D_u'' > D_u₀. Consequently, D_u₀ curve of Figure 2 should shift to the right.

Given equation (6)'', the equilibrium condition (8) is modified as,

\[ S_u = D_u'' \] ....(8)''

Now, putting equation (1)' in (4)'' we get a modification of expression (7) as,

\[ α_u''' = α_u'''(p_f/p_u, 0, n_1'', n_2'') = α_u'''(p_f/p_u) \] ....(7)'

Subsequently, putting equations (1)', (7)' and F = F' in expression (5) and then using equation (8)'', we get a modification of equation (9) and the new equilibrium value for S_u as, S_u''' = D_u''' = [(1-β_u₀)/α_u₀]. α_u'''*.F'''

Moreover, modifying equation (10) with α_u''' and F'' we have,

\[ Y_u''' = L_u''' = [α_u'''*.F'']/α_u₀ \]

Thus, the non-farm sector unambiguously expands. Here the impetus is coming from three sources; a rise in agricultural productivity, land-reforms as well as a shift of cropping-pattern towards basic food crops.

However, these simultaneous changes from αᵤ₀ to αᵤ''' and from F₀ to F''' both in the same (positive) direction generate ambiguous results for the formal sector as the direction of change in [(1-αᵤ).F] is uncertain.
Proposition IV: While RNFE undoubtedly benefits from a programme of land-reforms inducing agricultural productivity and increasing specialisation in cropping-pattern, the effect on the formal sector is ambiguous.

We test the hypothesis that RNF is associated with small-farm based and growing agriculture and this gets validated by regression Table 2. We select the year 1999-2000, as only for this year we have detailed data on the informal sector (rural value added - vainrl) for India and her states from NSSO (Report 459). Net State Domestic Product (nsdp), that from agriculture (nsdpagr), nsdpagr as share of nsdp (nsdpagr_nsdp) and share of marginal holdings in total number of holdings (sh_mr_hold) are collected and/or calculated from CMIE-data. We select thirteen major states of India as these states individually have more than one million informal enterprises.

REGRESSION 2.

<table>
<thead>
<tr>
<th></th>
<th>Vainrl</th>
<th>Const.**</th>
<th>sh_mr_hold***</th>
<th>nsdpagr***</th>
<th>Adj R-squared</th>
<th>Observations</th>
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<tr>
<td>(1)</td>
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<td>-2.27e+10</td>
<td>4.92e+08</td>
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<td>(4.44e+10)</td>
</tr>
<tr>
<td>Vainrl</td>
<td>Const.***</td>
<td></td>
<td>sh_mr_hold***</td>
<td>nsdpagr***</td>
<td>Adj R-squared</td>
<td>Observations</td>
</tr>
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<tr>
<td></td>
<td>(3)</td>
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<td>(1.0108594)</td>
<td>(4.44e+10)</td>
<td></td>
</tr>
</tbody>
</table>

** and *** imply 5 and 1 per cent level of significance. Standard-error values are given in brackets.

5. Crop Diversification

Let us assume that crop-diversification is not raising the level of agricultural productivity as such, it is rather occurring at the cost of crop-substitution. Hence, F remains unchanged. However, with crop-diversification there is a clear fall in n2. On the other hand, there is an induced decrease in n1 due to the operation of two effects. First, with diversification there is land-alienation to some extent, especially for the small and marginal farmers, directly leading to land-concentration. Secondly, as crop-diversification is practised by large agro-business firms under the institutional arrangement of contract farming, small and marginal farmers lose their independent decision-making power. This snaps the linkages between small farms based agriculture and RNFE. The consequent effect on RNFE is similar to that of increasing land-concentration.

As both n1 and n2 fall, from equation (3) we can say that there is a clear decline in \( \alpha_u \) from its initial value, \( \alpha_u^0 \).

Now, with unchanged F and reduced value of \( \alpha_u \), from equation (6), it is clear that D_u falls unambiguously from its initial value of \( D_u^0 \) as derived from equation (6)’. Consequently, \( D_u^0 \) curve in Figure 2 should shift to the left.

Given the fall in the value of D_u, we can infer from our basic model that the equilibrium values of S_u, Y_u and L_u must also fall unambiguously.
However, such contractionary effects on RNFE due to crop-diversification could be checked if an appropriate increase in F is ensured counter-balancing the effects of fall in both \(n_1\) and \(n_2\). This could be materialised only when crop-diversification takes place through extensive cultivation and/or increase in cropping intensity rather than crop-substitution.

