

Discussion Papers in Economics

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March 2007

Discussion Paper 07-05



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How Does Poverty Decline? Evidence from India, 1983-1999

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ABSTRACT

This paper attempts to assess the relative contributions of the farm and non-farm sectors to the increase in agricultural wage earnings in India between 1983-1999. Cross-section analysis of NSS data for 1983 and 1993 confirm the importance of farm productivity growth, consistent with the predictions of our theoretical model. A counterfactual exercise that attempts to estimate the relative contribution of the non-farm sector to the increase in the agricultural wage earnings during the period 1983-1999 suggests that this figure is no more than 25% at the all-India level, though it is higher in some states. Thus the bulk of the growth in wage earnings and the attendant decline in poverty during this period appears to be due to the farm sector.

Keywords: Farm and non-farm productivity growth, non-farm employment, poverty, wage earnings

JEL Classification Numbers: O13, O14, O53

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Acknowledgements: We would like to thank Paul Beaudry, Andrew Foster, Peter Lanjouw, Dilip Mookherjee, Suresh Tendulkar, Alessandro Tarrozi, the participants of the World Bank workshop on Equity and Development (December 7-8, 2004) and the participants of the ‘Workshop on the Indian Economy: Policy and Performance 1980-2000’ held at the Centre for India and South Asia Research, UBC in Vancouver (in June 2005) for their helpful comments. We are grateful to the Shastri Indo-Canadian Institute for financial support through the SHARP programme.

1. Introduction

In a less developed country, the most consequential aspect of GDP growth is the impact it has on poverty. A convincing empirical case has been made in the literature that higher growth translates into lower poverty [e.g., Besley and Burgess (2003), Dollar and Kraay (2002), Kraay (2004), Ravallion (2001)]. Using cross-country data for a number of years, Besley and Burgess estimate that a 1% increase in GDP growth reduces, on average, poverty by 0.73%. However, the average impact hides variation between countries. For example, the elasticity of poverty with respect to economic growth is -1 in East Asia but only -0.59 in South Asia (Besley and Burgess). In order to be able to discriminate among policies promoting growth, we need to understand the process by which different growth strategies impinge on the incomes of the poor. The purpose of this paper is to propose a framework that would enable us to analyze such a process by drawing lessons from the last two decades of growth and poverty decline in India. More specifically, we will try to evaluate whether it is the productivity growth in agriculture or in non-agriculture that has a bigger impact on poverty decline.

Such a sectoral decomposition of growth and its impact on poverty is valuable because the sector amenable to faster growth may not be the one whose growth has a greater impact on poverty. Typically, the non-farm sector in developing countries exhibits higher rates of growth since non-farm technology can be transferred more easily from developed countries; it may need less climatic adaptation. It is also the case that, unlike the farm sector, it is not crucially dependent on a fixed factor like land. Yet, a significant part of the labor force in developing countries makes its living in agriculture. A well-known statistic is that the poorer the country, the greater is the share of the labor

force in agriculture. How does the growth in the non-farm part of GDP translate into a boost in the incomes of those working in the farm sector? This question must be answered in order to understand the process by which poverty declines. If during a period of high growth, poverty also declines, it does not follow that the faster-growing sector is mostly responsible for it. It is quite possible that growth is mostly attributable to one sector and the poverty decline to the other.

India is one of the fastest growing economies in the world today. It also has the dubious distinction of having the largest share of the world's poor. In addition, it has some of the better quality data among the developing countries. It therefore makes an ideal case study for our purpose. Since the early 1980's, India has enjoyed an average GDP growth rate of 5.5 per cent per annum. More importantly, the proportion of the population below the poverty line declined from about 44.5% in 1983-84 to 26% in 1999-00. It is instructive, therefore, to examine the process through which the policies responsible for growth may have raised the incomes of the poor. It is worth noting that agricultural GDP grew at a much lower rate than the non-farm GDP from 1980-2000. Agricultural GDP grew at a rate of 3.36% in the 80's and at 2.5% in the 90's. Industry and services grew at 7.54% and 6.23% in the 80's and at 5.6% and 7.07% in the 90's respectively. An important question is: which sector contributed more toward the observed poverty decline?

2. Literature

Using country level panel data sets, several researchers (cited in the introduction) have looked at the growth-poverty relationship. This literature finds a strong negative

association between growth and poverty. However, this is the relationship on average, and country (and regional) experiences could be diverse. As Ravallion (2001) points out, the growth-poverty link may be quite weak in the face of rising inequality.

An identity links changes in the level of poverty in any given country with changes in the average income level (i.e., growth) and changes in income inequality. Changes in poverty can therefore be decomposed into a growth and a distribution component and their relative importance can be quantified. Besley, Burgess and Esteve-Volart (2004) undertake such an exercise for different states of India revealing the heterogeneity of the growth-poverty link. This finding calls for a deeper examination beyond growth-poverty correlations.

Cross-country regressions that relate inequality or poverty to the variables that have been known to be robust correlates of growth (“rule of law”, openness to international trade, inflation, size of government, measure of financial development) have pretty much drawn a blank [Dollar and Kraay (2002), Kraay (2004), Lopez (2004)]. Kray (2004) and Ravallion (2001) conclude that country-specific research is necessary to understand heterogeneous outcomes (of growth) for the poor.

In the Indian case, scholars have used state level panel data to establish the correlates of poverty. Ravallion and Datt (1996) find rural economic growth to have a significant impact in reducing urban and rural poverty while urban growth has little impact on rural poverty. In the rural sector, higher farm yield is the key variable that reduces poverty [Datt and Ravallion (1998)]. On the other hand, the impact of non-farm economic growth varies across states, depending on initial conditions [Datt and Ravallion (2002)]. In a similar analysis of panel data, Besley, Burgess and Esteve-Volart

(2004) report opposite results. They find economic growth in the secondary and tertiary sectors to contribute more to poverty reduction than primary sector growth. State level panel data has also been used to examine the impact of specific policies on poverty – including labour regulation [Besley and Burgess (2004)], land reform legislation [Besley and Burgess (2002)] and expansion of rural banking [Burgess and Pande (2005)]. Topalova (2005) assembled a district level panel data set and used it to establish that districts that experienced greater tariff reductions recorded slower decrease in poverty. Finally, Palmer-Jones and Sen (2003) is an instance of a cross-sectional analysis at the region level (intermediate between districts and states) where they relate rural poverty to agricultural growth and several control variables. Useful as they are in enhancing our empirical knowledge of which policies were associated with greater poverty reduction, these analyses have not established the causal mechanisms by which the poor have gained from the growth process.

In a recent study, Foster and Rosenzweig (2003, 2004) present a causal framework that links agricultural productivity increase and capital flows into the rural factory sector on the one hand with the agricultural wages on the other. They test this framework with panel data (not yet in the public domain) over the years 1983 through 1999. They find that in their framework agricultural productivity improvement increases inequality across regions while the rural factory sector helps to decrease it. They argue that it is only the non-traded segment of the rural non-farm sector that is positively affected by agricultural growth. The traded non-farm sector (consisting of rural factories) competes with the farm sector for labour and is therefore attracted to regions with low agricultural productivity. Their empirical results show that much of

the growth in the rural non-farm sector in India was due to the rural factory sector and not due to the non-traded sector. Furthermore, the growth in the rural factory sector was important in accounting for the increase in rural wages over the period 1982-99.

We have two points of departure from Foster and Rosenzweig (2003, 2004). First, at the theoretical level, we model preferences more realistically by incorporating Engel's law. This matters because the nature of consumer demand determines how labour is released from agriculture (which exhibits diminishing returns) following a productivity increase. Second, at the empirical level, we use national sample survey data that is publicly available. Our model, however, is simpler than that of Foster and Rosenzweig (2003, 2004) in other respects: it has only two as opposed to three sectors. Our focus is to assess the relative contributions of productivity growths in the farm and non-farm sectors to the observed growth in wages rather than evaluate their impact on the regional distribution.

