THE IMPACT OF MODERN TECH OLOGY ON RURAL FACTOR MARI ETS

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THE IMPACT OF MODERN TECHNOLOGY ON RURAL FACTOR MARKETS

DOCTOR OF PHILOSOPHY IN ECONOMICS

By

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CERTIFICATE

This is to certify that the thesis " The Impact of Modern Technology On Rural Factor Markets" submitted for the award of the Degree of Doctor of Philosophy in Economics, to the University of Dhaka is a record of bonafide research carried out by Mahbubul Mokaddem, under our supervision.

No part of the thesis has been submitted for any degree. diploma, title or recognition before.

He is permitted to submit the thesis.

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DECLARATION

I, Mahbubul Mokaddem, Associate Professor, Department of Economics, Dhaka University, Dhaka do hereby declare that the thesis "The Impact of Modern technology on Rural Factor Markets in Bangladesh" has not been submitted by me for the award of degree, diploma, title or recognition before.

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April, 1999.

(Mahbubul Mokaddem)

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Mahbubul Mokaddem

April, 1999. (Mahbubul Mokaddem)

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A very long summary

SUMMARY AND CONCLUSIONS

why not replace it with 2-3 page abstract which will summarize the main findings and conclusions

i. Aim of the Thesis

superfluous statement

The title of the thesis itself speaks about the aim of this thesis. However, it would still not be superfluous to make the precise meaning of the technical terms used in the title clear since they have different meanings in different contexts. BIO-CHEMICAL technology consisting of a package of high yielding seeds, water and chemical fertiliser, as we all know, in the case of rice, was originally invented in the 1960s by I.R.R.I. Since then during the last thirty five years of it's life, It has taken many names in many places, for example, H.Y.V. technology, Modern technology, Seed-Fertilizer technology, I.R.R.I. technology, etc. In the 60's when I.R.R.I. had first invented this technology, it's higher yielding capacity had become the main focus, hence the popular name H.Y.V. was assigned to it everywhere. However with time the focus of rice research has changed. Now-a-days the I.R.R.I. scientists are trying to invent a variety which may not be necessarily higher yielding, but may contain other favourable characteristics such as ability to resist not only diseases but also to bear sun and water stress. Thus I.R.R.I. scientists now a days prefer to call their technology M.V. technology or simply Modern Technology. [IRRI,1978] However, in this thesis, we have used all these names interchangeably (Bio-Chemical, H.Y.V., M.V., and Modern Technology) with a greater preference for the last two names.

does not appear in the title

write HYV and follow consistently

IRRI

MV follow consistently

Another technical term "Factor Markets" is used in this thesis in a more restricted manner. Obviously labour and land are two original factors of production and markets

f m

for them must be included in the definition of "Factor Markets". But besides these two original factors there are other produced means of production such as chemical. biological, mechanical inputs which are collectively called as "Capital" and their markets also should be included in the definition of factor market too. But in that case the number of markets to be studied would become too many and truly speaking it would become beyond the scope of one single PHD thesis. Thus instead of taking each of these input markets separately, the term "Factor Market" in this thesis will cover only one market and that is the rural credit market as an approximate substitute of all these several "Capital goods Markets". Thus in this thesis the "Rural Factor Markets" actually will cover rural "Labour Market", "Land Market" and "Credit Market".

The simple broad aim of this thesis is to trace the direct and indirect effects of the MV technology on these factor markets in the rural areas.

The literature review on adoption, diffusion and socio-economic interaction between the new technology and the rural societies presented in the chapter two of this thesis (which is a multi-dimensional process and is popularly known as the Green Revolution) reveals that there exist mutually conflicting views regarding the socio-economic consequences of this new technology based agricultural development(or G.R.) in the less developed countries : one is favourable and optimistic about the long run consequences of this MV technology, another is relatively more unfavourable and pessimistic.

→ extremely prolix

who are the technology optimists?
and who are the technology ~~pessists~~ pessimists?
who are in the middle? Can you cite some names.

Besides the above two extreme standpoints, there is another third group of authors who have a more balanced but inconclusive attitude towards the process of G.R. According to them the possibilities and consequences of the G.R. strategy can't be judged on an a-priori ground, since they will largely depend on the initial conditions and the overall state policy environment within which the process of G.R. has to unfold itself. This is an apparently a reasonable standpoint free from both the extremes of "technological optimism" and "radical pessimism". But like all middle approaches ~~it~~ it begs immediately answers to at-least two questions:

1) What are the initial conditions and the policy variables that influence the overall <u>final outcome</u> of the adoption of the M.V. technology?[1]

2) How do they affect the <u>final outcome</u> in terms of some chosen criteria e.g., growth, equity and the changing social balance of power through the mediation of the interdependent factor and product markets.

The inter-temporal and inter-spatial variation in the initial conditions and policy regimes pertaining to M.V. cultivation is so divergent that the same one or several aspects of the M.V. technology may result in completely opposite outcomes depending upon the specific context. This simple truth was overlooked by many analysts belonging to the two extreme groups of evaluators of G.R. and this was perhaps the root cause of such a prolonged quarrel between them. One group actually failed to appreciate the intrinsic positive features of the M.V. technology by overemphasizing the socio-economic

[1] By "final outcome" we mean the long run equilibrium situation that is attainable or attained after the adoption of the new technology.[Schultz 1975.]

constraints while the other group also failed to understand the deep significance of these constraints by overemphasizing the intrinsic positive aspects of the technology.

Thus, the **central focus of this thesis** will be to reconcile the two conflicting views on MV-Technology/Green Revolution by reexamining some old areas of controversy .

The **specific objectives** will be:

a) Examining the differential patterns of adoption across classes and regions.

b) Examining the different patterns of factor market adjustments in the post adoption phase.

c) Examining the implications of the rural factor market adjustments for the relative inequality across classes.

It is hoped that an in-depth examination of the above processes may unearth the real deeper issues and help to bridge the conflicting views on the nature and consequences of the Green Revolution/Mv-Technology. To this end, specific areas have been selected from the general review of literature covering both theory and facts, different regions and times, etc, to generate sufficient number of testable hypotheses. These focus areas for generating relevant testable hypotheses are: **adoption and diffusion of MV, labour market, mechanization , land market and credit market.**

ii. <u>Hypotheses</u>

The Literature review in the field of **adoption and diffusion** of the new technology revealed some unresolved issues or hypotheses. Among them a few testable hypotheses from both sides were chosen:

1) Because of regional adoption bias of M.V. technology it will enhance regional inequality.[2]

2) In areas with higher subsistence pressure the adoption of M.V. is likely to be quicker and larger. (Optimist View)

3) Small farmers with a relatively higher subsistence pressure will generally have a higher rate of adoption as well as higher productivity of land. (Optimist View)

4) In most areas as time passes on, M.V. adoption will tend to become universal across classes. (Optimist View)

The Literature Review on the operation of the **labour market** in the post adoption phase also reveals several mutually contending opinions. Formulated as a set of testable hypotheses they are:

5) M.V. increases labour use per unit of land and M.V.adopting large farmers meet that requirement by mainly hiring labour from the labour market. But small farmers meet it by withdrawing labour supply from other less important areas and due to an increase in their income their total supply of labour may also decrease. (Optimist View)

6) As a result of M.V. expansion, labour supply will decrease because of the withdrawal of the small farmers from the labour market but labour demand will increase on the part of the large adopter farmers, hence wage rate of hired labour generally increases. (Optimist View)

7) If MV expansion is not uniform or regional concentration exists then the wage rate in the technologically developed region may not increase as much due to flow

[2]However regional gap in income will partly be mitigated by adjustments in the inter-regional labour markets and cropping patterns.

of migrant labour from non prosperous are: the prosperous area. (Indirectly Optimist View)

8) Due to tightening of the labour market ion the big farmers who generally also have a relatively increased barg ıg power will try to manipulate the various terms and conditions (e.g. in cking, piece rate, contract system, etc.) of payment for the employed labo and may successfully prevent the landless workers from maximizing their g from the new technology. (Pessimist View)

9) M.V. induced increase in the s ly of food grain has kept the food grain price depressed and the low price c ood grain has helped the poor classes relatively more and indirectly has co uted to make the real income distribution more equitable. Especially it has ped to improve the food entitlement of the landless labour by improving the ınal wage/rice price ratio in the long run. (Optimist View)

Literature Review in the of **mechanization** reveals the following issues worth investigation:

10) Mechanization ostitution of labour with machine generally does not take place due to . induced wage increase or alternatively in a labour surplus economy M nnology alone is not sufficiently strong to start a process of so called "in mechanization" (Optimist View)

11) Mechan if it takes place at all, then mostly takes place due to any one or combi of the following other causes: historical presence of an entre rial class of farmers long before the advent of MV, managerial cor on the part of the large farmers, to release the time constraint against

more intensive cultivation, government manipulated low price of mechanical equipments and cheap credit offered by the government to buy mechanical equipments and some other technical problems associated with the particular cropping pattern or soil condition of the locality. (Optimist View)

12) The overall impact of premature mechanization on wage rate and labour use will be negative in a labour surplus area. But in the case of naturally necessary mechanization preceded by a shortage in the labour market, the overall impact on wage and employment will be positive. Even in the short run the impact on the employment of hired labour and their wages are likely to be positive. Indirect backward and forward linkage effects will also create new employments. (Optimist View)

Literature Review in the field of **land market** reveals the following hypothesis:

13) In general due to their resource advantage and market power, the large farmers will out compete the small farmers in the production of MV crops and the logic of capitalist polarization is bound to set in. (Pessimist View)

14) Large farmers are likely to be the earliest risk takers and therefore may reap some transitory "Schumpeterian Profit" from an early adoption of the new technology when the cost of inputs are more likely to be cheaper and the price of output more handsome! Therefore the large farmers will later use a part of this innovation rent to buy off the uneconomic holdings of the non-adopting small farms. Which will ultimately lead to increased inequality in the ownership of land. (Pessimist View)

15) The share cropping arrangements along with the semi-feudal character of the landlord-tenant relationship will prevent further innovation and expansion of MV

technology in the leased in land by the tenant.(Pessimist View) In contrast to this another alternative hypothesis is that the tenurial terms and conditions will adjust and new institutions will emerge to give way to further technological progress even by the poor tenant. (Optimist View)

16) Mechanization in the wake of MV expansion particularly by large farms may lead to the eviction of tenants and also there may increase inverse tenancy i.e. leasing out by the small to the large (Pessimist View)

17) In the land market of the technologically more mature areas, the small and the poor will participate more as sellers of land whereas the large farmers will play the role of buyers. (Pessimist View)

18) In the post adoption phase small farmers are more likely to mortgage-out their land due to their resource inadequacy. (Pessimist View)

Finally the review of literature on **Credit Market** reveals the following hypotheses:

19) The small and the poor farmers in the MV regions not only lack resources but also do not have access to formal credit institutions to surmount this problem. (Pessimist View)

20) The small and the poor in general depends more on the non formal credit institutions for credit where again the terms and conditions of loan is relatively more harsh. (Pessimist View)

Although the aggregate growth and equity effect of M.V. will depend upon not only these above mentioned series of events but also on a host of other co-events(Linkage Effects, Initial Distribution of Resources, Socio-Political Environment, State Policies, etc.) yet resolving at least the above issues or hypotheses, may give us a strong basis to find out the relative merits of the two conflicting views on G.R. field.

iii. Methodology

From the review of the empirical findings on G.R. in South Asia it becomes clear that most of the early studies on G.R. had been very harsh and critical about it's potential negative future consequences. But the more recent studies, in general show a more pragmatic attitude towards the G.R. The different empirical findings of these new studies today call for a fresh study of G.R. to re-scrutinize the earlier findings. This requires preferably a longitudinal set of data covering the old and the recent years as well. Thus whatever hypotheses we test we should try to test it dynamically or at least at two different points of time: one at an early stage of the G.R. and another at a more mature stage of G.R.

So far we observe in the literature mainly three different approaches towards the study of relative gain from the M.V. technology across classes and regions [Lipton and Longhurst, 1989].

1. Adding up of partial equilibrium results,
2. General Equilibrium Approach and
3. Political economy approach.

Each of the above approaches has been described and critically reviewed by Lipton and Longhurst [Ibid. 1989]. A careful reading of Lipton, shows that the general equilibrium approach and the political economy approach may supplement each other and also overcome the limitations of short run single round impact studies. These two approaches to the study may pave way to a more accurate and holistic assessments of the overall long run impacts of M.V. technology on the distribution of income, assets and rural power in the rural areas of the developing countries. Although Lipton et. al. in their review of these approaches did not make such a choice explicit. yet it follows from their discussion that the best approach to asses the M.V. impact on the distribution of income. asset and power would be the combination of the second and the third approaches i. e. general equilibrium approach supplemented by political economy.

The most common method of studying technological impact is to choose two sample areas of which one has a considerable progress in the adoption of the technology and the other has none or lags far behind. Then the relevant impact indicators for the two areas are compared to find out the significant differences that may be attributed to the technology factor. This method is very simple and already a few studies have been done in Bangladesh by using this method.[Hossain.1988 and Hossain. Quasem. Mokaddem and Jabbar. 1991] However the most common limitation of this type of studies is the lack of a proper control.These studies assume that the two areas compared differ only with respect to their technological development level. But this is rarely true. Hence other factors may come into play and modify the original consequences of the MV. technology in the relevant areas.