On the other hand, as crop-diversification is practised with or without crop-substitution, \(\alpha_u\) falls unambiguously. Hence, \((1-\alpha_u)\) rises, raising the value of \([1-(1-\alpha_u)F]\), that is, the level of supply of agricultural commodities to formal sector. Thus, the formal sector gets a crucial supply side inducement for expansion. This sector is doubly benefited if diversification of agriculture occurs through extensive cultivation and/or increase in cropping intensity, which raise the value of F over and above the increase in \((1-\alpha_u)\).

**Proposition V:** The effect of crop-diversification on RNFE crucially depends on whether it takes place through extensive cultivation and/or increase in cropping intensity or through crop-substitution. However, the corresponding effect on the formal sector is unambiguously positive.

We test the hypothesis that Simpson’s Crop-diversification Index (SDI)\(^{27}\) is positively associated with non-agricultural development rather than agriculture and hence, the rural informal sector (value added – vainrl, enterprise number – entinrl and number of workers – wkinrl) is negatively associated with SDI. Our hypothesis gets validated by Regression Table 3 and Correlation Table 1. We select the year 1999-2000, as only for this year we have detailed data on the informal sector for India and her states from NSSO (Report 459). Net State Domestic Product from non-agriculture in proportion to agriculture (nag_ag) and nsdpagr is calculated from CMIE-data. We select thirteen major states of India as above.

**Regression 3.**

<table>
<thead>
<tr>
<th>SDI</th>
<th>Const.*</th>
<th>Nag_ag**</th>
<th>Adj R-squared</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
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<td>.0974381</td>
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<tr>
<td></td>
<td>(.1130168)</td>
<td>(.0390211)</td>
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</table>

and ** imply 10 and 5 per cent levels of significance. Standard-error values in brackets.

**Correlation 1.**

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<th>Wkinrl</th>
<th>SDI</th>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td>-0.2061</td>
<td>-0.3993</td>
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<td>nsdpagr</td>
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<td>0.7707***</td>
<td>0.7683***</td>
<td>-0.3649</td>
</tr>
</tbody>
</table>

*** imply 1 per cent level of significance.

6. **Land-Conversion**

Setting up of secluded industrial zones (such as EPZ, SEZ etc.) has become a distinct process in India for quite some time. But this is happening at the cost of
conversion of huge tracts of agricultural land. Such a process of land-conversion is supposed to have far reaching impacts on agriculture as a whole. As a vast section of the agricultural population is expropriated, not only land-alienation but also a drastic fall in agricultural production may occur. Moreover, with the expropriation of peasantry from the means of production and subsistence, the very foundation of the RNFE is destroyed. These changes could be captured in the following way. First of all, there is a fall in $F$ from its initial value $F^0$. Moreover, as land-alienation occurs, the historically evolved value of the land-distribution parameter $n_1$ reduces. Consequently, from equation (3) we can say that there is a clear decline in $\alpha_u$ from its initial value, $\alpha_u^0$.

Now, with reduced values of $F$ and $\alpha_u$, from equation (6) it is clear that $D_u$ falls unambiguously from its initial value of $D_u^0$ as derived in equation (6'). Consequently, $D_u^0$ curve in Figure 2 should shift to the left.

Given the fall in the value of $D_u$, we can infer from our basic model that the equilibrium values of $S_u$, $Y_u$ and $L_u$ must also fall unambiguously. Thus, undoubtedly RNFE contracts due to land-conversion for large-scale industrialisation.

On the other hand, with a fall in $\alpha_u$, the fraction of supply of agricultural output, that is, $(1-\alpha_u)$ rises. But a simultaneous fall in $F$ due to agricultural land-conversion makes the extent of change in $[(1-\alpha_u).F]$ uncertain. Hence, the impact on the formal sector is ambiguous.

However, if we juxtapose land-conversion and crop-diversification, certain interesting implications become visible. It is proposed that to counter-balance the fall in $F$ due to land-conversion, agricultural productivity should be enhanced. But it is simultaneously asserted that, as basic agriculture has become un-remunerative and the tastes and preferences have shifted towards high value commodities (HVC), vigorous crop-diversification would be an appropriate choice. Thus, following our framework, a fall in $F$ is checked with an adequate reduction in $n_2$. Hence, land-conversion coupled with crop-diversification though keep the value of $F$ unchanged at the initial level, it comes with an even steeper fall in $\alpha_u$ compared to that under the partial policy of land-conversion. Thus, with a fall in $\alpha_u$ the RNFE contracts even though $F$ remains unchanged. On the other hand, land-conversion coupled with crop-diversification implies a sharp rise in $(1-\alpha_u)$ raising the level of supply of agricultural commodities to the formal sector, that is, $[(1-\alpha_u).F]$. Consequently, the supply constraint for the formal sector is relaxed which may induce its growth.