3. Using Agricultural Wages as a Poverty Measure

Official estimates of head-count ratios of poverty in India are computed from national expenditure surveys and a poverty line developed by the Planning Commission. Due to a change in the survey design in 1999 relative to 1993, the rate and direction of change in poverty in the 1990's cannot be established in a straightforward way. Adjustments have to be made to render the surveys comparable and this has generated a large debate about the merits of different types of 'adjusted' poverty measures.¹ The official poverty lines have also been criticized for the way in which they are updated

¹ See the collection of papers in Deaton and Kozel (2005).

from survey to survey. Deaton and Tarozzi (2005) and Deaton (2001) have proposed alternative price deflators which yield poverty lines and poverty measures that are different from the official estimates. This underscores another difficulty with conventional poverty measures: they are sensitive to the distribution of the population around the poverty line, and so results could vary widely depending on the choice of the poverty line.

This paper sidesteps these measurement issues by choosing to work with agricultural wages. It is well known that agricultural laborers constitute a large fraction of the poor in India and that their wages have a strong negative correlation with the headcount ratios. A recent study that documents this association is Kijima and Lanjouw (2005) who show agricultural wage rates at the region level to be strongly (inversely) correlated with region-level poverty rates in the three years between 1987 and 1999 for which such survey data were available.

Deaton and Dreze (2002) argue that agricultural wages can be taken not just as a proxy for poverty but as a poverty measure in its own right since it is the reservation wage of the very poor. It would also seem that it would be easier to theorize and model agricultural wages than it would be for poverty measures which are complicated non-linear functions of underlying average income and of income inequality.

To see the logic of our argument, consider a dual economy comprising a farm and a non-farm sector. Total factor productivity (TFP) in farm and non-farm sectors can be thought of as exogenous to this model. The connection between farm TFP and agricultural wage is quite direct: at the same level of production inputs an increase in agricultural TFP will raise the marginal product of labor and hence the wage. What is

the relationship between non-farm TFP and agricultural wages? Here the link is through labor allocation: if an increase in non-farm TFP increases the value of the marginal product of labor in the non-farm sector, it will draw labor away from agriculture and, given the diminishing returns due to land (a fixed factor), the agricultural wage will rise. The extent of the wage increase due to non-farm TFP growth would depend, of course, on the amount of labor drawn away from agriculture. In China, the percentage of labor force engaged in agriculture plummeted from 70% in 1979 to 47% in 1999. In other East Asian countries, like Taiwan and South Korea, this process of structural transformation was equally swift.

In India, the reduction of labor force in agriculture has been nothing like what was witnessed in East Asia. Estimates from employment surveys show that the share of agriculture in the labor force for males (measured in person days) declined from about 60% in 1983 to 53% in 1999-00. As the share of manufacturing has changed very little over these 16 years, the share of services has increased by about the same percentage. For females, the sectoral pattern of employment has remained stagnant. 72% of female labor force continued to be employed in agriculture in 1999-00 compared to 74% in 1983.

For 15 major Indian states, Figure 1 plots the average real daily wages (in 1999 rupees) in agriculture against the labour-land ratio (days per hectare of gross cropped area) for 1983 and 1999. It can be seen that for all but four states (Kerala, Haryana, Punjab and Rajasthan), the labour use per hectare of land has increased over this period. Yet, for all but one state (Assam), real wages have increased during this period. At the All-India level, real daily wages increased by 69% between 1983 and 1999. Quite

clearly, if either farm TFP or agricultural inputs such as fertilizers had not increased during this period, agricultural wages would have declined. It becomes interesting, therefore, to ask how much the non-farm sector growth has contributed to the growth of agricultural wages.

4. A Theoretical Framework

To isolate the contributions of the farm and non-farm sectors to the growth of the Indian economy, we adopt the dual economy framework that harks back to Lewis (1954) but later modeled, as in Matsuyama (1992) and Eswaran and Kotwal (1993), with neoclassical labour markets. We set out a model of a typical ‘regional’ economy, where a ‘region’ could mean—depending on our focus—the entire country, a state within the country, a district, or even a village. (Whether the region should be treated as a closed economy or as an open economy within the country will be dealt with below.) There are two sectors within the region: a farm sector (which produces an aggregate good, food) and a non-farm sector (which produces an aggregate of all other goods). Food production requires labour and land, whereas non-farm output requires only labour.

The total amount of land is fixed in the region. Since the distribution of income is not a primary focus of attention here, we assume that land is uniformly divided across all agents. There are \bar{L} agents in the economy, each inelastically providing one unit of labour. Since land is only used in farming, labour is the only input whose allocation across the two sectors needs to be determined in the general equilibrium.

It is our contention that the preferences of agents over farm and non-farm products in their consumption are an important determinant of the allocation of labour

across these two sectors. The assumption of homothetic preferences does not ring true in the context of developing countries, for they imply linear Engel curves. As Engel observed over a century ago, when income increases, the proportion of income consumers spend on food remains high initially and then declines quite rapidly. Explicit attempts to incorporate non-homothetic preferences were made in Matsuyama (1992), which employs Stone-Geary preferences, and Eswaran and Kotwal (1993), which invokes lexicographic ('hierarchical') preferences with satiation with respect to the farm product but not the non-farm product.

To capture the essential features of Engel's Law, albeit in stark form, we posit here that agents have quasi-linear preferences over the two consumption goods. The utility function, $U(x, z)$, representing a consumer's preferences is given by:

$$(1) \quad U(x, z) = u(x) + \mathbf{g}z, \quad \mathbf{g} > 0,$$

where x and z denote her consumption of farm and non-farm goods, respectively. We assume that the sub-utility function satisfies $u'(\cdot) > 0$, $u''(\cdot) < 0$, and $u'(\cdot)$ goes to infinity as its argument goes to zero, that is, the farm good is essential. The marginal utility of this good declines with consumption, while that of the non-farm good is constant.

We take the farm good as the numeraire and denote by p the relative price of the non-farm good. A price-taking agent with income y then solves

$$(2) \quad \max_{x, z} u(x) + \mathbf{g}z \quad s.t. \quad y \geq x + pz.$$

Denote the solution by $[x^*(y, p), z^*(y, p)]$. It is readily seen that the solution will not be interior (the agent will only consume the farm good) if her income is sufficiently low. In fact, $x^*(y, p) = y$ and $z^*(y, p) = 0$ when $y \leq H(\mathbf{g}/p)$, where

$H(\mathbf{g}/p) \equiv u'^{-1}(\mathbf{g}/p)$ is the (declining) inverse function of the marginal utility of the farm good. When $y > H(\mathbf{g}/p)$, the agent's consumption of this good is independent of her income: $x^*(y, p) = H(\mathbf{g}/p)$. All her income in excess of $H(\mathbf{g}/p)$ is spent on the non-farm good, since her marginal utility from this good is constant. The income elasticity of the non-farm good remains zero until the agent consumes $H(\mathbf{g}/p)$ units of the farm good; at higher income levels, her income elasticity of the farm good falls to zero. Quasi-linear preferences, therefore, simulate the dramatic decline in the share of income devoted to food when income rises to sufficiently high levels. However, the maximum per capita consumption of farm output, $H(\mathbf{g}/p)$, increases in the relative price, p , of the non-farm output; there is substitutability between farm and non-farm output.