This is indeed a familiar problem and is termed as "lack of proper control". Generally researchers try to solve this problems by focusing on " Before-After" comparison of the same area. Since before-after type of survey is based on the dynamic longitudinal data for the same area. so the problem of proper control becomes partly solved. The another utility of such dynamic longitudinal data is it's superior ability to address the questions regarding "dynamic tendencies" of the relevant variables. In our context a dynamic longitudinal data set can enlarge the scope of empirical analysis and provide answers to the following set of non traditional but relevant questions:

1)What happens to inter-regional adoption disparity? Does the gap increase, decrease or remain constant over time?

2) As time passes on, what happens to the inter-regional wage gap and land price gap?

3) What type of factor market adjustments take place in :

   a) region which remains static at a high level of MV technology for a long time.

   b) region which remains static at a low level of MV technology for a long time.

4) What happens to the distribution of income and wealth of a village when it climbs up through the ladder of MV. adoption?

5) Are the so called "positive impacts" (e.g. reduced absolute poverty, increased real wage and/or employment, increased productivity, increased cropping intensity, increased marketable surplus, lower incidence of distress sales, increased incidence of efficient tenancy, etc.) of MV technology real and sustainable over time?

6) If these "positive impacts" are not sustainable, then which factors or what new changes were responsible for offsetting them?

7) Are those factors or changes intrinsically connected with the MV. technology or arises from exogenous sources?

Since the present thesis also aims, as far as possible, to find out answers to the special set of questions mentioned above so traditional cross-section data covering one MV. area and another non MV. area will prove to be inadequate. We shall need an appropriate type of longitudinal survey data.

Fortunately at the beginning of this study we had with us a primary base-line survey data on the impact of MV. technology for 62 randomly selected villages of Bangladesh. That data referred to crops grown in 1987. This survey was carried out jointly by Bangladesh Development Institute (BIDS.) and the Bangladesh Rice Research Institute(BRRI.) It was financed by IRRI. under it's cross country "Differential Impact Study" project.

A multi stage random sampling method was used to select 62 sample villages for the study. Prior to an in-depth survey at household level, a census of households residing in all these 62 villages was conducted to gather data on the size of the household. ownership and the utilization of land, major sources of income , the type of housing, the age and educational status of the head of the household. The households were then classified into four landownership groups (1) functionally landless i.e. having less than 0.2 hectares, (2) small owner,i.e. having 0.2 to 1.0 ha., (3) medium owner, i.e. having 1.0 to 2.0 ha., (4) large owner i.e. having 2.0 ha. or more. Each of the landownership groups was again classified into two groups according to whether the household is engaged in tenancy cultivation or not. After that 20 households were selected out of these 8 strata using the proportionate random sampling technique from each village . In a few village the sample size was 21 because of rounding error. The total size of the sample so selected was 1245 households, who were then subjected to in-depth questionnaire survey. We have used this benchmark study to generate panel data. We administered a new census of all households in each of the five purposively selected villages for the year 1992-93.[3] In this way we hoped to generate panel data for the 100 DIS households from the five selected villages at least for two different periods with a four year gap between them. But after the actual second survey we could re-identify only 16 households out of the old 20 from the village of Darikamari, 13 out of the old 21 from the village of Patardia, 14 out of old 20 from the village of Baikunthapur, 17 out of old 20 from the village of Shankarpasha and 16 out of the old 19 from the village of Mailmara. In all we could re-identify seventy six old households out of the old set of hundred belonging to the old DIS sample of the selected five villages. Thus we were able to generate longitudinal panel data for at least seventy six households from our five different selected villages. The panel size of each village is very small indeed. But we could not help it because we were constrained by the small number of the selected villages as well as by the fixed sample size of the previous survey of each of these villages under DIS. But we hope that they will still be helpful in tracing the significant changes over time at household level. And also, whenever possible, we can supplement our panel findings with that from our village censuses. Our village censuses had covered respectively 181 households from Darikamari, 131 households from Patardia, 120 households from Baikunthapur, 269 households from Shankarpasha and 149 households from Mailmara. Thus altogether we covered 850 households, which as a study sample is not at all small by any standard. Even when the villages are divided into two broad groups such as technologically developed and technologically non developed, the respective sample sizes

[3] The selection criteria for these villages have been discussed in detail in the third chapter of this thesis.

remain large enough (432 for the two MV. villages and 418 for the three non MV. villages).[4]

No doubt that it would have been best if we could resurvey all the 62 DIS villages and generate a panel of 1245 households for our study. But financial constraint did not allow such a venture by an individual Ph.D. researcher. DIS researchers previously tried to characterize the production environments of all the 62 villages, they had surveyed. Their exercise led them to identify broadly five types of production environments. They are -:

1) IRRIGATED VILLAGES.

2) DROUGHT-PRONE VILLAGES.

3) FLOOD-PRONE VILLAGES.

4) SALINE AFFECTED COASTAL VILLAGES.

5) FAVOURABLE RAINFED VILLAGES.

The exact definition of these production environments are presented in the third chapter of this thesis. It would be interesting to see how our selected villages are placed in the above classification scheme and whether there exists significant correlation between these production environments and their corresponding extent of MV cultivation. Analysis of data presented in the chapter three shows that the extent of MV cultivation was in general higher in the dry season for all the villages in our sample. It also shows that the extent of MV cultivation varied widely among the sample villages in 1987-88. These findings also denote that in terms of the level of technological development there actually exists different types of villages in our sample. The first two villages (Darikamari and

[4]The definition of MV and non MV villages are discussed in detail in the third chapter of this thesis.

Patardia). in spite of their wide intra-household disparity in MV adoption can be distinctly separated from the remaining three villages as relatively "High MV" villages. On the other hand two other remaining villages (Shankarpasha and Mailmara) can safely be put under the "Low MV" category of villages on the basis of the 1987-88 data. The last remaining village Baikunthapur, has an in-between medium level of MV cultivation. And these variations in the degree of MV cultivation also correspond with their respective production environments! In our sample **Patardia** and **Darikamari** are the two irrigated villages and they also have very high levels of MV cultivation in both periods. On the other hand **Baikunthapur** is a draught prone area and did experience limited growth of MV production over the study period. **Shankarpasha** is a flood prone village and as expected has no MV cultivation in the wet season. But in the dry season it did experience a tremendous expansion of MV and irrigation over the study period i.e. from 1987 to 1992. The last village in our sample **Mailmara** is a Saline prone village and also did not experience any progress from it's nearly nil MV cultivation over the study period.

This unique set of data gives us an extra-ordinary privilege to verify most of our hypotheses against both panel level dynamic findings and also to compare them with the usual static cross section comparisons.

iv. <u>Findings</u> This materials that follows is the same as the last chapter. So my comments on the last chapter

[A] Before presenting the findings from our survey data we presented the findings from the currently available empirical studies on G.R in South Asia in chapter two of this thesis. The literature on Green Revolution is voluminous. We chose sixteen from amongst them to determine the common empirical findings on the selected issues and hypotheses. All these studies were focused on the Subcontinent i. e. India, Pakistan and Bangladesh.

All these countries have undergone the process of Green Revolution during in and around 1960's and by now that process has reached a crucial juncture everywhere. Further progress has become more constrained and more difficult. So the time has been ripe for a comprehensive evaluation of past experiences in Green Revolution in these countries. There is observed a wide divergence in the opinions or/and findings on the same aspect of the same country from author to author. This is so because either the time or place of the different studies were not exactly same or sometimes the interpretation of the same data of the same country was done differently by different authors. Let me put those conflicting findings in brief:

1) In Table:2.1 we presented the findings on the "Inter-Regional Adoption Disparity" of eleven different authors. Of them five were selected from India and three each from Pakistan and Bangladesh. From the findings of these studies it is clear that everybody agrees that there has been a significant regional adoption bias in the process of G.R. in all these three countries. But the authors do not agree among themselves regarding the true explanation of this common phenomenon. It is difficult to validate any specific hypothesis from these conflicting findings. However, most of the later period studies revealed that the adoption disparity was decreasing over time. Moreover in some cases regional agricultural productivity and income gap between M.V. and non M.V. areas were also narrowing down. Unequal regional water endowment seems to be the only commonly agreed ground which can cause significant regional disparity in the adoption of MV. But whether that can persist for a long time or the final significance of that in terms of regional income disparity remains controversial.

2) Table 2.2 refers to the empirical evidences on Intra-Regional adoption Disparity. In total twelve studies were examined of which six were from India and three each from both Pakistan and Bangladesh. The general findings from these studies show that on the basis of a traditional definition of adoption (i.e. the percentage of land devoted to MV cultivation), the so called pro-rich bias of M.V. technology has either become invalid or turning invalid quickly in all these countries. However the definition of "Adoption" varies and the conclusion largely depends on the definition used. Two other definitions used as the proxy indicator of "Adoption" were numerical ratio of adopters and the complex index of participation. The number of studies which have used these definitions are few and they do not reveal any systematic bias in the MV technology.

3) Table 2.3 refers to evidences on Mechanization and Employment effects of G.R. All the studies reviewed, in general point out to the crucial role of the non agricultural sector in determining the nature and consequences of agricultural mechanization. "Induced Mechanization" hypothesis in it's crude form is also rejected by most of the authors and in case of a labour abundant country like Bangladesh it seems highly improbable. In case of Pakistan politically induced mechanization was observed although it's actual consequences remains controversial.

4) Table 2.4 refers to price effects of M.V. technology. Most of the studies suggest that "price of foodgrain" is a highly sensitive politico-economic variable. It's movement therefore can't be determined alone by the economic and technological forces.

5) Table 2.5 presents the evidences regarding the most controversial issue of the G.R. i. e. the issue of Distributive Impact. From all the conflicting findings the little consensus that emerges is that M.V. can at best have a reducing impact on absolute poverty but that may or may not sustain in the long run. depending upon other accompanying conditions.

From this brief review of the empirical findings on G.R. in South Asia it becomes clear that most of the early studies on G.R. had been very harsh and critical about it's potential negative future consequences. But the more recent studies, as argued earlier . in general show a more pragmatic attitude towards the G.R. The different empirical findings of these new studies today call for a fresh study of G.R. to re-scrutinize the earlier findings. This requires preferably a longitudinal set of data covering the old and the recent years as well.

[B] Let me now present the findings from our both village level survey and the longitudinal panel data:

1) Our village and panel level longitudinal data both together reveal that the dry season adoption intensity gap between the rainfed villages and the irrigated villages has ~~been waning away with~~ waned over time. But the adoption intensity gap during the wet season between the two irrigated villages and the two non-irrigated villages has been increasing over time. However, the across region average rice yield gap in the wet season was decreasing in spite of the increase in the inter-regional adoption intensity. Thus the net effect of the increase in the wet season adoption intensity gap were also partly offset by the partial reduction in the average rice yield gap during the same season. The macro evidences on the trend

of coefficient of variation in the inter-district adoption intensity also shows a declining trend over time for at least the dry season.

2) Our data also shows that the socio-economic factors symbolized by the land-ownership and tenurial status have very little influence on the propensity or the intensity of adoption among the different classes of farmers in a village at least in the dry season which is also the main season of adoption in Bangladesh. By and large they are determined by the technical factor of irrigation and the natural environmental factors.

3) But in the wet season there is in general a low level of adoption in Bangladesh ,
a fact that reflects
an~~d that is mainly due to~~ the high risk arising from the uncertainty of rainfall and flood in that season. And this uncertainty coupled with lower risk bearing capacity of the pure tenants, small landowners and other poor or weaker sections may cause a relatively higher socio-economic disparity in adoption propensity and intensity during the wet season.

4) Analysis of data on **labour market** reveals the following interesting findings:

   a) In general MV technology increases the productivity of agricultural labourers and thereby increases the demand for labour directly in the agricultural operations.

   b) It also has positive forward and backward linkage effect on employment creation.

   c) This increased demand for labour is partly met by casual labour supply by small farmers.

d) A significant part of the increased demand in the more prosperous areas is also met by professional agricultural labour from the locality and also by migrant labour supply.

e) The incidence of contractual labour and piece rate also increases in the more prosperous MV areas for special operations.

f) In general these changes tighten the labour market for the employers and increases the bargaining strength of the labour power sellers.

g) The institutional changes like switching to permanent labour or interlocked labour transaction on the part of the employers in response to the tighter situation in the labour market is not found to be a common practice in Bangladesh.

h) However migrant labour inflow from more backward areas to more developed areas somehow slackens the tightness of the labour market and helps the employers of the prosperous areas to limit the increase of the wage rate. But from another point of view it implies a positive spill over effect of MV technology for the labourers of the non MV areas!

i) In Bangladesh it seems to be generally true that wage increase is likely to lag far behind rice price increase and conversely employers are unlikely to pay lower nominal wage if the rice price falls. In this situation MV technology has an added income benefit for the poor through inducing a fall in the rice price or at least restraining it's increase.

5) Following are the major findings from the analysis of mainly secondary data on

Mechanization:

a) MV technology has not induced mechanization in Bangladesh.