Proposition VI: A policy of large-scale industrialisation at the cost of agricultural land-conversion induces a contraction of RNFE, while its impact on the formal sector is ambiguous. However, as this process of land-conversion is coupled with crop-diversification to maintain the aggregate agricultural supply, even if RNFE shrinks, the effect on the formal sector is surely expansionary.
VI
IN LIEU OF CONCLUSION

Several other policies could be discussed with this framework.
Ranis and Stewart (1993) propose the expansion of modernised RNF driven by urban growth as capable of fostering prosperity. But we cannot forget the potential conflict between ‘modern’ and ‘traditional’ RNF and the possibility of immiserisation of the vast traditional RNF activities, given the generic agricultural and other supply-constraints.

A policy of boosting RNF through export promotion may apparently seem beneficial. But, given the agricultural supply-constraint, such a policy could be counter-productive. As with open-economy transactions, the price of RNF is largely determined in the international market, expansion of demand for RNF may rather reduce real income by pushing up food-price. Similar effects may arise due to agricultural policies promoting ‘food’ exports through crop-diversification siphoning off resources away from RNF.

Direct employment-generation-programmes like MGNREGS may immiserise RNF by diverting basic food to feed the newly employed population. The beneficiaries of employment programmes are mostly marginalised people who spend a major part of their income on basic food siphoning off necessities from RNF. The programme of ‘food-stamp’ may generate similar problem, if it has partial coverage.

Direct promotion of RNF through governmental and non-governmental ‘technologies’ may also prove to be counter-productive, given the resource-constraints. Agriculture–formal sector interaction has been deliberately avoided in our modelling exercise. However, it could be an interesting extension.

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NOTES
1. TABLE A. SIMPSON INDEX OF CROP-DIVERSIFICATION FOR WEST BENGAL, GUJARAT, TAMIL NADU, PUNJAB AND ALL-INDIA

<table>
<thead>
<tr>
<th></th>
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<tbody>
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<td>0.43</td>
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<tr>
<td>All India</td>
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<td>0.50</td>
<td>0.51</td>
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<td>0.51</td>
</tr>
</tbody>
</table>

For food grains, fruit and nuts, fibres, oil seeds, plantations, spices, vegetables etc. from Kundu and Chakrabarti (2010).

2. We must note here that the quality of assets play a crucial role for non-farm sector. But we are neglecting these quality differentials for paucity of qualitative data. Value of assets could act as a proxy for quality, which, however,
could open up scope for extension from the paper. However, analysis of Figure 1 showing net receipts from non-farm business could provide some support, in this regards.

3. In fact, in various studies it is found that the regions practicing intensive HVC cultivation in India have concentrated in urban and semi-urban areas (Rao et al., 2006).

4. For coarse crop (cereals and pulses) we have used the necessary ASICC code for the range of 12301 to 12492 and 12979 respectively for industry group NIC-151. For industry group NIC-153 the similar task has been done for the group of 12301 to 12979. On the contrary, for HVCs the necessary ASICC codes picked up from the ranges 12102 to 12213; 13504 to 13929; 12522 and 12539, for NIC industry group 151. For NIC group 153, the range varies from 12101 to 13534 and 63104 to 63203.

5. We have separated out the informal manufacturing units from the rest of the units which falls under the unorganised manufacturing but not as informal manufacturing. For segregation we have used the definition adopted by NSS 55th Round of Informal Sector. Moreover, we have separated out the list frame (that captured the sufficient number of non-ASI bigger urban small scale industry units) from the area frame.

6. It is noteworthy that generally we use the median value for comparison, which is unaffected by outliers, instead of mean. We consider only the mean value as an average if median values of two categories are zeros.

7. 92.91 per cent of the total rural processing, grinding and milling units (irrespective of the use of two types of raw materials) falls under the category of OAME using coarse crops for their production process.


9. Even if hired casual labour is used the character of production does not change, as the motive of both employer and employee is the same, that is, consumption.