On the supply side, we assume the farm production function exhibits constant returns to scale. The aggregate farm output, X , is written

$$(3) \quad X = AF(L_f),$$

where A denotes the total factor productivity parameter (augmented by an increasing and concave function of the fixed amount of land), and L_f is the agricultural labour input.

The function $F(L_f)$ is increasing and, since the fixed land input is suppressed, exhibits diminishing returns with respect to labour: $F''(L_f) < 0$.

The aggregate non-farm output, Z , is produced using only labour and exhibits constant returns in the amount of labour employed, L_n :

$$(4) \quad Z = BL_n,$$

where B is the total factor productivity parameter, again augmented by other factors of production such as capital that are left out of the analysis.

An important consideration here is whether the region should be thought of as self-sufficient or as one that freely trades with neighbouring regions. We analyze two scenarios that are polar extremes: one in which the region is taken to be completely closed, and the other in which each region is treated as a small open economy. The implications that follow in the two scenarios are quite different. The reality, we expect, lies somewhere in between. In subsequent sections, we shall try to identify which of these two extremes better approximates the regions in the Indian economy.

Region as a Closed Economy

Suppose each region is fully self-sufficient. We assume all markets (labour, land, farm and non-farm goods) are perfectly competitive. If L_f is the labour employed in agriculture, labour market clearance implies that the non-farm employment is given by $L_n = \bar{L} - L_f$. Since the returns to each factor is given by the value of its marginal product, the wage rate, w , is given by

$$(5) \quad w = AF'(L_f).$$

Since the farm production function is linearly homogeneous, the total remuneration to labour and land must exhaust the output. Thus, for a given labour allocation, the aggregate rental income accruing to land is $AF(L_f) - wL_f$, that is, $AF(L_f) - AF'(L_f)L_f \equiv R(L_f, A)$. This aggregate rental income is readily seen to be increasing in the amount of agricultural labour (since that raises the marginal product of

land) and in the total factor productivity. Since all agents own an equal share of the land, the land rental income of each agent is $R(L_f, A)/\bar{L}$. The income, y , of a representative agent, which is the wage rate and the rental income may be written in terms of farm employment as

$$(6) \quad y = AF'(L_f) + R(L_f, A)/\bar{L}.$$

Since $1/B$ units of labour are required to produce a unit of non-farm output, the marginal cost of producing the non-farm product is w/B . Competition in the non-farm market will ensure that the (relative) price of this good is given by

$$(7) \quad p = w/B.$$

The general equilibrium is readily determined in this model. The crucial endogenous variable here is farm employment, L_f . Once this is determined, the wage rate and the land rental incomes are known. These determine the price of the non-farm output (which depends only on the wage rate), and these, in turn, determine the demands for farm and non-farm outputs. General equilibrium then requires that the original labour allocation be such that all markets clear. The land market clears trivially, since land is only used in agriculture and the production function (3) implicitly assumes this. The market for labour clears since we have set $L_n = \bar{L} - L_f$. Using Walras' Law, we can drop the market for the non-farm good, which leaves the market for the farm product. We shall assume that we are in the regime where the solution to the consumers' optimization problem is interior, that is, they demand farm and non-farm goods. Market clearance requires that the excess demand for farm output be zero. This excess demand can be written

$$\bar{L}H(\mathbf{g}/p) - AF(L_f),$$

which upon substituting for the relative price of non-farm output from (7) and using (5) becomes

$$(8) \quad \bar{L}H(\mathbf{g}B/(AF'(L_f))) - AF(L_f) \equiv E(L_f, A, B).$$

In equilibrium, the excess demand for the farm product must be zero:

$$(9) \quad E(L_f, A, B) = 0.$$

It is readily seen that the excess demand function, $E(L_f, A, B)$, is everywhere declining in L_f . The unique solution to this equation determines the equilibrium farm labour, $L_f^*(A, B)$, and nails down the general equilibrium of the region. Since the farm product is essential to consumers, we can never obtain the corner solution $L_f^*(A, B) = 0$.

We are assuming that we do not obtain the corner solution with $L_f^*(A, B) = \bar{L}$. (This corner solution would obtain only when agricultural productivity is so low that the entire closed economy needs to specialize in farm production.) Since there exists a non-farm sector even in the smallest of villages, we may disregard this possibility in what follows and assume that the solution to (9) is strictly interior.

The following proposition records the comparative statics of the general equilibrium farm employment with respect to the productivity parameters.

Proposition 1:

(a) An increase in non-farm total factor productivity reduces the equilibrium farm labour allocation.

(b) An increase in farm total factor productivity has an ambiguous effect on the equilibrium farm labour allocation.

Proof:

(a) Totally differentiating (9) with respect to B, we obtain

$$(10) \quad [\partial E(L_f^*, A, B) / \partial L_f] (dL_f^* / dB) + \partial E(L_f^*, A, B) / \partial B = 0.$$

From (8),

$$\partial E(L_f^*, A, B) / \partial B = \bar{L} H'(\mathbf{g}B / (AF'(L_f^*))) (\mathbf{g} / (AF'(L_f^*))) < 0,$$

where the inequality follows on using the fact that $H(\cdot)$ is decreasing in its argument.

Since the excess demand function is declining everywhere in L_f , (10) yields the result

$$dL_f^* / dB < 0.$$

(b) Totally differentiating (9) with respect to A, we obtain

$$(11) \quad [\partial E(L_f^*, A, B) / \partial L_f] (dL_f^* / dA) + \partial E(L_f^*, A, B) / \partial A = 0.$$

From (8),

$$\partial E(L_f^*, A, B) / \partial A = \bar{L} H'(\mathbf{g}B / (AF'(L_f^*))) (-\mathbf{g}B / (A^2 F'(L_f^*))) - F(L_f^*).$$

Since the two terms on the right hand side of this expression are of opposite sign, we see from (11) that the sign of dL_f^* / dA is ambiguous: an increase in A has an indeterminate effect on equilibrium farm employment.

The intuition for this result is as follows. Productivity increase, whether in the farm or the non-farm sector, apart from obviously raising income, changes the relative price of the non-farm good. When it is non-farm productivity that increases, at given relative prices, the demand for farm output stays constant (with quasi-linear preferences)

while that for non-farm output increases. But, at the original labour allocation, the relative price of non-farm output declines following the productivity increase, and this induces consumers to curtail their consumption of farm output and substitute non-farm output. The decline in demand for farm output releases labour from agriculture. In terms of releasing labour from the farm sector, the income and substitution effects associated with non-farm productivity increase work in the same direction. This explains part (a) of the proposition.

When it is farm productivity that increases, at given relative prices, here too the demand for farm output stays constant while that for non-farm output increases. But, at the original labour allocation, the relative price of non-farm output increases following the productivity increase, and this induces consumers to substitute away from non-farm output and increase their demand for farm output. The increase in demand for farm output raises the demand for labour in agriculture by working against the productivity increase (which tends to release labour from the farm sector). In terms of releasing labour from the farm sector, the income and substitution effects associated with farm productivity increase work in opposite directions. This accounts for the ambiguous effect of farm productivity increases on farm employment, as stated in part (b) of the proposition.

The analysis above would seem to suggest that non-farm productivity increases would be more efficacious than farm productivity increases in generating non-farm employment. However, this would be an unwarranted conclusion: the relative effects of the two productivity increases depend on the sensitivity of the consumer demand for farm

output with respect to the price of non-farm output—in other words, they depend on the cross-price elasticity of farm output consumption.