HH is an unusual abbreviation for household. Also note that ~~is~~ this "shortening" is improper as household is a single word.

b) The labour displacing effect of limited mechanization was in general small enough to be offset by the effect of increase in cropping intensity.

c) Mechanization in some places may lead to eviction and further concentration of land in the hands of the few. But this can not be attributed to the MV technology even indirectly since none of the direct causes of the limited mechanization in Bangladesh were directly influenced by MV.[5]

6) Following are the major findings from the analysis of data on **Land Market:**

a) The relative importance of tenancy measured in terms of numerical proportion of the tenant HHs is slightly higher in the non MV villages but in terms of the proportion of operational land under tenancy, MV villages come first. Thus less numerous tenants were cultivating more amount of land in the MV areas as compared to the non MV areas.

b) The relative importance of tenancy in terms of both number and amount of leased land was increasing among the panel HHs from the MV region, while the same was decreasing at a much faster rate among the non MV panel HHs.

c) There was a shift from traditional sharecropping to fixed rent arrangements in the MV villages.

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[5]One may argue that MV technology by increasing the income of the large farmers may increase their leisure preference and thus indirectly push them further towards mechanization. Although the second part of the argument is true, but the first is not since large farmers have resorted to mechanization in spite of less MV while the small did not mechanize in spite of high MV.

d) The Tenurial arrangement were not of semi-feudal character in the MV villages and in one non MV village although it was semi-feudal by nature but it could not prevent technological progress.

e) In general the data from sample villages show that resource complementarity may be the most important determinant of the leasing decisions. Thus with a relatively surplus self cultivated land the HH refrains from leasing in while the HH with surplus labour and livestock is encouraged to lease in.

f) The socio-economic profiles of sellers of land, buyers of land and mortgaging households (in or out) prove that there was no systematic tendency of transfer of land from poor to rich in the sample villages. The transactions actually took place among the small farmers themselves in the case of MV villages. On the other hand in the non MV villages these transactions were confined among the members of the richer classes from both sellers and buyers sides.

7) Following are the major findings from a very brief analysis of the data on **credit market**.

a) Majority of the borrowers from both MV and non MV villages had the opportunity to get access to the credit from the formal sources even in the non MV villages.

b) The small farmers were not in a relatively disadvantageous position with respect to access to the formal sources of credit. If any relative disadvantage they have, they have it with respect to the informal credit market.

c) In general the average size of the loans for the adopters was higher than that of non adopters.

d) It is more than clear that the access to formal credit both in terms of number of loans and size of credit were at least not rich biased in the formal credit market. If the credit has any bias at all then it was for the adopter HHs irrespective of their land ownership status.

v. Conclusions

The findings from our own survey in general goes in favour of a more liberal view of the impact of MV technology in the rural factor markets. The favourable mechanism of MV induced growth in the rural areas can be depicted as follows:
First of all the previous and the current study disproves the old hypothesis of regional and intra-region class disparity in the adoption and diffusion of this technology. Thus whatever benefit is arising from the application of this technology in the rural areas, it will not be confined among the richer sections alone! Regional bias will also be decreasing overtime unless there are very obvious natural constraints such as salinity, draught, flood, etc.

Secondly , because of it's intrinsic labour intensive nature MV creates a tighter condition in the labour market and puts an upward pressure on the wage rate in the rural labour market. If mechanization or offsetting population growth or negative policy interventions are not there then the real wage of the agricultural wage labour may increase.

This real wage increase in the rural areas is further reinforced if there is a downward pressure on the rice market via increase in the supply of rice as a result of the adoption of the MV technology. If there is also a positive linkage effect of agricultural growth on the non farm employment then this above mentioned tendency will be reinforced further through expansion of employment opportunity in the rural areas. Low rice price actually will benefit the poorer classes relatively more since they are the major consumers of rice. And with a higher nominal wage and a low or stable or slowly growing rice price, the food entitlement of the poor wage earners is bound to grow. However, it is true that the landless do not have land to adopt MV technology. And if they live in the remote non MV villages then the indirect effects may not reach them at all. But now a days the availability of credit and the comparative advantage of those landless households who have surplus stock of labour and animal power enable them to get land from the tenancy market. Tenancy in the MV areas are by no means any longer semi-feudal by nature. And land is generally going to those who can use this scarce resource most effectively. Tenancy arrangements shifting from share cropping to fixed rent system are creating opportunities for better use of this land. And since land goes from big to small in general, so it has a general equalizing effect too. Even in villages where large owners of land predominate tenancy does not act as a barrier against technological innovation.

Finally, with an increased staying power of the poor due to rising income from the rural labour market, better access to credits, adoption of a more productive technology and a more optimum use of their resources through the adjusted operation of the land market, the process of polarization in the land-ownership is checked. if not halted. Absolute poverty declines, if not the relative poverty! But this grand elegant story what is that ?

also has it's own pitfalls. It can unfold itself completely only under a favourable initial condition and only in the long run. Any short run view and focus on a particular area where there is unfavourable state policies encouraging premature mechanization, excessively high price of inputs charged by the monopolists and artificial encouragement of large scale capital intensive farming, or lastly wherever there exist an insurmountable natural-technical constraint against the very adoption of the technology, the benefits of the MV technology will not materialize fully. However, the chief lesson to be learnt from the past mistakes of the early extreme negative evaluations of the G.R. is to avoid all abstract and hasty generalizations in either directions. Today there is also a great risk of swinging from over pessimism of the structuralist to over optimism of the technocrats; from an earlier extreme negative bias to an another extreme positive bias for G.R. If we want to avoid such undesirable swings in our current evaluations, we must form all our conclusions conditionally, contextually and within a holistic framework of analysis.

These caveats are excessively guarded in light of your earlier findings + and in some ways nullify the force of your arguments and evidence. Rewrite to make it compatible with your earlier assessments

vi. Scope and Limitations

Today in Bangladesh it is a well recognised fact that MV driven technology does have a threshold limit. Sometimes that limit against further expansion is set by either falling yield rate as MV is cultivated in more and more marginal lands or due to the intensive cultivation without balanced fertilisation of the soil. And sometimes the particular variety of seed itself loses some of it's desirable qualities and more and more yield is lost due to pest susceptibility. The limiting constraint may also originate from an excessive rise or/and fluctuation of price of inputs without any commensurate rise in the output price. Sometimes environmental hazards due to excessive withdrawal of ground water may also put up a constraint against further expansion. Sometimes need for diversified cropping can also put a limit to expansion of MV if it is confined to rice crop only. All these constraints can work together and be further reinforced by a more unequal distribution of land, capital, and the overall power in the rural areas. But the important thing that comes out of the analysis of our thesis is not to take a one sided view of any one of the constraints. For example the structuralist radicals usually assert that without breaking the power structure in the rural areas through land reform no growth is possible. By saying so they are actually asserting the priority of tackling the socio-economic constraints over other kinds of constraints. Similarly the technocrats often assert that developing new varieties with new qualities (Such as Hybrid Seeds, or New Varieties that can bear abiotic stress better, etc) and dissemination of that knowledge among the farmers as well as by arranging complementary irrigation, flood control and supplying other inputs through market will ensure a new period of growth in Bangladesh.

This debate is a very old debate. Similar debates were launched at the early stage of the first Green Revolution in the late 60's. Our analysis has already pointed out to the futility of such debates. These debates were like the debate of "Chicken first or Egg first".

In order to have a sustainable agricultural growth in Bangladesh today we will have to adopt a balanced and holistic strategy of fighting both the technical constraints and the socio-economic constraints simultaneously instead of counterpoising them against each other. The important question is not which is more important but to start with positive action in either front.[6]

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[6]As Sen has so wonderfully put it, " For example, Buridan's ass, which died of hunger being unable to decide which of the two haystacks in front of it happened to be superior, could have rationally chosen either of the haystacks, since he had good reason for choosing either rather than starving to death. but it had not enough reason to choose one haystack rather than the other, and choosing either of them would have been only partially justified. Rational public decisions have to come to terms with such partially justified choices." [Sen, A.K. 1987]

CHAPTER:I

INTRODUCTION

1.1 Agricultural Sector And The Necessity Of Technological Change

The main and essential factor of production in agriculture is land. Other inputs such as water and chemical fertilizer can also greatly supplement the so called "original and indestructible fertility" of the soil, but they are not yet perfect substitutes of land. Moreover for a given nation state its total area is almost fixed, therefore total supply of arable land is also limited.

But as the population of a given country increases, the aggregate demand for agricultural products, especially foodgrains also increases, and thus arises the necessity of producing more out of the given fixed land. The imperative becomes stronger if the country lacks the opportunity to import foodgrains from outside. The need to produce more foodgrains from the same soil is also enhanced by the growth of the per-capita income of a country with further economic development, because the income elasticity of foodgrain demand is generally quite high in less developed countries.

Under the impact of colonial rule these less developed countries in general experienced a demographic revolution without a concomitant growth in their industrial base. So the population of these countries crowded into the agricultural sector and the pressure on land in most of these countries became quite high. The common scenario that ultimately emerged in most of these less developed countries is a tiny modern sector surrounded by a huge overpopulated traditional sector.[Lewis,1954] The general

consequence of this situation was widespread hunger and absolute poverty. Experience of the then East Pakistan(Now Bangladesh) is worth mentioning here, which had faced several local famines immediately after the partition of 1947.(Kamal, A. 1989)
Faced with the same problems all these developing countries were actively looking for a development strategy that would provide for both higher output and greater employment in the agricultural sector with the given limited amount of land.

The experience of west European or the socialist countries were not of much help to solve the problems of these less developed countries. The mechanized farming technique followed in the developed countries could not solve the specific problems of the developing countries' agriculture, since they are labor saving by nature. These technologies would of course enhance the productivity of soil but only at the cost of increasing the problem of unemployment. On the other hand, under the traditional technology there was no longer, further scope for increasing the productivity of land by applying additional labor, because of the boundary set by the law of diminishing marginal productivity of labor. [Schultz, 1964]

So, the problem was to find out a new suitable technology for increasing simultaneously the productivity of land, the productivity of labor and the employment capacity of land. We can illustrate the above problem more formally. For example, a basic identity in the agricultural sector can be expressed as:

$$\boxed{y/ln = l/ln * y/l}$$

Where y= Total output of the agricultural sector.

Ln= Total arable land.

l= Total labor employed in the agricultural sector.

describe the result: output per hectare = Labor intensity x labor productivity
The challenge is to find a technology that ~~does not~~ increases labor productivity without ~~depre~~ decreasing labor intensity

Given the above identity the developing countries were interested to find out such a technology for the agricultural sector of their countries which will increase y/ln, l/ln and y/l simultaneously. The old traditional technology was not adequate because it was associated with very low levels of y/ln, l/ln as well as y/l. The other available western mechanical technology consisting of machines like tractors, harvesters, etc. was also not suitable because this could improve the two ratios y/ln and y/l, only at the cost of depressing the employment capacity of land, i.e. l/ln.This is best illustrated through the case of agricultural mechanization in U.S.A.

It may be useful to compare here the historical trends in factor productivities and land-man ratio of the new continent with those of the SOUTH ASIA, where the adopted agricultural technology was relatively less mechanized. In U.S.A. the agricultural labor productivity (y/l) and land productivity (y/ln) both grew at an annual compound rate of 6 ~~P.C.~~ percent and 2.1 ~~P.C.~~ percent during 1950-80. But at the same time labor-land ratio (l/ln) declined at an annual compound rate of (-)3.9 ~~P.C.~~ percent. In contrast to this we find in India the labor productivity and land productivity grew at an annual compound rate of only 1.1 and 2.2 ~~P.C.~~ percent respectively. But at the same time labor-land ratio increased at a 1.1 percent rate.[Y. Hayami and Saburo Yamada, 1991]. On the basis of these contrasts some authors have asserted about the existence of two different paths of agricultural development namely **Asian path** and **continental path**. [Y. Hayami and V.W. Rattan, 1971]. But the experience of Japan, ~~an Asian country~~, also proves that shifting from one path to another is not impossible. Japan actually followed a path of non-mechanized

labor productivity and labor intensity

agriculture during 1880-1950 when the factor productivities as well as l/ln ratio had been increasing simultaneously. But after 1950 Japan slowly shifted to mechanized agriculture and it's labor and land productivity during 1950-80 had increased at an annual compound

percent

rate of 5.5 and 2.3 ~~P.C.~~ whereas at the same time the l/ln ratio had decreased at the high

inspite

rate of 3.2 P.C. [Hayami and Yamada 1991]. So it is evident that ~~in spite~~ of being an Asian country, Japan had to shift to the so called **continental path** of agricultural development in the long run. However, from the above illustration it also becomes clear that at least in the short run the most suitable technology for the developing countries agriculture will be the newly invented MODERN VARIETY/BIO-CHEMICAL/H.Y.V. TECHNOLOGY[7] which can improve the three indicators all at a time.