10. Simple tools produced in non-farm sector itself are used.

11. Thus, any interaction between the formal and non-farm sectors is assumed away for simplicity of analysis.

12. Here ‘food’ is a composite commodity, including agro-inputs used in RNFE.

13. Between agriculture and formal sector, on one hand, and between the former and RNFE, on the other.

14. Basic food-crop producing agriculture is much more integrated with RNFE, while the HVC segment is linked with the formal sector.

15. Small farm based agriculture is closely linked with RNFE, though the big farmer class allies with the beneficiaries of formal sector.

16. Unbalanced trade is financially unsustainable for both these sectors.

17. As we have assumed balanced trade between agriculture and RNFE and a single (market) price for food, $\alpha_u$ represents fraction of both agricultural income and marketable surplus of food transacted with the non-farm sector. $\alpha$ fraction of aggregate agricultural income is spent on non-farm products and hence, RNFE obtains the same fraction of marketable surplus of food. Thus, this is a demand-driven outcome and the division of agricultural supply is just a result of that.

18. Summary of fraction (per cent) of value added going for self-consumption and reproduction in unorganised manufacturing enterprises (India: 2005-06).

---

### MANUFACTURING ENTERPRISES (INDIA: 2005-06)

<table>
<thead>
<tr>
<th>No. of Enterprise</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
<th>Maximum</th>
<th>Minimum</th>
<th>First Quartile ($Q_1$)</th>
<th>Third Quartile ($Q_3$)</th>
<th>Inter Quartile range ($Q_3-Q_1$)</th>
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<tr>
<td>OAME Rural</td>
<td>12.20</td>
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<td>1.12</td>
<td>6.34</td>
<td>5.22</td>
</tr>
</tbody>
</table>

**Source:** Calculated from NSS 62nd Round: Unorganised Manufacturing Enterprise (2005 -2006) Unit Level data.

From this table it is evident that: so far as the average/mean of value added in reproduction and self-consumption as a percentage of total annual value added is concerned we see across different enterprise types (especially OAME and NDME) both in rural and urban sectors there is no wide difference. It is much more prominent if we consider median value instead of mean. Similarly, standard deviation is not a resistant measure and hence it shows a wide variability across enterprises for each enterprise type (it is basically due to wide difference between maximum and minimum value). But inter quartile range, which is a resistant measure of dispersion and also depicts the middle 50 per cent of the data set, shows the variability of this share ranges, for all types of enterprises, between 5.22 per cent and 10.91 per
It does not show any abrupt change. Hence median value along with IQR depicts the fact that the fraction of value of consumption and production to total gross value added is varying within a particular range, which partially indicates that this value is more or less constant across all enterprises.

19. Retaining the two basic assumptions for the non-farm sector, the absence of capital and the consumption motive, leaves the analysis fundamentally the same, even though we relax other assumptions like existence of surplus-labour and fixity of \( a_0 \). The corresponding modification can be that, the \( S \) curve is no longer perfectly elastic and its slope is determined by the elasticity of labour supply in RNFE.


21. The distributive factors are not determined through demand-supply interactions, but by class relations (Bharadwaj, 1991). We can interpret our assumption of fixity of terms of trade between agriculture and formal sector as an expression of alliance between different propertied classes (see Mitra, 1977, where t-o-t represents a synthesis of class interactions). This is particularly plausible as crop-diversification practised by independent large farmers and tied up small peasants (through contract farming) integrate the diversified segment of agriculture with the ‘modern’ formal sector.

22. A plausible assumption for short run analysis.

23. Price indices are collected from Reserve Bank of India website.

24. We know Punjab agriculture could reap the maximum benefits of green revolution in India. But at the same time it has experienced increasing concentration. The index of concentration of operational holding has risen sharply from 0.42 to 0.70 during 1970-71 to 1981-82, whereas for India as a whole this index has shown a marked decline during the same period (Mukherjee, 2007, p. 50).

25. Here also, Punjab happens to be a classic case.

26. In India crop-substitution’s contribution to diversification is 63.37 per cent, whereas for whole of South Asia it is 57.02 per cent (Joshi et al., 2004).

27. Simpson’s Diversification Index (SDI) measures degree of crop-diversification: SDI=1-\( \Sigma \left( p_i / \Sigma p_i \right)^2 \), where \( p_i \) is the area under \( i \)-th crop.

REFERENCES


CMIE (2006), EIS: Time-Series Database, Centre For Monitoring Indian Economy, Mumbai.