To see this more clearly, we assume that the sub-utility function from farm output consumption is given by

$$(12) \quad u(x) = -x^{-\mathbf{a}}, \mathbf{a} > 0,$$

and the production function for this good is Cobb-Douglas:

$$(13) \quad F(L_f) = A(L_f)^{\mathbf{d}}, 0 < \mathbf{d} < 1,$$

where \mathbf{d} represents the share of labour income in farm output. It is readily verified that, in this case,

$$(14) \quad H(\mathbf{g}/p) = (\mathbf{a}p/\mathbf{g})^{1/(1+\mathbf{a})},$$

which is an agent's consumption of the farm good when the solution to her utility maximization problem is interior. The wage rate of a worker when L_f workers are employed in the farm sector is given by

$$(15) \quad w = A\mathbf{d}(L_f)^{\mathbf{d}-1}.$$

The market clearing condition (9) for the farm good, which determines the equilibrium farm employment, becomes

$$\bar{L}(\mathbf{a}\mathbf{d}A/(\mathbf{g}B))^{1/(1+\mathbf{a})} (L_f)^{(\mathbf{d}-1)/(1+\mathbf{a})} - A(L_f)^{\mathbf{d}} = 0,$$

the solution to which is

$$(16) \quad L_f^*(A, B) = C/(A^{\mathbf{a}}B)^{1/(1+\mathbf{a}\mathbf{d})}, \quad \text{where } C = (\bar{L})^{(1+\mathbf{a})/(1+\mathbf{a}\mathbf{d})} (\mathbf{a}\mathbf{d}/\mathbf{g})^{1/(1+\mathbf{a}\mathbf{d})}.$$

The elasticity of equilibrium farm employment with respect to A and B are, respectively, $-\mathbf{a}/(1+\mathbf{a}\mathbf{d})$ and $-1/(1+\mathbf{a}\mathbf{d})$. Thus the absolute value of the elasticity of

farm employment with respect to farm productivity exceeds that with respect to non-farm productivity if $\mathbf{a} > 1$.

The parameter \mathbf{a} is related to the cross-price elasticity, $\mathbf{h}_{x,p}$, of farm output demand with respect to the non-farm price. From (14), we see that $\mathbf{h}_{x,p} = 1/(1 + \mathbf{a})$, so that $\mathbf{a} = 1/\mathbf{h}_{x,p} - 1$. The condition $\mathbf{a} > 1$ translates into the inequality $\mathbf{h}_{x,p} < 1/2$. Thus if a 1% decline in the price of non-farm output curtails the demand for farm output by less than 0.5%, the absolute value of the elasticity of farm employment with respect to farm productivity would exceed that with respect to non-farm productivity. In the extreme case of lexicographic preferences (zero substitutability in consumption between farm and non-farm output, that is, $\mathbf{h}_{x,p} = 0$), non-farm productivity improvements will release no labour at all from agriculture [Eswaran and Kotwal (1993)]. For farm productivity improvements to be more efficacious than non-farm productivity improvements in removing labour from agriculture, the cross-price elasticity $\mathbf{h}_{x,p}$ has to be “sufficiently” small. Since the demand for food is driven by the biological instinct for survival, however, there would be very limited scope for substitution between farm and non-farm output, especially at low levels of income.

Whether this is so or not is, of course, an empirical matter. Some evidence that corroborates this hunch is found in Deaton (1997, Ch. 5, Table 5.7), which is drawn from Deaton, Parikh, and Subramanian (1994). This Table presents the cross-price elasticities of the demands for eleven food items with respect to nonfood goods for rural Maharashtra for 1983. Many of these cross-price elasticity coefficients are insignificantly different from zero. We aggregate all food items into a single ‘farm product’, and obtain the imputed cross-price elasticity of this product with respect to the price of the nonfood

aggregate (using budget shares) and setting the statistically insignificant elasticities to be zero. We obtain the figure of 0.11 as the cross-price elasticity for the aggregate good denoting ‘farm’ product, which is much less than 0.5.

We can push this exercise a little further and investigate when the wage rate will be more sensitive to productivity improvements in the farm sector than in the non-farm sector. Substituting (16) into (15), the equilibrium wage rate may be written in terms of A and B:

$$(17) \quad w = \mathbf{d}C^{d-1}(A^{1+a} B^{1-d})^{1/(1+ad)}.$$

We immediately see from (17) that the elasticity of the equilibrium wage rate with respect to farm productivity is always higher than that with respect to non-farm productivity (since $\mathbf{a} > 0$ for the assumed functional form). For more general functional forms for $u(\cdot)$, from what we have already argued, we would expect the difference between these elasticities to be higher (in favour of farm productivity) the lower is the cross-price elasticity, $\mathbf{h}_{x,p}$. This is because low cross-price elasticities facilitate the release of labour from the farm sector when the productivity in that sector increases, reinforcing the wage increase brought about by the productivity improvement. This prediction regarding the elasticities of farm employment with respect to farm and non-farm productivities is eminently testable.

Region as a Small Open Economy

We briefly consider the other polar extreme, where each region is deemed a small open economy. The prices of the outputs are assumed to be set at the all-India (or the world) level. From the point of view of a single region, the relative price of non-farm

output is assumed to be fixed at some level \bar{p} . We assume labour to be immobile across regions. While there is labour migration in reality, especially from some specific regions of India to others specific regions, at the country-level migration is small enough to render labour immobility a reasonably good working assumption.

The consumers' optimization problem is the same as that in the case of a closed economy; only the market determination of the relative price of the non-farm sector changes. For ease of comparative statics, we assume that the region does not completely specialize; that is, there are always operational farm and non-farm sectors—however small—within the region.² The equilibrium is easily nailed down: the equilibrating condition is that the value of the marginal product of labour must be equated between the farm and non-farm sectors. That is,

$$(18) \quad AF'(L_f) = \bar{p}B.$$

The comparative static derivatives of the equilibrium farm employment, $\hat{L}_f(A, B)$, are trivially determined. We record this for ease of subsequent reference:

Proposition 2: When the region is a small open economy within the country,

- (a) an increase in non-farm productivity decreases equilibrium farm employment,
- (b) an increase in farm productivity increases equilibrium farm employment.

Proof: Immediate, on totally differentiating (18) with respect to the productivity parameters and invoking strict concavity of the farm production function:

$$(a) \quad d\hat{L}_f(A, B)/dB < 0, \text{ and } (b) \quad d\hat{L}_f(A, B)/dA > 0.$$

Local consumer demand is irrelevant here since the region can import from and export to other regions in the country. Higher total factor productivity improves the region's comparative advantage (or reduces the comparative disadvantage) in that sector and more labour is absorbed into it as a result. The region will either export more of the good to other regions or import less of it.

Parts (a) of Propositions 1 and 2 are identical, that is, whether the region is a closed economy or a small open economy, an increase in non-farm productivity releases labour from agriculture. However, since the result in the case of a closed economy is ambiguous, parts (b) of the two propositions can be potentially different. [This result is somewhat reminiscent of Matsuyama (1992) though, because he employs Stone-Geary preferences, the effect of agricultural productivity increase in a closed economy is unambiguous in his case, as it is in Eswaran and Kotwal (1993).] This difference opens the door to possible empirical examination of which scenario is more appropriate as a description of the typical region. In particular, if the data show that regions with higher agricultural productivity employ less labour in the farm sector, all else constant, the presumption that the regions are small open economies would be directly refuted. This inference would be further corroborated if it is found that the elasticity of farm employment with respect to farm productivity is not only of the same sign but also greater in magnitude than that with respect to non-farm productivity. Such a finding, in addition, would provide circumstantial evidence that the cross-price elasticity $\mathbf{h}_{x,p}$ is small. For only then would the substitution effect associated with the relative price

² Theoretically, complete specialization can never occur in the non-farm sector because the marginal

increase of the non-farm product following farm productivity improvements be dominated by the income effect that induces agents to consume more non-farm output.