The basic point is that how you organize your agriculture depends on your factor endowments. As Japan started to face labor scarcity, it adopted for mechanization

1.2 <u>The New Technology: Conflicting Views</u>

The new technology actually brought about several qualitative and quantitative changes in the overall agricultural practices of the adopting countries. It changed their

bio chemical HYV Nowadays IRRI

[7]The ~~BIO-CHEMICAL~~ technology in the case of rice was originally invented by ~~I.R.R.I.~~ It has many names, for example, ~~H.Y.V.~~ technology, Modern technology, Seed-Fertilizer technology, I.R.R.I. technology, etc. In the 60's when I.R.R.I. had first invented this technology, it's higher yielding capacity had become the main focus, hence the popular name H.Y.V. was assigned to it everywhere. However with time the focus of rice research has changed. ~~Now-a-days~~, the I.R.R.I. scientists are trying to invent a variety which may not be necessarily higher yielding, but has ~~may contain~~ other favourable characteristics such as the ability to resist not only diseases but also ~~to bear~~ sun and water stress. Thus I.R.R.I. scientists now a days prefer to call their technology M.V. technology [IRRI,1978] However in this thesis we have used all the three names interchangeably (H.Y.V., M.V. and Bio-chemical) Although the term "Bio-Chemical" is not very popular, yet we have retained and frequently used this name just to emphasize the original non-mechanical character of this invented technology.

low yield variety ?

cropping pattern by replacing L.V.'s with the M.V.'s. it made cropping possible even in the dry season through irrigation and thus increased the cropping intensity of land. It enhanced the growth of aggregate output, employment and markeTable ? surplus as well. It introduced new inputs such as pumpmachines, tubewells,chemical fertilizer, etc. in the remote villages.The extent of market involvement of the villagers significantly increased after the introduction of the new technology. Of course, the spread and depth of all these changes was ~~were~~ neither uniform nor ~~they~~ had similar consequences everywhere.

Under certain ideal conditions this technology was enthusiastically received and adopted by the majority of the farmers. There the farmers not only adopted the new seeds, but also arranged for other complementary inputs(e.g. fertilizer, labour, pesticides, water and even mechanical techniques when required) in appropriate quantity and some ideal farms were able to reach as close as the ideal laboratory yield rate. These farms had to arrange also the marketization of the surplus product with a reasonable rate of return. Part of the return was also invested for extending H.Y.V. production further.In this way the process of self sustaining growth of production and income spinned off in some ? favoured pockets of some developing countries. These ideal successful pockets of agricultural growth and change were renamed as regions of **GREEN REVOLUTION**, and attempts were undertaken to replicate this strategy elsewhere. But under non ideal conditions it proved to be a very difficult task.

X

my impression is that it is more than pockets in many countries

Mainly there arose two different kinds of problems. The first generation problem was how to induce the traditional farmers to adopt the new technology. At this phase the emphasis was put mainly upon the agricultural extension services. K knowledge of the new

Is this the beginning of a new sentence?

technology was taken to the door step of the farmer; demonstration farms were built up, subsidized supply of new inputs and various kinds of easy credits were made available to the farmers and sometimes price support programs were also arranged to facilitate the selling of the surplus grains. Various kinds of large scale water projects were built in order to mitigate the danger of flood as well as to facilitate the irrigation of soil. Various kinds of rural organizations were also built around all these programs, which were mainly aimed at enhancing the rate of adoption of the new technology. But these steps were again not uniformly successful everywhere. And in spite of a few ideal pockets of success, as a whole the general average rate of adoption remained quite low, at least far below the potentiality. This low adoption rate relatively more true for the rice regions was the first generation problem that vexed most of the policy makers. [Falcon, W. P., 1970]

rewriting would help.

These are unsubstantiated comments. Some evidence to illustrate the point would help.

This so called first generation problem : does ~~they~~ it still persist? Or largely overcome. The reference to Falcon is an outdated one

There are also other kinds of problems known as the second generation problems of green revolution. Those problems are more concerned with the distributive aspects. It is alleged that whatever limited adoption has taken place has taken place with a distinct bias towards the rich. The larger and the richer farmers are said to be the main beneficiaries from the adoption and the spread of the new technology; because in general they are the first to adopt it and they also have under their control the larger part of the productive forces required for this technology.

It is also argued that the large and rich farmers of the village not only have relatively higher initial factor endowments, but also able to obtain higher amount of support and incentives from the existing power structure. The state in the third world usually helps the rich in many countries through certain deliberate policies and institutional support mechanisms. The policy of subsidized input supply, a very low rate of taxation of the rich farmers, channelizing a higher proportion of institutional credits towards the rich, a high amount of price support for the marketed grains of the surplus farmers and the maintenance of an overvalued currency system which often encouraged the import of agricultural machineries, are some examples of such policy bias. All these policies have encouraged large scale mechanized farming and may have also aggravated the unemployment problem. In their net effect these policies and steps of the state have also helped the rich and large farmers of the third world to further consolidate their position in their respective domain.[Wharton 1969,Frankel 1971, Cleaver 1972, Griffin 1974, Hewitt and Alacantra 1976, Harriss 1977, and Pearse 1980.]

Some concrete examples citing inequality data from some countries would have strengthened the argument

However, some economists [Hazell and Ramasamy,1991, Blyn,1983, Barker and Herdt,1978, Herdt and Capule,1983, Chaudhury 1982, Pinstrup-Andersen,1982, Byerlee and Harrington,1983, David and Otsuka, 1994, Griffin,1988, Harriss,1991.] argue that the above mentioned so called second generation problems of equity although popularly associated with the spread and diffusion of the new technology is actually not an essential feature of the technology itself. In a different social setting with an appropriate policy environment and a somewhat more egalitarian pattern of distribution of initial resources among the farmers, the effect of the spread of the new technology would have turned far more equitable. Even under the non ideal conditions if the technology can at least maintain it's labour intensive character intact, then also the aggregate employment would have increased further and consequently the wage rate may increase too. Both of these changes are absolutely favourable for the poorer sections and hence their positions should also improve at least absolutely, if not relatively. They also argue in the long run new technology would have more beneficial effects for the poor through its various indirect linkage effects. For example the new technology can help to contain the rising tendency of the food grain price by increasing their supply in the market. This will occur even more if the technology has an adoption bias towards the rich, since they have a higher rate of marketable surplus. this should again help the poor consumers relatively more since they are the main consumers of foodgrain. The cheaper price of foodgrain can again ensure a lower and stable money wage rate, which would again encourage further investment in the non agricultural sector and would help the unemployed poor by creating new jobs for them in the non agricultural sector.

In many Asian countries, cheap food prices, because of huge subsidization of production in the US and Europe, is a huge, huge problem!

The additional demand for the non agricultural products and services from the rich adopter farmers may also give further impetus to the growth of the non agricultural sector and thus create further job opportunities for the poor. Finally a foodgrain importing country can save valuable foreign currency, if the total foodgrain production increases irrespective of the nature of the distributive impact involved with that particular growth process.

The brief overview of the new technology presented above reveals that there exist mutually exclusive or atleast conflicting views regarding the socio-economic consequences of this new technology based agricultural development in the less developed countries.

CHAPTER:II

A REVIEW OF LITERATURE

2.1 Survey Of The Different Attitudes Towards Green Revolution

views

Broadly speaking there are three mutually exclusive attitudes towards the complex multidimensional process of G.R.(which in our context is defined as the process of adoption and diffusion of the new technology and it's concurrent effects.) The attitude of the first group of authors can in general be termed as negative. They usually try to indicate various limitations as well as the negative consequences of the G.R. process. By "limitations" they usually understand the failures or inadequacies of the G.R. process to fulfil it's promises with which it had been started. This pessimist group of authors actually dominated the academic discussion of the 60's and 70's.[Op.cit.] More recently in the late 70's and also in the running decade of 80's, there has arisen a persuasive new alternative opinion which has a more liberal attitudes towards the process of G.R. They try to indicate on the basis of recent empirical evidences that there exists an immense potentiality of G.R. for the development of the agricultural sector in many developing countries. They not only emphasize the potential of G.R., but also point out some important positive consequences of the process such as increase in the foodgrain production, increase in the employment of the farm population, reduction of absolute poverty, etc. Some of them also argue in a round about manner about how worse would have been the situation in the case of a complete absence of the G.R. process.[*]

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[*] 1980's decade was in fact a decade of reappraisal of G.R. many influential scholars changed their old positions in favour of a more moderate attitude towards G.R. and many others follow suit. To mention a few names, Griffin(1988), John Harris(1991), Blyn(1983),Byerlee and Harrington(1983), Hazel and Ramasamy(1991), Chaudhury(1982), Herdt and capule(1983), Pinstrup and andersen(1982).Griffin and John Harris's cases in the above list are particularly interesting since they shifted considerably from a highly negative previous position.[For their old viewpoint please consult Griffin,1974, and John Harris, 1982]

Besides the above two extreme standpoints, there is another third group of authors who have a more balanced but inconclusive attitude (view) towards the process of G.R. According to them the possibilities and consequences of the G.R. strategy can't be judged on an a-priori ground, since they will largely depend on the initial conditions and the overall state policy environment within which the process of G.R. has to unfold itself. This is an apparently a reasonable standpoint free from both the extremes of "technological optimism" and "radical pessimism". But like all middle approaches it also abounds with ambiguities. It begs immediately answers to at (or) least two questions:

1) What are the initial conditions and the policy variables that influence the final outcome of the adoption of the M.V. technology?[9]

2) How do they affect the final outcome in terms of some generally chosen objective criteria e.g., growth, equity and the changing social balance of power.

They seem to be the same question, placed in two-question form.

The inter-temporal and inter-spatial variation in the initial conditions and policy regimes pertaining to M.V. cultivation is so divergent that the same one or several aspects of the M.V. technology may result in completely opposite outcomes depending upon their contexts. This simple truth was overlooked by many analysts belonging to the two extreme groups of evaluators of G.R. and this was perhaps the root cause of such a prolonged quarrel between them. One group actually failed to appreciate the intrinsic positive features of the M.V. technology by overemphasizing the socio-economic constraints while the other group also failed to understand the deep significance of these constraints by overemphasizing the intrinsic positive aspects of the technology. Let us

[9]By "final outcome" we mean the long run equilibrium situation that is attainable or attained after the adoption of the new technology.[Schultz 1975.]

reexamine some major controversial issues on G.R. to reveal the biases of these two groups of authors from this new perspective.

2.2 Survey of Controversial Issues

It is not enough to understand that the long run outcome of Green Revolution is shaped through the interaction of multiple factors e.g., environmental, technological, economic and social factors. One should also try to identify the specific controversies on the nature of those potential outcomes so that one can also identify specifically when and where what went wrong in the long run? And also how far they could be attributed to the MV technology itself?

With this view in mind we are presenting below a descriptive analysis of a few major areas of controversy regarding the long run outcome of MV technology adoption in a developing country like Bangladesh.

[A] Inter-Regional Adoption Bias Of MV Technology

The problem of inter-regional adoption bias of the M.V. technology is embedded in the very nature of this technology. The M.V. technology has been ideally defined as artificially bred new seed varieties which are expected to give improved yields and/or embody combination of desired characteristics fitting specific environments. The intrinsic feature of such seeds is it's higher energy intensiveness. As compared to T.V. it's water, nitrogen and human energy requirements are much greater.[10] Actually it's ability to use

[10]Various scientists have attempted to measure the "energy rate"(E.R.)or the ratio between energy produced and energy used for various M.V. crops and have revealed startling facts. In Hongkong E.R. of rice and vegetable gardening during the 1930's was 24.4. By 1971 after the introduction of energy intensive technology, the E.R. declined to an average value of 1.3, whereas for intensively cultivated fields the value dropped as low as o.13(Newcomb, 1975.) Similar examples have been reported from Latin America (Leach,1976),Africa and India.(Makhij Ani and Poole, 1975)In some of these unfavourable regions the E.R. was so low that the M.V. cultivation was not even economically feasible.

q

up larger amount of nutrients results in it's higher yield. But to ensure it's optimal yield ~~effect~~ it requires an optimal level of use of water and fertilizer along with proper cropping husbandry and also chemical insecticide whenever necessary. The optimum dose of these inputs vary from environment to environment and can be ascertained only by field level repeated practices and scientific observations.

q Is it still true of all farmers everywhere?

Since the field level farmers were in general not aware of such complexities, the applied input dose widely deviated from the ideal and resulted in wider variance in regional yield rates and/or cost of M.V. across the different regions. More alarming was the fact that certain regions were showing not only higher average yield but also higher adoption levels in terms of both number of adopters and percentage of land devoted to M.V. cultivation. Moreover the regional inequality in the adoption of the M.V. was accentuating over time, creating a host of other socio-economic ~~problems.~~[11]

This study refers to ancient times— situation thirty years ago.

A close look at the problem reveals that the root of the problem lies in the diversity of water regimes across the regions. Though all three inputs water, fertilizer and seeds are necessary for M.V., water is still the number one lead input among them. Without it the marginal yield effects of other inputs become extremely negligible and non cost effective. Hence controlled water service availability has become the first and foremost prerequisite of M.V. cultivation. This automatically excluded a large number of flood prone, draught prone and saline prone Agro-Ecological zones out of an immediate scope of M.V. cultivation. This is the natural basis of regional inequality that

[11] For example W.P. Falcon(1970) in his pioneering article mentioned about the regional bias in the G. R. strategy of the subsequent political crisis of pakistan.

give some concrete examples from some concrete countries

we observe in the regionally biased pattern of M.V. cultivation. However the social scientists have also pointed out from the very beginning that in addition to this natural bias political policy bias\to certain regions may also play a significant role in creating and\or accentuating such inequalities. Therefore how much of regional inequality in adoption is due to political neglect and how much of it can be attributed to the natural environmental limitations can't be ascertained on a-priori basis by just looking at the data on differential adoption patterns. Herefrom emerges the importance of contextualizing politically, socially and historically the issue of regional biases in M.V. adoption.

do you mean policies? or differences in government investment in irrigation across regions etc?.