The comparative statics of the equilibrium wage rate with respect to the two productivities present a stark contrast:

Proposition 3: When the region is a small open economy, the equilibrium wage rate has

- (a) zero elasticity with respect to farm productivity, and
- (b) unitary elasticity with respect to non-farm productivity.

The proof of this proposition is apparent from condition (18). As long as the region has even a smallest of non-farm sectors, the value of the marginal product of labour is pinned down by this sector. If farm productivity increases, this sector absorbs more labour until the entire initial increase in the wage rate is dissipated: farm productivity increases have zero effect on the equilibrium wage rate. Non-farm productivity increases, on the other hand, increase the wage rate in proportion by drawing out labour from the farm sector. This sharp difference in the predicted effects of the two productivities on the wage rate arises from the fact that labour faces diminishing returns in the farm sector (due to a fixed factor) but not in the non-farm sector. We could introduce diminishing returns to labour even in the non-farm sector by, for example, incorporating capital as an input (in both sectors) and having capital be a fixed factor in the short run. In that case, both productivity increases would raise the wage rate—the outflow of labour from a sector to the one experiencing the productivity increase would

product of labour is unbounded when farm output is zero; complete specialization, if it ever occurs, can occur only in the farm sector.

raise the equilibrium value of the marginal product of labour (in both sectors). We would, however, expect the equilibrium wage rate to be more elastic with respect to non-farm than farm productivity as long as diminishing returns to labour is less constraining in the non-farm sector.

Before we turn to investigating the empirical reality in India, we collect the potentially testable empirical hypotheses drawn from the theory:

1. All else constant, farm productivity and farm employment should be positively correlated if the regions approximate open economies within the country but *could* be negatively correlated if the regions approximate closed economies. Lower farm employment in regions with greater agricultural productivity would provide strong evidence that regions are better treated as closed economies.
2. If the region is an open economy and there is incomplete specialization, the wage rate would have lower elasticity with respect to farm than non-farm productivity. (With complete specialization in the farm sector, productivity increase in the non-farm sector would, of course, have no effect of the equilibrium wage rate.)
3. If the region is a closed economy, the agricultural wage rate will be more elastic with respect to farm as opposed to non-farm productivity if the cross-price elasticity of the demand for farm output with respect to the non-farm output price is sufficiently low.

5. Cross-sectional Analysis: Empirical Model and Data

Irrespective of whether the economy is closed or open, the theoretical model can be reduced to two equations that determine wages and farm employment (using equations (5) and (9) if the economy is closed or equations (5) and (18) if the economy is open).

The exogenous variables in these reduced form equations would be the total factor productivities in the farm and non-farm sectors. The predictions of the earlier section could then be examined by estimating the reduced form equations for regions in rural India.

Data limitations, however, mean that such a relation cannot be estimated. The ideal data set would contain repeated observations on the dependent and independent variables for a number of years. As wages data are available only at five yearly intervals, we do not have sufficient observations at the all India level or at the state level. The difficulty is compounded by the absence of non-farm TFP data. Various estimates are available for the organized manufacturing sector but only at the state level (for example, Veeramani and Goldar (2004)). But this leaves out the unorganized manufacturing as well as the entire service sector. It is the service sector expansion that has contributed most to the growth of non-farm employment between 1983 and 1999. Therefore, restricting the measure of non-farm TFP to manufacturing is unlikely to capture the impact of non-farm TFP on non-farm employment and wages. The lack of relevant data means that econometric analysis cannot shed light on the relative importance of agricultural and non-agricultural TFP in explaining wage growth of agricultural labour. However, analysis can still test some of the key predictions of the theoretical framework.

To resolve the problem of insufficient observations, we estimate the regressions at the village level due to the two stage sampling design of the employment surveys where the village is the primary sampling unit and the households are sampled from the selected villages. For small geographical units, findings can be conclusive in only one direction. If the findings indicate that agricultural TFP plays a dominant role in driving wages, then

the result can only be stronger for larger geographical aggregates. However, if non-agricultural TFP is important in explaining wages, then this need not indicate a similar or stronger result for larger geographical aggregates because the economy could be closed at this level. The reduced form model can then be written as

$$(19) \quad f_v = \mathbf{b}_0 + \mathbf{b}_1 A_v + \mathbf{b}_2 B_v + \mathbf{b}_3 E_v + u_v$$

$$(20) \quad w_v = \mathbf{j}_0 + \mathbf{j}_1 A_v + \mathbf{j}_2 B_v + \mathbf{j}_3 E_v + \mathbf{e}_v$$

where v indexes the village, f and w are the log of farm employment and wages respectively, A and B are the log of total factor productivities in the farm and non-farm sector respectively, and E controls for differences in village endowments (population, irrigated land, cultivable land).

The agricultural wage and employment data is available from the all-India employment surveys of the National Sample Surveys Organization (NSSO), where households are the final sampling units and the survey reports the employment status of each member of the household. In this paper we use that part of the schedule where, for the reference period of a week, the survey elicits an individual's time disposition during each half-day of the week. This data takes into account multiple economic activities and employment states that are characteristic of poor households. Furthermore, as households are surveyed uniformly throughout the year, the aggregates derived from weekly data are representative of annual aggregates. The NSS surveys are conducted at 5-year intervals and the unit level data from 1983, 1987-88, 1993-94 and 1999-00 surveys are available.

For the reference period of a week and for each economic activity reported by an individual, the employment survey also reports the weekly earnings.³ A measure of daily earnings in the activity can be obtained by dividing the weekly earnings by the number of days worked in that particular activity. To control for cost of living differences across time and across states, wages have to be deflated. The Planning Commission uses the consumer price index for agricultural labourers and the consumer price index for urban manual workers to update its poverty line in nominal values. We use the deflator implicit in the Planning Commission poverty lines to deflate wages across time and states.

While the dependent variables of (19) and (20) can be obtained from the NSSO surveys, TFP estimates must be sought elsewhere. In the literature, estimates of farm TFP are available only at the state level (Fan, Hazell and Thorat, 1999). One exception is Kumar, Kumar and Mittal (2004) which contains estimates at the district level but they confine their exercise to states in the Indo-Gangetic belt. To overcome this limitation, we combine data on output and inputs from Bhalla and Singh (2001) with cost share information from the cost of cultivation surveys. While the data in Bhalla and Singh is at the district level, we construct TFP estimates at a higher level of aggregation. Over time districts have been subdivided and new districts formed. To ensure comparability across periods, Bhalla and Singh present their data according to the district boundaries in 1961. It is therefore not possible to disaggregate their data so that it maps to district definitions in the more recent NSS data. The sampling design of the NSS uses a larger geographical area called the NSS region. The NSS region consists typically of more than one district and its boundaries are usually those of its constituent districts. Since it is possible to

³ Earnings are not available for self-employed individuals.

aggregate the Bhalla and Singh data to the NSS region level in a consistent manner, we are able to construct farm TFP estimates at the NSS region level. However, this data set is confined to the crop sector and so are the cost shares from the cost of cultivation surveys. Another limitation is that the Bhalla and Singh data is not available for the period beyond 1993. Our analysis is therefore limited to 1983 and 1993-94.

The absence of non-farm TFP estimates has already been discussed. As estimates of non-farm output are available only at the state level, it would be beyond any researcher to obtain non-farm TFP measures at a lower level of geographical aggregation. However, state level estimates would probably suffice as non-farm TFP is unlikely to be as narrowly location specific as farm TFP. Economic policies, technology, and infrastructure (the primary determinants of non-farm TFP) are likely to be uniform across a well-defined political and administrative unit such as a state. If so, we could assume that non-farm TFP is invariant within a state and use state-specific fixed effects to control for non-farm TFP. This strategy allows us to consistently estimate the impact of farm TFP on the endogenous variables; however, it cannot give us the impacts of non-farm TFP. The version of (19) and (20) that is therefore estimated looks like the following.

$$(21) \quad f_{vrs} = \mathbf{b}_0 + \mathbf{b}_1 A_{rs} + \mathbf{b}_{2s} + \mathbf{b}_3 E_{vrs} + u_{vrs}$$

$$(22) \quad w_{vrs} = \mathbf{j}_0 + \mathbf{j}_1 A_{rs} + \mathbf{j}_{2s} + \mathbf{j}_3 E_{vrs} + \mathbf{e}_{vrs}$$

where the variables are now indexed by the level of geographical aggregation. For instance, while f_{vrs} is the log of farm employment in village v of NSS region r and state s , A_{rs} is the farm TFP in region r of state s . Note that \mathbf{b}_{2s} and \mathbf{j}_{2s} are state fixed effects and capture among other things the state specific non-farm TFP.

6. Cross-sectional Analysis: Findings

Our interest in the above regressions is the coefficient of farm TFP. In particular, we would like to check the theoretical predictions that in a small open economy, farm TFP has no impact on agricultural wages and that an increase in farm TFP leads to higher farm employment.

In the benchmark case, the dependent variables are the log of mean farm wage in the village and the log of the ratio of farm work days to all work days (farm + non-farm). We use the latter variable rather than farm work days to control for labor supply response to farm TFP. As farm TFP could have different impacts on males and females and also on different age cohorts within males we also consider variants where we vary the group of workers over which farm employment and wages are defined. Besides the distinction between male and female workers, we also consider three age cohorts within males – young males (aged between 18 and 33), middle aged males (between 34 and 49 years of age) and older males (between 50 and 66 years). The control variables are the ratio of village population to land, the proportion of cultivable land that is irrigated and dummy variables for the quarter in which the household was surveyed. Variables measuring the age composition and education profile of the village population were insignificant.

We first consider results from 1983 displayed in Table 1. The coefficient of farm TFP in the wage regression is positive and significant. The elasticity is around 0.5 for all the variants. For all workers, the elasticity of farm employment (normalized by total work days) to farm TFP is -0.28 and is highly significant. For sub-groups of females and young males, the impact is much larger. As can be seen, the only group of workers for

whom the impact of farm TFP is not well estimated are the older male workers. These results contradict the predictions about the impact of TFP in a small open economy.

Table 2 displays the results from the employment and TFP data for 1993/94. The coefficient of farm TFP in the wage regression remains positive and significant for all groups of workers. However, it is about half of the magnitude in 1983. Thus, while the result contradicts the extreme case of a small open economy, it also indicates a movement since 1983 towards a small open economy. This is confirmed by the employment regressions. The coefficient of farm TFP is positive but small and insignificant. Within the sub-groups, the picture is no longer uniform. While female employment is still negatively correlated with farm TFP (but the elasticity is less than half of what it was in 1983), the employment of young males is positively and significantly impacted by farm TFP.

Closed and small open economies, of course, are polar extremes. The econometric results suggest that villages are better thought of as intermediate between these extremes – as “large” open economies – while villages trade with the outside world, the prices they face are not independent of the volume of transactions. For villages that are not well connected to markets (because of distance, for example), an increase in farm output (due to higher productivity) might pose problems in marketing. As a result, farm produce prices depend on the local output even when part of it is traded. Our cross-sectional analysis above suggests that between 1983 and 1993, villages got more integrated with larger markets, as a result of which they moved closer to being a small open economy. Another striking result from the analysis is that the employment structure of middle aged and especially older males is less responsive to farm TFP.

A larger unit than the village is the NSS region. We could estimate the wage and employment regressions at the region level as well. As the data does not support the view that even villages are small open economies, one would expect that this is even more strongly contradicted at the region level. However, with only 57 regions and fixed effects for the 15 states, the regressions are not as well estimated. The sizeable impact of TFP on wages persists in the region-level regressions. The impacts on farm employment are, however, not significant.

7. A Counter-factual: The Role of the Non-Farm Sector

While the previous section is suggestive of the role of agricultural productivity, it does not pin down the contribution of non-farm economic growth to the rise in agricultural earnings. Ideally, we would have liked to construct a panel across the time period 1983-99 to check how much of the variation in wage increases over the period could be explained by productivity increases (TFP and inputs) in agriculture. But since we do not have data on agricultural production in 1999, we have no alternative but to think of a second best way to estimate the relative contribution of agricultural productivity increases to wage increases in agriculture. We will call this second best alternative ‘a counterfactual exercise’ to indicate the nature of the thought experiment involved in the process.

Figure 2 is a graphical representation of the counterfactual that we wish to consider. Here R_1 and w_1 denote, respectively, the agricultural labour-to-land ratio and the wage rate (read off the marginal product curve) in 1983. In 1999, the marginal product curve in agriculture shifts out, either because of greater use of other inputs or

because of an increase in total factor productivity. The new agricultural labour-to-land ratio and wage rate are denoted by R_2 and w_2 , respectively. In the counterfactual, suppose the non-farm sector didn't create any additional jobs during 1983-99, so that agriculture would have absorbed the additional employment that was created in reality by the non-farm sector. The agricultural labour-to-land ratio would have increased to R_2^H and agricultural wages dropped to w_2^H . The distance between w_2 and w_2^H is the part of the observed wage increase ($w_2 - w_1$) that is due to the non-farm sector. Note that this attributes the entire increase in non-farm employment to productivity increase in the non-farm sector. This is surely not the case as a rise in agricultural productivity leads to greater demand for non-farm goods and services and some part of non-farm employment is due to it. In this sense, the procedure adopted in the counterfactual overestimates the contribution of the non-farm sector and our estimate is an upper bound.

The first column of numbers in Table 3 presents the proportional change in agricultural employment if the non-farm sector had not created any jobs between 1983 and 1999.⁴ Note that there is considerable variation in the non-agricultural employment created between 1983 and 1999 across states. Leaving aside the case of Kerala which is an outlier (45% of total agricultural employment was created in the non-agricultural sector between 1983 and 1999), the range of variation is from 10% in Orissa to 30% in Punjab. It is noteworthy that the states that are well-known for having attracted

⁴ The proportional change in agricultural employment if the non-farm sector had not created any jobs between 1983 and 1999 is given by $\frac{\Delta NFEMP}{AGEMP + \Delta NFEMP}$, where $\Delta NFEMP$ is the change in non-farm employment between 1983 and 1999 and $AGEMP$ is agricultural employment in 1999.

relatively greater investment in the modern industrial sector (i.e., Gujarat, Haryana, Karnataka, Maharashtra and Tamilnadu) have created considerable employment in their non-farm sectors but no more than around 27%.

To take our thought experiment further, we need to be able to estimate how much lower the change in labour earnings in agriculture would have been had the non-farm sector created no additional jobs between 1983 and 1999. To answer this question, we assume that the agricultural output, Q , is given by a Cobb-Douglas production function:

$$Q = AL^d \prod_{i=1}^n X_i^{r_i} \quad \text{with } \mathbf{d} + \sum_i \mathbf{r}_i = 1,$$

where L denotes the amount of labor employed in agriculture, X_i denotes the i th input other than labor (such as land, fertilizers etc), and A denotes the total factor productivity.