[B] Intra Region Adoption Bias Of MV Cultivation

who are these scholars? spell out

This is a hotly debated issue and equally renowned scholars are there on both sides. The early evaluators of G.R. tried to argue that since M.V. is not resource neutral and any new technology initially involves some extra risk apprehension, hence it is likely to be adopted by only those rich classes of the village who are expected to have higher resources and greater risk bearing capacity.

In response to the above argument the opposite group presented the following chain of counter-arguments:

a) In the long run due to the diffusion of knowledge and experience the risk perception of all the farmers in a M.V. region will reduce considerably and the risk constraint would no longer be effective. The time gap between awareness and adoption will also be shortened significantly for the late adopters[12].

[12] Rogers(1962) first presented this hypothesis and later it was also tested and confirmed in case of Bangladesh by Islam and Halim(1976). In a selected union of Bangladesh, in 1965 they found that at the beginning of M.V. cultivation only four farmers were aware of it and on average they spent 3.5 years in trial and experiment before taking the final decision to adopt M.V. Two years after, in 1967, fifty sample farmers from the same area on average took only two years for taking the same decision. Finally in 1970 36 farmers were informed of the technology and they took only one year for their decision to adopt.

b) In the long run as new irrigation facilities are created by the relatively rich in the village, the water would become available to all slowly. This will be so because of the random nature of the location of the tubewells or\and pumps around which there is also likely to be numerous tiny plots owned by the small farmers too.It will also be of mutual interest for both to sell and buy water at a mutually acceptable price.

c) Given the availability and cost effective price of water, the other three perfectly divisible inputs, fertilizer, seeds and labour can easily be procured by the poor.Even if they initially lack the primary capital, they can procure it easily from the informal rural credit market in spite of the high interest rate since the prospect of gain is likely to be much higher.Moreover after two or three rounds of subsequent cultivation they may become self sufficient.

The essence of the above mentioned arguments is that in the long run if it is technically feasible and economically profitable, relatively higher resource constraint of the poor classes can not prevent them from adopting the M.V. technology. Ruttan and Binswanger (1977) collected numerous empirical evidence~~s~~ in support of this hypothesis. They found that the small farms and tenants can catch up the large farms and landlords approximately within three to five years from when the adoption starts.

Their evidence~~s~~ shows that up to three years the gap in adoption generally increases but from then on the adoption by the poor grows far more swiftly and they catch up their rivals or partners by next one or two years. However this is just an empirical generalization on the basis of a limited sample of evidence~~s~~ (although quite

Would you tell the readership regarding where the evidence is coming from (i.e. which countries) etc widespread) and was therefore liable to many counter arguments. Atleast three counter arguments are worth mentioning:

a) The "catching up" of the poor assumes that the water market, the input market and the credit market are such that poors have access or the capacity to buy or borrow from them. But these assumptions may not hold good everywhere. Especially the villages with highly skewed distribution of resources and also without any countervailing egalitarian government policies, may exhibit persistent lag on the part of the poor. Can you provide some evidence from the works of others that these markets could be highly restricted

b) Again some have argued that small farm-size and the tenant status of a villager is not a good index of poverty hence success of small farmers and tenants in adoption as revealed by empirical evidences should be rechecked in terms of their overall income status.[Byers, 1981]

c) After making a review of numerous case studies on adoption available till 1985, G.feeder, R.E. Just and D. Ziberrman (1985) re-qualified the hypothesis of Ruttan et. al. in following terms:

> "Even if this is the case, the early adopters (usually the larger and the wealthier farms) can accumulate, more wealth and use the differential to acquire more land from the laggard. The acquisition of new wealth enables further adoption and thus affect the dynamic pattern of aggregate adoption".

indented quotation does not require quotation marks

A closer examination of these more refined counter arguments reveals that the socalled rich biasness of the M.V. technology does not actually altogether follow from the intrinsic features of the technology itself. It is true that M.V. technology intrinsically

~~pert~~ does not at all

requires a relatively higher amount of intermediate inputs but this alone can not be a sufficient basis for a pro-rich bias in the adoption of the technology. It's resource intensiveness in conjunction with imperfect property rights, imperfect markets, other biased institutions and policies all taken together may finally result in a pro rich bias. So alone M.V. can't be singled out as the root of all evils. But in practice often the limitations of other conjunctive conditions were blamed upon M.V. Referring to the case of Ethiopia Michael Lipton thus wrote,

"One can not blame the M.V. for the persistence of three dubious policies of the (Imperial)government of Ethiopia: heavily subsidized mechanization (favouring very large scale); grants of big individual land ownership rights; and broken promises of land reform. But if M.V.s are introduced into such a context the effects on the tenants can be terrible. It is after all the combination of the M.V.s and the policy context that renders it profitable for the landlords in such circumstances to adopt their new strategy of eviction and tractor combine-farming."[Lipton and Longhurst 1989]

If indented, no need to add quote. The quote should be single spaced.

We can further supplement the above argument by also pointing out the contrary circumstances where the special feature of labour intensiveness of M.V. was able to offset these negative biases atleast partly, and could make it more poor friendly. For example, the labour intensiveness of M.V. actually favours the small farms and the tenants relatively more since the opportunity cost of their labour(Both management labour and field labour) is relatively low. On the other hand, for the large farmers, the opportunity cost of not only labour but also the cash capital under certain circumstances may be so high that they may either refrain from or limit their level of M.V. adoption

[Thorner, 1982]. In that case the so called resource advantage of the large farmer may not be translated into a higher level of adoption by them and we may find an inverse relation between adoption and farmsize.

There is no compelling evidence that small farmers lack farming knowledge compared to large farmers

The labour advantage and the higher subsistence pressure of the small farms in spite of their lack of non labour resources (e.g. knowledge and cash capital.) can also make them more "efficient" user of their tiny plots. Numerous studies on farm-size and productivity have revealed again and again the persistence of the inverse relation between them even after the adoption of the so called resource intensive M.V. [Cornia. 1987][13] However in terms of net profitability criterion where the assessment of the labour cost is done at the existing market wage rate, may easily overturn this advantage of small farms.

We wrap up the discussion by pointing out a few testable hypotheses from both sides:

1) In most areas as time passes on, M.V. adoption will tend to become universal across classes.

2) In areas with higher subsistence pressure the adoption of M.V. is likely to be quicker and larger.

3) Small farmers with a relatively higher subsistence pressure will generally have a higher rate of adoption as well as higher productivity of land.

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[13]However, with further transition to mechanized farming in Punjab of India this inverse relationship was changed and turned into a direct one.[Roy 1981, Berry and Cline 1979, Bhalla and Chadha 1983.] But this is a separate issue and will be dealt in the next section.

You should use MV without periods as you have done elsewhere. Be consistent

4) Large farmers are likely to be the earliest risk takers and therefore may reap some transitory "Schumpeterian Profit" from an early adoption of the new technology.

5) The large farmers in the early period of adoption may use a part of their surplus earnings as a rent for innovation to buy off the uneconomic holdings of the non-adopting small farms.

(C) The Issue Of Mechanization And Employment

The central issue is here, whether mechanization is induced by M.V. technology or by factors independent of M.V.? One of the parties argue that introduction of M.V. causes an upward shift in the demand curve for labour. At the same time due to income effect labour supply curve also shifts upward. As a result the wage rate is pushed up. Especially during peak season there is a concentrated peak demand for labour by large farm households while the small farmers also withdraw from the labour market in order to engage themselves in family farming. Thus a situation of extreme shortage of labour in combination with extremely high wage rate may induce the big farmers to mechanize. And once mechanization is undertaken it has to be continued even in the slack seasons which implies ~~further~~ an aggravation of the unemployment problem and ~~further~~ a decrease in the real average wage rate. Moreover with mechanization the old inverse relation between farm size and productivity may become direct, inducing the large farmers to search for more economy of scale. This may result in the eviction of former tenants and purchase of land by the large farmers from the small, ultimately leading to higher concentration of wealth and income [Duff 1978, Byres 1981].

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why this boldness as well the quotes?

There are two different lines of arguments against the above chain of arguments. One challenges the "CAUSALITY" and the other refutes the "EFFECTS".It is argued that given the general abundance of labour supply in the less developed countries. the small average farm-size and the intrinsic scale neutrality of the M.V. technology it is highly implausible that capital intensive farming would become naturally more profitable through market mechanism alone. For a few large farm it may become profitable but that is mostly due to causes other than M.V. For example, in Pakistan it was found that the Government followed an aid based cheap credit program for tractorization and also an overvalued currency regime which had made tractors artificially cheaper. These factors were actually more important causes behind premature tractorization in Pakistan. In the case of Punjab of India it was found that tractorization of the large farms had been started there long before the introduction of M.V. A survey of all the evidences on tractorization in South Asia found that "Tractorization was almost as rapid before as after the introduction of the M.V. technology" [Iftekhar Ahmed, 1976].

However a special combination of circumstances such as the existence of time constraint due to higher intensity of cropping, managerial constraint, hardness of soil, shortage of fodder, higher intensity of weeding under bullock ploughing. higher transaction cost of labour, highly unequal distribution of land and lastly all or some of them leading to an extreme shortage of labour and high wage rate, may also cause early tractorization.[14]

Griffin tried to provide a political economy argument

[14]The above argument was reconstructed somewhat differently by Griffin. He pointed out that the state power which usually makes the factor price distorted to favour mechanization is actually largely controlled by the big landowners who are also in most of the cases the main beneficiaries of these policies. This class of big landowners are also the main promoters of public irrigation projects and M.V. in the countryside. According to Griffin as long as this particular class remains powerful , they will ensure interlinked existence of M.V. and mechanization. Referring to Philippines as an example Griffin wrote, "Modernization in the Philippines and the rest of the contemporary Asia is a seamless web; tractors and M.V. are politically linked."[Griffin 1978]

But all these factors causing tractorization neither essentially follow from nor essentially marches together with M.V. technology. Even if some link can be forged between one or two of them with M.V., those few together may not be sufficient for inducing mechanization unless government also arranges for subsidized equipments. [Jaysuria and Shand 1986, Binswanger 1978, David 1982 and Gill 1981.]

The more fundamental issue is whether mechanization at all results in the deterioration of the unemployment problem and induces further decline in the real wage rate. It is argued that tractorization only replaces the ploughing labour, the quantitative significance of which in the total labour use is very little. Moreover ploughing is done by family labour or permanent labour, so their replacement does not reduce the demand for hired casual labour. Rather by loosening the time constraint through quicker ploughing tractorization makes it possible for the farmer to go for double or even triple cropping. This creates more hired labour employment than what is lost through the replacement of hired ploughing labour. Thus in spite of tractorization, in some countries there was observed a net increase in hired labour employment per unit of land, although total labour use per unit of land declined.[Ranade and Herdt,1978.] The real wage rate also showed a concurrent positive trend which depends more on the demand for hired labour than the volume of total labour use. It is also argued that tractorization may create extra employment in the non agricultural sector through demand for repair services. However the newly created repair workshops may again act as a substitute of the artisan services and therefore the net effect remains uncertain. Empirical evidences from both Philippines and Punjab show that the real wage of agricultural hired labour had increased in the long run in spite of high tractorization [IRRI, 1978].

Rather than discussing various analytical outcomes, I would have looked at the evidence much more thoroughly! The present discussion on evidence is at patchy but often somewhat superficial.

(That is, somewhat greater details of the quantitative results and how robust were those results. In other words, provide some evaluation on methodology) the

Considering all pros and cons, some economists have pointed out that actual effect of mechanization on employment will largely depend on the initial field situation. If mechanization is all pervasive and replaces not only the ploughing labour but also harvest labour, weeding labour, rice processing labour, etc. and if there is no offsetting large scale increase in non farm work opportunities then it is less likely that mechanization in the rural areas would be able to offset the total loss in the agricultural employment. But in that case the old question crops up again, i.e. whether mechanization in all these areas are really induced by M.V. alone? If relative factor price movements causes mechanization then obviously M.V. will be only a part of that process since many other factors influence the movement of the relative factor prices.

If "time constraint" causes mechanization, then perhaps M.V. may be treated as the dominant cause of it. But in that case the net effect on real wage is likely to be positive due to concurrent increase in cropping intensity. However if labour mobility across regions were perfect then such "time constraint" could no longer prevail in a isolated particular place of a country which is as a whole labour surplus. Therefore with perfect labour mobility, the so called turn around time constraint can not rule away double or triple cropping even with non-mechanized bio-chemical technology. under such circumstances the M.V. would no longer induce premature mechanization and the maximum impact of M.V. on employment would be realized. In that case an increase in the total earning and employment would generate further benefits for the poor.[15] The

[15]Griffin made this point more clear by referring to the example of Philippines. He wrote, "There was a sharp rise in the amount of labour used in care of the crop(seedbed preparation, replanting, fertilizing, spraying and weeding.) as one would expect from the nature of the M.V. technology. Part of that rise, however was offset by a 50% decline in the amount of labour required for land preparation. That is significant. If the labour required for land preparation in 1975 had been the same as in 1966, labor use would have been about 9.7 mandays per hectare higher. The increase in total

above discussion proves that the controversy regarding the causes and effects of mechanization in the less developed countries with M.V. technology can't be resolved by just looking into direct empirical evidences. This is so because each of the parties has adopted the strategy of defending their original position by adding several supplementary qualifying clauses whenever they faced contrary evidences.Since it is beyond the scope of this thesis to examine all the relevant issues here, we shall select and concentrate upon a series of inter-related hypotheses.[16] These hypotheses are as follows:

1) M.V. increases labour use per unit of land and M.V.adopting large farmers meet that requirement by mainly hiring labour from the labour market. But small farmers meet it by withdrawing labour supply from other less important areas and/or increasing their own labour intensity.