Let the period subscripts 1 and 2 denote variables in the years 1983 and 1999, respectively. Denote by L_j, X_{ij}, A_j, w_j ($j = 1, 2$), the amount of agricultural labor used, input X_i used, the total factor productivity, and the agricultural wage, respectively, in period j . Taking the price of agricultural output as the numeraire, the wage rate in period 2 (given by the marginal product of labor) may be written

$$w_2 = \mathbf{d} A_2 L_2^{-(1-\mathbf{d})} \prod_{i=1}^n X_{i,2}^{r_i} = \mathbf{d} A_2 \prod_{i=1}^n (X_{i,2} / L_2)^{r_i}$$

Suppose l denotes the increase in non-farm employment over the 16 years under consideration. Assume that if the non-farm sector had not created this employment, the employment in agriculture in 1999 would have been higher by this amount. Let w_2^H denote the agricultural wage that would have prevailed in 1999 in this *hypothetical*

scenario. Assuming that all inputs other than labor would have been employed in this fictitious setting at the same level that they were in 1999, we may write

$$w_2^H = \mathbf{d}A_2 \prod_{i=1}^n (X_{i,2} / (L_2 + l))^{r_i} = \mathbf{d}A_2 \prod_{i=1}^n (X_{i,2} / L_2)^{r_i} (1 + l / L_2)^{-r_i} = w_2 \prod_{i=1}^n (1 + l / L_2)^{-r_i},$$

which may be rewritten

$$(29) \quad w_2^H = w_2 (1 + l / L_2)^{-\sum r_i} = w_2 (1 + l / L_2)^{-(1-d)}$$

The observed increase in wages over the 16 years is $w_2 - w_1$. This increase can be decomposed into that which would have obtained if the non-farm sector had not absorbed any additional employment and the increase that came about because of additional non-farm employment:

$$w_2 - w_1 = (w_2 - w_2^H) + (w_2^H - w_1).$$

The increase in wages that would have been observed in the hypothetical scenario, using (29), is given by

$$(30) \quad w_2 - w_2^H = w_2 [1 - (1 + l / L_2)^{-(1-d)}].$$

From (30), we obtain the proportional increase in the agricultural wage *attributable to non-farm employment* as:

$$(31) \quad (w_2 - w_2^H) / (w_2 - w_1) = (w_2 / (w_2 - w_1)) [1 - (1 + l / L_2)^{-(1-d)}].$$

This expression is couched entirely in terms of observable quantities and can be readily computed if we have an estimate of \mathbf{d} .

In competitive markets, \mathbf{d} is equal to the output share of labor. National account statistics do not provide data on the value of agricultural output. However, the value of principal crops and the value of livestock is available state-wise and we consider their

sum to be the value of output from agriculture.⁵ Agricultural employment and average daily wages in each state are computed from the NSS data. For rural areas the NSS data also contains details about the type of operations the individual was working in. To keep our estimates of agricultural employment and wages comparable with the value of output data, we excluded work in forestry, fisheries and activities other than cultivation. The share of labour in agriculture, then, is simply the ratio of the estimated wages paid out to labour to the value of output in agriculture. These labour shares are displayed as the third column in Table 3.

We evaluate the maximum possible increase in agricultural wages across all workers that could be attributed to non-farm sectoral growth using the labor shares appropriate for each state. This is done in Table 3. The second column of numbers presents the observed ratio of average agricultural wages in 1999 to that in 1983 for the 15 major states.⁶ (These 15 states accounted for 98% agricultural employment in 1999.) The all-India ratio (aggregate of 15 states) for agricultural earnings is shown at the bottom of the column. Between 1983 and 1999, at the all India level agricultural wages grew by 69%.

The fourth column of numbers in Table 3 shows the maximum projected proportional change in agricultural earnings that could possibly be attributed to the growth of the non-farm sector during 1983-99. It is computed using expression (31).

⁵ The data are collected from various issues of Value of Output from Agriculture and Livestock, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Govt. of India. The crops included are cereals, fruits and vegetables, total fibres, pulses, sugar, oilseeds, spices, total drugs and narcotics, total by-products, indigo and other crops.

⁶ Agricultural wages are approximated by average daily wages in agriculture. The daily time disposition block in the NSS employment rounds gives total weekly earnings and days worked in the week by activity. Average daily earnings are derived as the ratio of the two.

The fifth column shows the proportion of the observed increase that can be attributed to the non-farm sector. So, for example, in the state of Andhra Pradesh the non-farm sector was responsible for only 18.9% of the increase in real agricultural wages over the period 1983-99. Assam is the only state where real agricultural earnings were almost stagnant during this period. Without the growth of the non-farm sector in the state, agricultural earnings would have fallen. In the final two columns of Table 3, we present standard errors and the associated t-statistics for the contribution of the non-farm sector presented in the fifth column. These standard errors are obtained by a cluster bootstrap with a thousand replications.⁷ Other than for Assam, the contribution of the non-farm sector is precisely estimated.

Ignoring Assam, where the estimates are not precise, the maximum contribution of the non-farm sector varies from a low of 9% for Bihar to a high of 55% for Punjab. States where the contribution of the non-farm sector is greater than 30% are Haryana, Kerala, Punjab and West Bengal. Other than Gujarat, Maharashtra and UP, in all the other states the maximum impact of the non-farm sector is limited to less than 20% of the earnings increase. The 15-state average at the bottom of the second column is obtained by considering just the 15 states. Overall, therefore, growth in the non-farm sector could at the most have accounted for 23% of the increase in agricultural earnings between 1983 and 1999.

⁷ As noted earlier, the NSS surveys have a two stage design where clusters (villages in the rural sector and urban blocks in the urban sector) are sampled in the first stage and households from the selected clusters in the second stage. There are 10527 clusters in the 1983 survey and 8530 in the 1999 survey (in our sample of 15 states). The bootstrap draws 1000 samples of the clusters (with replacement) and the contribution of the non-farm sector is calculated for each sample. The standard error of this statistic is calculated from its distribution over all the samples.

In the above discussion, we have assumed that each state is a closed economy by which we mean that the relative price between the farm and non-farm goods in each state is determined completely by the demand and supply within the state. The assumption is supported by the results of Section 6, at least till 1993. One way to think about it is to think of the economy of a state as a ‘large’ open economy in a continuum situated between two extremes: one where the size of the outside economy that the state is trading with is negligibly small compared to the size of its own economy (closed), and the other where its own size is negligibly small compared to the size of the external economy with which it trades (open). As trading costs (including transportation costs) fall and a state starts trading with wider and wider regions, it moves from the closed economy end of the continuum towards the open economy end. Our assumption of a closed economy for a state should not be regarded as an assertion that there are no trade flows among Indian states but is tantamount to saying that Indian states are still close to the first end of the continuum. As trading costs have fallen all over the country, many states may have moved a little distance along the continuum. What does this mean for the relative contribution we have attributed to the productivity increase in non-farm sector?

As long as all states are close to the closed economy end, we can consider the different positions they occupy on the continuum as the extent to which the relative price of the non-farm good is different from the relative price that would obtain under a closed economy. In other words, what we have designated as the upper bound on the contribution of the productivity growth in the non-farm sector should be in fact regarded as the upper bound on the combined contribution of the contribution of the

productivity growth in the non-farm sector plus the changes in relative price of the non-farm good introduced by trade with the areas across the state borders. Viewed this way, it is noticeable that a lion's share of the increase in agricultural wages over the period 1983 -99 have resulted from an increase in agricultural productivity increase.

8. Conclusions

In this paper, we have attempted to assess the relative impacts of productivity growth in the farm and non-farm sectors on India's poverty (as proxied by the real wage). We set out a theoretical model consistent with Engel's Law and generate some theoretical predictions on the wage and labour allocation effects of productivity growth in the two sectors. Cross-sectional evidence from the 1983 and 1993 NSS rounds confirm the predicted effects of farm TFP differences. Because of severe data limitations, however, we are unable to identify the effects of non-farm TFP differences. To remedy this, we then conduct a counterfactual exercise to evaluate the relative contributions of the farm and non-farm sectors on the real wage increase in India between 1983 and 1999. We find that, at the all-India level, the non-farm sector's contribution is no greater than a quarter.

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Figure 1: Real (daily) Wages in Agriculture and Labour-Land Ratio

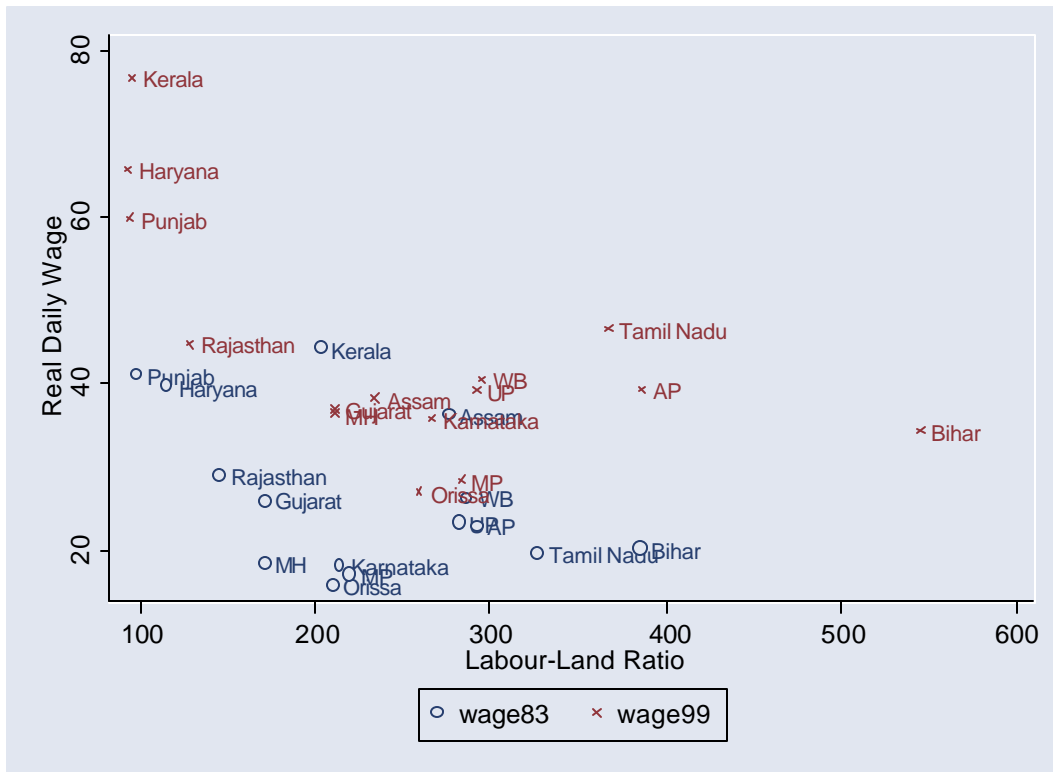


Table 1: Coefficient of log of farm TFP, 1983

Group of workers over which the dependent variable is defined	Dependent Variable					
	Log of Mean wages			Log of ratio of farm work days to total work days		
	N	Coefficient	p-value	N	Coefficient	p-value
All	5792	0.56	0	6778	-0.28	0
Males	5614	0.53	0	6778	-0.25	0.002
Females	3687	0.53	0	6778	-0.62	0
Young Males	4472	0.48	0	6778	-0.60	0
Middle Aged Males	3817	0.47	0	6778	-0.57	0
Older Males	2204	0.50	0	6778	-0.20	0.145

Control variables are the ratio of population to land in the village, the proportion of land irrigated and state fixed effects

Table 2: Coefficient of log of farm TFP, 1993

Group of workers over which the dependent variable is defined	Dependent Variable					
	Log of Mean wages			Log of ratio of farm work days to total work days		
	N	Coefficient	p-value	N	Coefficient	p-value
All	4969	0.26	0	5868	30.06	0.193
Males	4783	0.24	0	5868	0.10	0.035
Females	3143	0.16	0	5868	-0.23	0.006
Young Males	3704	0.18	0	5868	0.25	0.003
Middle Aged Males	3324	0.21	0	5868	0.09	0.308
Older Males	1959	0.20	0.002	5868	0.10	0.26

Control variables are the ratio of population to land in the village, the proportion of land irrigated and state fixed effects

Table 3: The Relative Contribution of the Non-farm Sector to Wage Increases

State	Proportional change in agricultural employment (hypothetical)	Proportional change in agricultural wages (actual)	Labour Share of output in 1999	Proportional change in agricultural wages due to non-farm sector	Proportional contribution of non-farm sector to change in agricultural wages	Standard Error by Bootstrap	t-statistic for the contribution of the non-farm sector
		$\frac{(w_2 - w_1)}{w_1}$	d	$\frac{(w_2 - w_2^H)}{w_1}$	$\frac{(w_2 - w_2^H)}{(w_2 - w_1)}$		
Andhra Pradesh	0.185	0.720	0.516	0.136	0.189	0.024	7.898
Assam	0.283	0.055	0.484	0.127	2.293	114.101	0.020
Bihar	0.118	0.691	0.670	0.061	0.089	0.018	4.895
Gujarat	0.213	0.420	0.568	0.114	0.270	0.066	4.127
Haryana	0.215	0.651	0.321	0.205	0.315	0.156	2.022
Karnataka	0.148	0.966	0.426	0.149	0.155	0.034	4.544
Kerala	0.445	0.732	0.397	0.345	0.471	0.045	10.575
Madhya Pradesh	0.106	0.656	0.473	0.086	0.131	0.026	5.007
Maharashtra	0.265	0.961	0.426	0.248	0.258	0.037	6.912
Orissa	0.100	0.699	0.479	0.082	0.118	0.044	2.687
Punjab	0.300	0.458	0.269	0.255	0.556	0.096	5.791
Rajasthan	0.188	0.541	0.602	0.102	0.189	0.065	2.924
Tamilnadu	0.271	1.364	0.574	0.230	0.169	0.025	6.671
Uttar Pradesh	0.202	0.684	0.502	0.148	0.216	0.028	7.673
West Bengal	0.244	0.537	0.323	0.212	0.394	0.075	5.224
All India (15 States)	0.198	0.685	0.461	0.156	0.228	0.010	21.935

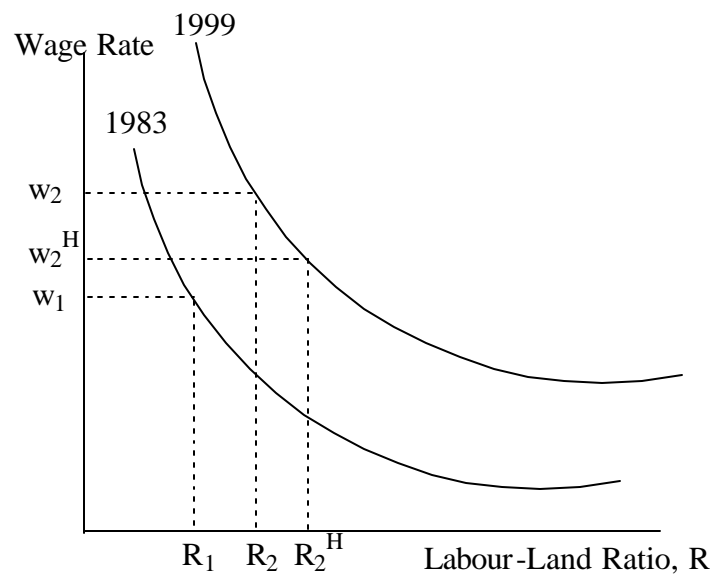


Figure 2