2) As a result of M.V. expansion, wage rate of hired labour, at least does not decrease, if not increases.

3) Mechanization does not take place due to M.V. induced wage increase.

4) Mechanization mostly takes place due to any one or combination of the following causes:

   a) Managerial constraint on the part of the large farmers.

   b) To release the time constraint against more intensive cultivation.

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employment between 1966 and 1975 would have been 54 percent higher. in other words, if there had been no change in land preparation (technology), the rate of growth of demand for labour would have exceeded by a comfortable margin the rate of growth of labour supply. Under such circumstances the introduction of M.V. would have been associated clearly with some combination of a reduction in unemployment, an increase in the number of days of employment per person, and higher real wages for agricultural labourers, all of which would have helped to reduce poverty and improve the distribution of income in the country side." [Griffin, 1978.]

[16]Because of lack of appropriate data, we shall examine only the plausibility of these hypotheses, rather than trying to establish or refute them.

c) Government manipulated low price of mechanical equipments and cheap credit offered by the government to buy them.

5) Mechanization by large farms may lead to the eviction of tenants and can also turn the old inverse relation between productivity and farmsize into a direct relation.

6) The overall impact of premature mechanization on wage rate and labour use is negative in a labour surplus area. But in the case of naturally necessary mechanization the overall impact on wage and employment will be positive. Even in the short run the impact on the employment of hired labour and their wages are likely to be positive.

(D) The Price Issue

There have been two different approaches to measure the sum total effects of M.V. induced fall in foodgrain prices. The partial equilibrium approach [Evenson and Flores, 1978] predicts that given the inelasticity of demand for food, M. V. induced exogenous increase in the supply of foodgrain would cause a fall in it's price, a large increase in consumer surplus and a small or no increase in the producer surplus. Since the poorer section spends a greater proportion of income on foodgrains, so they (i.e. urban workers, landless as well as the net buyer peasant households.) will be the main gainers.

The other approach for measuring the same effect is known as computable general equilibrium model (C.G.E.) which is more comprehensive than the former because it takes into account of all other possible gains and losses realised through long run chain effects. Thus it also introduces certain complexities and uncertainties in the neat findings of the partial equilibrium approach. Some of the long term insights gained from this type of exercises [Janvry and Sadoulet, 1987] are presented below.

1) The gain of the poor people (Landless, urban workers and poor peasants.) will largely depend on whether their money incomes remain stable while rice price is falling. At least in case of India many studies corroborate the thesis of unidirectional movement of both money wage rate and price of rice in the long run. [Parthasarathy 1977, Papanek 1986] This erodes a considerable part of the poor peoples' potential gain as consumers of foodgrain.

2) In many cases the extra output due to M.V. may only replace import or increase export or may be fully absorbed by the increase in demand induced by both natural population growth as well as increase in per capita income. In all these cases the price would not fall and the relative gain would be more for the surplus farmers implying further increase in inequality.[17]

3) In some C.G.E. models government policy is also treated as an endogenous variable. In that case the possibility of M.V. induced price fall and it's effects become more uncertain. In many countries the government follows the twin objectives of satisfying the two main political pressure groups such as (a) the urban organized consumers of foodgrain and (b) the rural landlords. The government, in order to keep these two groups simultaneously satisfied often provides generous subsidy for both urban food rationing and for the buyers of modern agricultural inputs. Sometimes price support policy for agricultural

[17] However the C.G.E. approach also does not forget to add that such income gains by the surplus farmers may again indirectly benefit the poorer sections through the multiplier effect from the additional consumption and investment expenditures.

products is also undertaken. Under these circumstances the most vulnerable sections of both urban and rural community who usually do not have access to either cheap ration or cheap inputs or any surplus grain to sell, suffer the most.[18]

4) The falling foodgrain price may counteract on the further growth of M.V. production by depressing the level of producers' incentive. This is particularly true for non adopting backward regions and the late adopting farms who may generally have to face a more unfavourable output-input price ratio. Moreover experts assert that with wider spread of intensive farming there occurs a general degradation in the paddy production environment which may exhaust the production frontier in the long run unless new scientific breakthroughs are made. There is also a general rise in the cost of production due to the extension of cultivation to the marginal lands. With fixed output, rising cost of production and fixed technology, the possibility of simultaneously sustaining the steady supply of foodgrain and falling prices may slowly dwindle away in the long run. [Hossain, 1994]

Moreover if the farmers are sufficiently price responsive, then they can shift to non foodgrain crops in response to falling foodgrain prices and partially offset their losses and also check back the price fall through cut in supply of foodgrains.

5) It is generally argued that M.V. production reduces price instability by filling the gap of supply in the dry season. But this effect may not materialize always because M.V.'s due to their very high dependence on purchased inputs may show

[18]However these negative consequences should not be blamed upon M.V. Generally the rich people gained from these policies either because they were designed to benefit the rich or because the existing institutional set constrained the poor people from utilizing these policies in their favour in spite of the well intentions of these policy makers.

great instability in output and prices if the supply and the price of these inputs vary too much.

6) It is often argued that cheap price of foodgrain enables the poor to get more calorie at a lesser cost and thus help them to improve their nutritional status with the same income. This may also add to their efficiency and income earning capacity as well. But in a counter argument it is said that if the progress in M.V. cereal is achieved by replacing various other nutritious crops e.g. pulses(which is in fact the cheapest source of protein for the poor)then the net change in the nutrition status of the poor consumers may become problematic.[19]

Are the above all findings from CGE models?

The above mentioned few insights illustrate sufficiently that M.V. based increase in supply of foodgrain may not necessarily result in price fall and even if it does so the long run consequences of it would depend much upon the response pattern of the policy makers and the farmers. It also supports our general contention that "partial equilibrium" approach is not suitable for assessing the effects of green revolution. Moreover a general equilibrium approach of traditional type devoid of the socio-political policy variables may prove to be inadequate.[20] The scope of this thesis does not permit us to compute a C.G.E.to trace all the complex causal relations mentioned above.We can examine here

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[19] However more in-depth study of the relative cost of nutrition effect in India shows that protein yield per unit of land and labour input is actually higher in case of M.V. wheat than pulses. Thus M.V. wheat may lead to cheaper protein as well as calorie for the poor. But for M.V. rice the net effect is yet to be studied.[Lipton,1989.]

[20] As Lipton has commented, "M.V.'s seem to have help poor, via production, employment and consumption in "partial equilibrium" i.e. when we look at each effect separately, locally, and in respect of the affected crop alone. Yet the results of M.V.'s for the poor while positive, have been disappointing .... The standard G.E. approaches of pure economics, ..., help resolve this paradox in some respects, but in others they sharpen it..... Another approach to the paradox is by looking at the economic behaviour of political agents,groups, states,classes and asking how the impact of M.V.'s might affect that behaviour or it's outcome".[Lipton,1989]

only the direct effect of M.V. on the price of foodgrain and explore some of it's implications. The following set of hypothesis can be tested by drawing heavily from secondary sources of data.

1) M.V. induced increase in the supply of foodgrain has kept the foodgrain price depressed.

2) The low price of foodgrain has helped the poor classes relatively more and indirectly contribute to make the real income distribution more equitable.

3) The depressed rice price has a disincentive effect on the rice growers and they respond to it by shifting their cropping pattern.

(E) The Issue Of Equity

In general it is recognized that M.V. technology raises the absolute income but worsens the relative income distribution by favouring land owners. The chain of arguments run as follows. Whenever the MV technology is adopted the immediate effect is the rise in the absolute productivity of land and labour simultaneously. Consequently the demand for land and labour increases simultaneously. However in a less developed country the supply of land is perfectly inelastic and that of labour is highly elastic. Thus at post adoption equilibrium the rent would rise relatively more than the wage. In general the rise in the rent would be higher if the big landowners also resort to early mechanization and withdrawal of land from their tenants. On the other hand wage increase would be zero or negligible in the long run if labour supply from backward areas occur in response to the short run increase of wage in the M.V. areas. If mechanization is whole scale and all pervasive, the absolute wage rate and\or employment level may even fall. Thus as a whole the absolute gain in income would be relatively more for the

a) The propensity to save of the income gainers.

b) The pattern of expenditure (both consumption and investment) of the income gainers e. g. whether they spend it for local or non local goods, whether the goods are more labour intensive or not, etc. In general, if the propensity to save is low, the consumption multiplier will be high and depending upon the nature of consumption there may take place domestic employment expansion through forward linkage effect. This would increase the possibility of gain for the poor classes through secondary channels. On the other hand if the saving propensity is high, the consumption multiplier will be low, but in that case the investment multiplier may become high depending upon the investment behaviour of the savers. The impact of high investment multiplier will usually work through backward linkages and it's impact on employment would also depend upon the nature of the new investments.

M.V. technology may also accelerate inequality of income distribution by widening the regional income gaps. Till now nearly 40% of rice areas in South and Southeast Asia consists of mainly unfavourable rainfed low land, upland, deepwater, and tidal wet areas which are still planted to traditional varieties.[IRRI, 1991] In these areas the incidence of poverty and unemployment is found to be relatively higher. However it is also argued that these backward areas may also indirectly share the benefits of the M.V. technology through regional mobility and adjustments in the labour markets and their cropping patterns.[Otsuka and David, 1994] However the validity of the above argument also largely depends on the composition, extent and the direction of these adjustments. For example in a backward area usually the better off section is better equipped with knowledge, information and initial surplus to migrate to an advanced area (Village or Town) which has a higher income opportunity. Such migration affects the backward area negatively by draining off valuable resources(Skill and capital) from it. On the other hand the poor in the backward region lacks the capital for permanent migration and often import valuable resources from outside through seasonal migration. If incidence of aggregate "pull migration" of the rich outpaces the "seasonal push migration" of the poor, the net effect in the backward areas may become negative.[Lipton and Longhurst, 1989]

It is obvious that as long as the main productive asset land and the social or market power derived from it is unequally distributed the M.V. based total income gain would also be shared unequally. But this type of institution induced inequity can not be attributed to M.V. unless one can prove that the technology itself reinforces the inequality in the distribution of land and power. While the study about the impact of M.V. on the power structure and institutions are extremely meagre, there are some evidences about the impact of M.V. on the distribution of owned land. In general it was found that in M.V. areas where the adoption pattern was neither rich biased nor machine oriented, the staying power of the small and marginal farmers rose considerably through M.V. adoption and thus land grabbing by the richer sections became increasingly difficult. Whereas in the backward non M.V. areas the small farmers, being unable to withstand the demographic pressure and diminishing productivity of land are often easily forced to sell their land to the rich, thus enhancing the land or wealth based inequality further. however if we introduce the government into the stage then the impact of M.V. on the distribution of income becomes highly indeterminate, varying according to the various policy configurations. To illustrate the complexity involved we can present here the case of India. In India the government at first encouraged the surplus farmers by following an extensive foodgrain procurement program with price support in the M.V. regions. This had naturally harmed the poorer sections in the short run by artificially holding the food price at a higher level. However the initial negative effect on the poor had been largely offset, when in the wake of green revolution the Indian government undertook a huge expansion of anti poverty programs(during the seventh plan.) such as Maharastra employment guarantee scheme, noon meals for all school children in Tamil Nadu, etc.

And these policies could be undertaken only because of availability of large foodgrain stocks made possible by the previous procurement policy in the M.V. regions. Thus a policy apparently negative for the poor in the short run became beneficial for them in the long run. Although the aggregate equity effect of M.V. depends upon almost all other sub-effects (Price effect, Employment effect, Linkage effects, Adoption pattern, Initial distribution of resources, Socio-political environment, etc.) discussed before yet we can disentangle a few distinct hypotheses here supplementing the previous ones:

1) Because of regional adoption bias of M.V. technology it will enhance regional inequality. However regional gap in income will partly be mitigated by adjustments in the inter-regional labour markets and cropping patterns.
2) In the non M.V. areas the incidence of absolute poverty will be higher.
3) In the non M.V. areas the incidence of landlessness as well as the process of proletarianization or pauperization will be speedier.
4) The relative income distribution in M.V. areas as compared to that of non M.V. areas can be both higher or lesser depending upon the pre M.V. conditions, post

adoption behaviour of the factor and product markets and also the policy environment. in other words it is neither easy nor proper to subscribe a rigid point of view in this respect.

2.3 Synthesis:Review Of Literature

We started this review of issues on G.R. with the observation that there was a widespread bias against G.R. in early studies. Many reputed scholars had asserted wrongly that G.R. would surely lead to further deterioration in not only income and asset distribution in the rural areas but also further increase in the level of absolute poverty. Some even went so far as to see the potentiality of red revolution in the rear of the G.R. please cite here But a careful scrutiny of recent empirical evidences and deeper analysis of relevant facts within a holistic framework has invalidated most of these assertions. Naturally the question arises : "How did the same bias or mistakes occur at the same time among so many reputed scholars"? In answer to this question we can offer atleast five possible reasons.

1) Given the vastness and diversity of the area of G.R., there is always a natural risk of over generalization. And that risk was considerably higher in the early stage of the study when enough data was not available.

2) Early studies on G.R were carried out too soon after the release of the new technology. So the early scholars had to base their analysis on the immediate short run impacts of G.R. which were naturally more unequal since in most cases the primary adopter beneficiaries of the new technology were the rich and the strong. Later studies found a completely different picture because the adoption had become more equal and almost universal by that time.

3) The later studies were superior because they also examined the many other long run positive indirect effects of G.R. For example:

a) Trickle down benefits for the labour of the backward regions through the adjustments in the interregional labour market.

b) Benefit for the producers of the backward regions through adjustments in the cropping patterns and interregional product markets.

c) Benefit for the poor consumers through fall in the relative price of rice.

d) Other benefits arising from growth linkages of G.R. with rural nonfarm economy and the consequent benefits of that for the poor.

e) Benefits were also considerably higher in some places where the initial distribution of resources were more egalitarian and where the government policies were in favour of the poor.[21]

4) The early authors were often guilty of confusing the negative effects of population growth, unfavourable institutions, wrong agricultural policies, premature mechanization, etc. with that of the G.R. This led to two major misunderstandings: firstly the causes of poverty and inequality were often wrongly identified and attributed to MV. Secondly most of the scholars failed to appreciate the counterfactual i. e., how worse would have been the rural poverty and hunger in the absence of G.R.

5) Finally as time passed on the technology was further refined to make it more suiTable to the specific areas of it's application. So the later period effects were relatively more congenial.

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[21] As an empirical instance of this, please read the study of Hazell and Ramasamy about the process of G.R. in South India

However, the chief lesson to be learnt from the past mistakes of the early evaluations of the G.R. is to avoid all abstract and hasty generalizations in either directions. Today there is also a great risk of swinging from over pessimism of the structuralist to over optimism of the technocrats; from an earlier negative bias to a another positive bias for G.R. If we want to avoid such swings we must form all our conclusions conditionally, contextually and within a holistic framework of analysis.

I am not fully sure what it means!

2.4 Empirical Evidence~~s~~ : Green Revolution In South Asia

The literature on Green Revolution is voluminous. We have c~~hosen here sixteen from~~ reviewed a select few amongst them to illustrate empirical findings on the chosen issues and hypotheses reviewed in the previous chapter. All these studies were focused on the Subcontinent i.e. India, Pakistan and Bangladesh. All these countries have undergone the process of Green Revolution during in and around 1960's and by now that process has reached a crucial juncture everywhere.Further progress has become more constrained and more difficult. So the time is now ripe for a comprehensive evaluation of past experiences in Green Revolution in these countries.

We have presented the findings from all these studies on each of the five controversial aspects of G.R. in five different Tables (2.1 to 2.5) arranged countrywise. There is observed a wide divergence in the opinions or findings on the same aspect of the same country from author to author. This is so because either the time or place of the different studies were not exactly same or sometimes the interpretation of the same data of the same country was done differently by different authors. Let us reexamine them issue by issue.

In Table: 2.1 we have presented the findings on the " Inter-Regional Adoption Disparity" of eleven different authors. Of them five were selected from India and three each from Pakistan and Bangladesh. From ~~the findings of~~ these studies it is clear that everybody agrees that there has been a significant regional adoption bias in the process of G.R. in all these three countries. But the authors do not agree among themselves regarding the true explanation of this common phenomenon. In the case of India four of the five authors carried out their researches during 1960's and early 70's. Their common view is that the resource bias, water bias, skill bias and wheat bias of M.V. technology itself is responsible for such inter-regional disparity in it's adoption. In other words the regions with more suitable water regime, higher availability of capital and skill and more suitable climate for the M.V. crop wheat, had gone more ahead in the adoption and diffusion of M.V. One of these early studies also mentioned about the regional bias in the government policies as another significant supplementary factor for increasing regional disparity in adoption.

who are they?

what is the reference? mention the name, date etc

The fifth study on South India was carried relatively lately and also covered a longer time span: 1973\74 to 1984\85. The unique advantage of this study was that it had panel data. The study revealed that the particular region, once lagging far behind other regions in India had somehow been able to cover up the gap in the adoption level within ten years. This study concludes that regional bias is not inherent in the technology of G.R. This also indirectly implies that the early regional bias in M.V. adoption may not persist in the long run except in those areas where natural environment is completely inimical to agriculture itself.

Again : it would have been helpful to review
(i) the precise quantitative results
(ii) how good the underlying regression or quantitative results were.

Don't seem to correspond with the table.

the ? ?

(Khan ( ), ~~Chaudhury~~ Nulty ( ))

In case of Pakistan two of the three studies reviewed here were carried out during 1960's The authors of them opined that significant regional bias in adoption was present in Pakistan because of some inherent biases of M.V. technology such as resource bias, water bias and skill bias. Both of these studies ~~also~~ strongly ~~mentioned~~ argued about the regional policy bias of the then government. The other study on Pakistan was carried out for the period of 1960 to 1980 and was mainly based on secondary ~~sources of~~ data.The study found that the regional disparity in Pakistan measured in terms of agricultural growth rate and productivity was actually narrowing down during the period of G.R.The finding implies ~~(if the secondary data is accepted as true)~~ that even if there were any regional bias in the M.V. technology, it was not strong enough to perpetuate the regional productivity and income gap in Pakistan.It also proves that over time generally the agricultural productivity in M.V. areas declines while that on the non M.V. areas increases. So this study also supports that in the long run the regional gap is going to decline.

references ?

For Bangladesh all the three studies found that the differences in natural environmental conditions were the most crucial causes of regional adoption disparity. One of the studies also mentioned that areas with relatively higher density of population usually shows greater adoption rate.It is difficult to validate any specific hypothesis from these conflicting findings. However, most of the later period studies revealed that the adoption disparity was decreasing over time. Moreover in some cases regional agricultural productivity and income gap between M.V. and non M.V. areas were also narrowing down. Unequal regional water endowment seems to be the only commonly agreed ~~ground~~ factor which can cause significant regional disparity in the adoption of MV. But whether that can persist for a long time or the final significance of that in terms of regional income disparity remains controversial.

Table 2.2 refers to the empirical evidences on Intra-Regional adoption Disparity. In total twelve studies were examined of which six were from India and three each from both Pakistan and Bangladesh. Out of the six studies that examined the Indian experience, four agreed on the point that there was a significant pro rich bias in the adoption pattern of M.V. at least during the initial stage of adoption. It is noteworthy that all the four studies were carried out in the 1960's. which is also the initial period of G.R. in India. Two other studies from India were carried out at early 70's and late 80's. The authors of these studies were not as categorical as their predecessors. Especially the latest study carried out in the 80's in the rice region of South India asserted just the opposite.

For Pakistan two of the three studies were carried out in pre-1970 period. The authors of these early studies found significant pro-rich bias in the adoption of M.V. But the other study covering a longer time period i. e. up to 1980's; found this bias to be not only reducing over time but also finally changing in favour of the poor. However in case of rice M.V. (which is not the main crop of Pakistan) there still persists a direct relation between adoption and farm-size.

In case of Bangladesh in general adoption intensity was found by all the three studies to be higher for the small farmers.But in terms of numerical proportion of adopters in respective classes (defined by the size of land ownership) there was observed a significant pro-rich bias.In terms of the compound indicator(i.e. PARTICIPATION INDEX= % of adopters x % of cultivated land under M.V.), the results seemed to be ambiguous. The general findings from these studies show that on the basis of a traditional definition of adoption, the socalled pro-rich bias of M.V. technology has either become invalid or turning invalid quickly in all these countries. However the definition of "Adoption" varies and the conclusion largely depends on the definition used. Two other definitions used as the proxy indicator of "Adoption" were numerical ratio of adopters and the complex index of participation. The number of studies which have used these definitions are few and they do not reveal any systematic bias in the MV technology.

Table 2.3 refers to evidences on Mechanization and Employment effects of G.R. Findings of three studies on India, all carried out during 1960's support the traditional idea that the bio-chemical technological diffusion at a certain stage induced mechanization. These three early studies also argued that the employment and wage effect of such mechanization was at best uncertain if not negative. The two other studies on India carried out at a later period i.e. in the 70's and early 80's reported on the contrary that in spite of the reduction in total agricultural labour use per unit of land as an effect of mechanization, the hired agricultural labourers of these regions enjoyed a net gain due to an increase in their total income and employment in the post mechanization period. One of these studies attributed these income and employment increasing effects to the combination of tractorization and bio-chemical technology itself. The author of the second study thinks that the growth of non farm employment opportunity which may or may not be linked with M.V. was the main reason for such a positive outcome for the landless agricultural labourers.

In case of Pakistan two of the three studies covering the pre 1970 period categorically pointed out to the negative employment effect of mechanization. They were also of the opinion that mechanization had indirectly accelerated the process of that inequality in the distribution of income and assets. However the third study covering a longer period from 1960 to 1980 found that labour replacement effect of mechanization was completely offset by the labour augmenting effect of the bio-chemical technology and the real wage of the hired agricultural labour actually increased in Pakistan in spite of the progress in mechanization. But here also the effect of non farm sector was not separately accounted for.

All the three studies in Bangladesh found virtual absence of mechanization in Bangladesh in spite of some progress achieved in M.V. expansion. One of the authors from Bangladesh has categorically said that in Bangladesh there would be no progress in mechanization unless some rapid growth occurs in the non agricultural sector to change the age old scenario of the huge surplus labour.

All the studies reviewed above in general point out to the crucial role of the non agricultural sector in determining the nature and consequences of agricultural mechanization. "Induced Mechanization" hypothesis in it's crude form is also rejected by most of the authors and in case of a labour abundant country like Bangladesh it seems highly improbable. In case of Pakistan politically induced mechanization was observed although it's actual consequences remains controversial.

Table 2.4 refers to price effects of M.V. technology. All the five studies in this field took place in India and were based on pre 1980 data. Four of these studies pointed out that price of wheat did not show any secular decreasing trend in India in spite of the continuous increase in the production of wheat. However one study covering the longest period of 1973/74 to 1983/84 from a rice region reported that significant declining trend in rice price occurred. But the author attributed this decline mainly to the policy interventions by the government. Each of the three studies from Pakistan pointed out that up to 1980, the Pakistan government actively followed a price support policy and prevented any fall in the grain price at the cost of the consumers. the effect of the new liberal price regime after 1980 is yet to be assessed. Of the three studies on Bangladesh the earlier studies were very critical of the price support policy of the old government for it's surplus farmer bias at the cost of the interest of the large majority of net foodgrain buyers who generally belong to the poor classes. The latest study carried out during 1987-88 after the introduction of a new liberal price policy mentions some possible positive effects on the welfare of the poor due to a decline in the relative price of rice.

Thus most of the studies suggest that "price of foodgrain" is a highly sensitive politico-economic variable. It's movement therefore can't be determined alone by the economic and technological forces.

Table 2.5 presents the evidences regarding the most controversial issue of the G.R. i. e. the issue of Distributive Impact. Of the nine studies on India in this field four seems to be more or less sure of a negative impact of the M.V. technology on the distribution of income and assets in the rural areas. all these studies were carried out during the early stage of G.R. i. e. the pre 1970 period. Two of these early studies covered the time period up to mid 1970 and their conclusions were a little bit complex.

They held M.V. technology only partially responsible for the observed negative effects on equity. Of the remaining three studies all were carried out at a later period during 1970's and/or 1980's, only one reported that there was noticeable positive improvement in the overall equity situation along with progress in G.R. But even this study also attributed this positive effect on equity to multiple factors. However in the case of India there seems to be a convergence of opinion among all these different authors at least on one point and that is the positive impact of G.R. on absolute poverty.

Three studies were selected from Pakistan for looking into the same issue. Two of their authors categorically asserted about the negative impact of M.V. technology on equity. But both of them held the pro-rich policies of the government to be also partially responsible for such an unhappy outcome. The other third study was based on the secondary sources of data and referred to a long period of 1960 to 1980. It's author reported that in the long run G.R. had even reduced relative inequality in the rural areas of Pakistan!

Of the three studies from Bangladesh two reported positive outcome in terms of reduction of absolute poverty. But in terms of impact on the relative distribution of income and assets, they found it to be negative. Only one study categorically asserted that in the long run the negative equity effect would become predominant, not because of the M.V. technology, but because of structural and institutional constraints. From all these conflicting findings the little consensus that emerges is that M.V. can at best have a direct reducing impact on absolute poverty but that may or may not sustain in the long run, depending upon other accompanying conditions. The direct impact of MV on equity in asset and income distribution is very hard to isolate and therefore it remains an unsettled issue .

Synax Summary

2.5 ~~Synthes~~is Of Empirical Findings

From this brief review of the empirical findings on G.R. in South Asia it becomes clear that most of the early studies ~~on G.R.~~ highlighted ~~had been very harsh and critical about it's~~ its potential negative future consequences. But the more recent studies ~~as argued earlier~~ . brought out ~~the positive~~ its positive consequences. These significantly ~~in general show a more~~ pragmatic attitude towards ~~the G.R.~~ ~~The~~ different empirical findings of these new studies ~~today~~ call for a fresh study of G.R. to re-scrutinize the both earlier earlier findings. This requires preferably a longitudinal set of data covering t~~he old and the~~ recent years ~~as well~~.

"Evidence" is a non-countable notion and has no plural form.

should also include the date of the research study. e.g. Rao (1975) etc.

TABLE 2.1

EVIDENCES ON INTER REGIONAL ADOPTION DISPARITY.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
1. C. H. HANUMANTHA RAO. ( )	DIFFERENT STATES India WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 to 1970.	regional disparity in adoption increased due to unequal distribution of credit and irrigation facility.
2. Biplab Dasgupta Is it in the list of references?	Do.	Do.	MV. technology had a distinct crop bias. Wheat regions performed more efficiently than the rice-regions in terms of both quantity and quality of adoption.
Francis Frankel ( )	Do	1960-70	Policy bias in favour of PUNJAB. especially for Loudhiana in PUNJAB in order to create a show-piece. accentuated the inter-regional bias.
2.G. S. BHALLA AND CHADHA.	PUNJAB (India)	1974 to 1975.	PUNJAB marched ahead of other states in India due to following set of favourable initial conditions: Strong irrigation base. a large group of enterprising middle farmer. cheap institutional credit and high remittance inflow. research support from PUNJAB Agri. University and massive infrastructural investment by the Govt.

Place all the studies in the list of references if they are not there.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
5. HAZELL AND RAMASAMY.	NORTH ARCOT. TAMILNADU.	1973/74 to 1983/84.	Initially the adoption level was much lower than PUNJAB. But it changed from mere 39% to 93% of paddy land . as irrigation facility developed over the study period.
6.M.H.Khan.	PUNJAB and Indus Basin. (Pakistan)		MV. was mainly concentrated in the commercially oriented regi ons. disparity further increased by the biased policy of disbursing credit to the non-subsistence commercial sector.
M. Ghaffer Chaudhury. (Pakistan)	Various Provinces of Pakistan With Especial Focus On PUNJAB. (Pakistan)	1960 to 1980.	green revolution could not widen the income disparity in Pakistan. over time the productivity gap between irrigated and non irrigated land was narrowing down. the poorer provinces of Pakistan were able to increase their share in the gross value of agricultural product of Pakistan in spite of the uneven technological progress.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
8.Leslie Nulty.	Do.	1948/49 to 1970.	the main factor behind regional bias of MV was the regional bias in water distribution. almost 60% of the private tubewells were sunk in west PUNJAB. in sind the problem of salinity prevented it. moreover PUNJAB had a better infrastructure. markets. credit institutions and enterprising farmers. willing to invest in the mv. cultivation of wheat. cotton and rice.
9.Hossain. Mahabub.	Primary Survey of 62 Villages of Bangladesh	1987 to 1988.	multi-variate analysis showed that in Bangladesh the environmental factors were more important than the socio-economic factors in determining the level of mv adoption. two other most important factors were the provision of irrigation facility and electricity supply.
Atiqur Rahman.	Sample Villages and Macro Data.	1980.	mv adoption is relatively higher in the villages where the duration of mv is higher. villages. where govt. has supplied higher level of credit and inputs also enjoy a higher level of adoption.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
Md.Asaduzzaman.	Bangladesh As a Whole.	1980.	since extension facility, fertilizer availability and irrigation facility were unequally distributed across regions, so there was a high regional disparity in adoption. however the socio-economic factors such as inequality in the distribution of land did not affect the level of adoption.

TABLE 2.2

EVIDENCES ON INTRA-REGIONAL ADOPTION DISPARITY.

AUTHORS/ RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
1. C. H. HANUMANTHA RAO.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 TO 1970.	Small farms in general adopted lately in both prosperous and non-prosperous villages.
3. T. J. BYERS.	PUNJAB AND HARYANA.	1966 TO 1971.	Initially there was a rich biasness in all the states of India. Small farms caught up lately but faced two additional difficulties i.e. unfavourable price for both output and input and unequal competition with the large scale mechanized farms.
4. BIPLAB DASGUPTA.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 TO 1970.	Although the technology is scale neutral and most of the inputs are divisible, yet as compared to the traditional technology it required more resources, better managerial capacity and a higher risk bearing capacity. And all these had favored the rich more.
5. FRANCIS FRANKEL	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1960 TO 1970.	Those who lacked cash capital, land and entrepreneurial capacity were not able to adopt. In Punjab and wheat growing regions these factors were less skewedly distributed than in the rice growing regions.
6.G. S. BHALLA AND CHADHA.	PUNJAB.(India)	1974 TO 1975.	There were no adoption bias in favour of the rich in all the three regions of Punjab under study. Mainly because of the universal availability of irrigation facility. However the traditional inverse relationship between farmsize and productivity was weakened or overturned. This was due to the decline in productivity of the small farms as a result of thinner spread of resources over two crops.
7. RAMASAMY, PARAMASIVAM AND KANDASWAMY.	TAMIL NADU, SOUTH INDIA.	1987 TO 1988.	Multi variate analysis shows that the socio-economic variables such as tenancy, farmsize and literacy played a minor role in the determination of the adoption process.
10. M. H. KHAN.	PUNJAB AND INDUS BASIN.(PAKISTAN)		Large farmers pioneered the adoption of MV. and the small farmers followed them. Stronger financial position, superior knowledge, greater access to credit, subsidized inputs as well as price support by the Govt. favoured the rich peasants.
11.LESLIE NULTY.	VARIOUS PROVINCES OF PAKISTAN WITH SPECIAL FOCUS ON WEST PUNJAB.	1948\49 TO 1970.	The large farmers were using more fertilizer, water, tractor and other modern inputs than the small farmers, because of their higher resource endowment.

AUTHORS/ RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
12. M. GHAFFER CHAUDHRY.	DO.	1960 TO 1980.	On the basis of time series data Chaudhry forwarded several novel propositions: a) The fertilizer use per acre was initially higher for the large farms. But over time the gap was reducing and ultimately in 1980 it was equal for both small and large farms. b) The gap in the adoption level measured in terms of percentage of cropped land devoted to MV. also reduced over time and became equal in the case of wheat. c) By 1971-72 seventy nine percent of cropped area of the small farmers were benefitted from irrigation as against only 60 percent of the large farms' cropped area. d) By 1971-72 the cropping intensity of the small farms (122.6) became higher. e) Only for the rice crop (which is not a main crop) the direct relationship persisted.
13. MD. ASADUZZAMAN	BANGLADESH AS A WHOLE.	1980.	There is a direct relationship between farmsize(operational) and proportion of adopters. Extent of adoption is however inversely related with the operational area.Adoption rate does not vary systematically with changes in ownership and tenurial status.Two factors that help small farmers'adoption most are higher consumption pressure and availability of surplus labour.
14.ATIQUR RAHMAN.	DO.	1980.	Adoption rate is directlybutadoption intensity is inversely related with the farmsize. MV rate of profit is higher than traditional variety for all seasons and across all classes. But the gap is higher for the large farmers. Productive investment per acre also varies directly with farmsize.
15.MAHABUB HOSSAIN.	VILLAGES IN BANGLADESH.	1987 TO 1988.	Previously small farmers could not adopt more in the dry season because water was costly. in wet season there was no such bias even at the early stage. With time as water and credit became available to more and more farmers. the adoption intensity as well as fertilizer use per acre became inversely related with the farmsize. Small adopted more because of higher subsistence pressure.

TABLE 2.3

EVIDENCES ON MECHANIZATION AND EMPLOYMENT.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
1. C. H. HANUMANTHA RAO.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 TO 1970.	New technology had a huge positive impact on employment per acre. if its' bio-chemical character is maintained. Even with partial mechanization the impact remains positive. With complete mechanization the impact becomes uncertain. the wage rate also increase due to improvement in the quality and productivity of labour.
2. T. J. BYERS.	PUNJAB AND HARYANA.	1966 TO 1971.	MV in the longrun induces mechanization in the fields of ploughing. threshing and harvesting. This results in slower growth of demand for hired labour. Mechanization is induced by high wage rate. time constraint due to double cropping and scarcity of labour during the peak period. Economy of scale becomes positive with mechanization. Large farms evict tenants in the wake of mechanization.
3. BIPLAB DASGUPTA.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 TO 1970.	In the long run MV. induces mechanization. However labour saving effects of mechanization has been more than offset by the labour increasing effects of MV.
4.HAZELL AND RAMASAMY.	NORTH ARCOT. TAMILNADU. SOUTH INDIA.	1973\74 TO 1983\84.	Mechanization occurred in the fields of irrigation and threshing. Per hectare employment loss due to mechanization had offset the employment gain of the new technology. But still real agri. wage increased at a lesser level of agri. employment due to the withdrawal of the small farmers from the hired labour market as well as the increase in the off-farm activities.
5. BLYN. GEORGE.	PUNJAB.	1966 TO 1979.	Tractorized farms provided more employment per hac. for the hired labour than the non-tractorized farms. Tractorized farms show a negative rate of return if the imputed values of self labour and land rent is taken into account. But if the imputed values of the social and family use of tractors. income from hiring out tractors. etc. are taken into account. the net return turns positive. Tractorization led to multiple-cropping by reducing turn-around time. It also reduced the fodder need. A minimum of 25 acres of land is required for making tractorization profitable.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
6. M. H. KHAN.	PUNJAB AND INDUS BASIN.(PAKISTAN)		Premature mechanization took place and per acre labour use declined. However, per acre hired-labour use did not decline.
11.LESLIE NULTY.	VARIOUS PROVINCES OF PAKISTAN WITH SPECIAL FOCUS ON WEST PUNJAB.	1948\49 TO 1970.	Premature mechanization artificially accelerated by the Govt. policies resulted in: a)Decrease in labour use per cropped area. b) Eviction of tenants. c)Concentration of operational land in a few hands through inverse share-cropping and land purchases.
12. M. GHAFFER CHAUDHRY.	DO.	1960 TO 1980.	The labour replacing effects were offset by the labour increasing effects of MV. Tractor was used in Pakistan for ploughing only, where labour replacement was very little. The real rural wage increased in Pakistan from 1951-52 to 1974-75. And the rate of increase was higer after late sixties. But that was actually the hay period of GR.
13.MD. ASADUZZAMAN.	BANGLADESH AS A WHOLE.	1980.	Mechanization is rare except in the field of irrigation. MV. technology is labour augmenting but does not create any employment opportunity for the hired labourers since most of the incremental labour demand is fulfilled by using family labour.
14.ATIQUR RAHMAN.	DO.	1980.	MV. is continuing without mechanization in Bangladesh. But with mechanization in future there will be a need for concentrating land in the hands of the large farmers and also creation of alternative employment opportunity for the small plot holders.
15.MAHABUB HOSSAIN.	62 VILLAGES IN BANGLADESH.	1987 TO 1988.	In Bangladesh mechanization is rare. Only two out of sixty-two villages reported the use of power tiller and thresher.

TABLE 2.4

EVIDENCES ON PRICE EFFECTS.

AUTHORS/ RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
1. C. H. HANUMANTHA RAO.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 to 1970.	In spite of increase in supply of wheat. the wholesale price of wheat did not fall in PUNJAB due to three reasons: a)Rising demand for wheat due to population increase and per capita income increase in the local area. b)Export of wheat to other areas. c)High procurement price policy of the government.
2.G. S. BHALLA AND CHADHA.	PUNJAB.(India)	1974 to 1975.	The marginal and small farmers can meet three-fourth of their consumption needs from their home production of cereal. They are forced to buy one-fourth of their consumption need from the market in the lean season when the price is considerably higher than their harvest time selling price.
3. BLYN. GEORGE.	PUNJAB (India)	1966 to1979.	The upward movement of money wage rate was often offset by increase in the consumer price index for the landless labourers. both in Punjab and Haryana. Time distribution of changes showed labourers getting real gains in the late 1960's followed by labour loosing ground in the early 70's then gaining again in the middle of 1970's.
4. MURRAY J. LEAF.	PUNJAB (India)	1965 t0 1978.	Before the advent of marketing co-operatives the producers had to accept very low price for wheat during harvest season. From 1968 co-operatives began operating in a large scale manner with the help of government credit. Thus the low price ceiling has been replaced by a high price floor.
5. HAZELL AND RAMASAMY.	NORTH ARCOT. TAMILNADU.	1973/74 to 1983/84.	During this period the buying price of rice for the landless and small farmers declined by 11 p. c. Whereas for the large farmers it declined by 17 p. c. Most of these price declines were due to government policy of subsidized rationing in the rural areas in 1982\83. Thus as subsidy was withdrawn in the next year price rose again by 20 p.c.and 25 p.c. respectively.

AUTHORS/ RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
6.M.H.Khan.	Punjab and Indus Basin. (Pakistan)		Pakistan government generously supported the surplus farmers by offering price subsidy and input subsidy. Both these subsidies not only caused allocative inefficiency but also imposed a social cost in general upon consumers who were deprived from cheaper import of cereals.
7.M. Ghaffer Chaudhury. (Pakistan)	Various Provinces of Pakistan With Especial Focus On Punjab. (Pakistan)	1960 to 1980.	Liberal input subsidies and active price support in the 60's promoted the cause of G.R. In the 80's both were withdrawn and this would most likely slow down the pace of G.R.
8.Leslie Nulty.	Do.	1948/49 to 1970.	The incentive to produce and sell the surplus did not dampen in Pakistan due to generous price support by the Pakistan Government. Also industrial growth and population increase facilitate the marketization of the surplus grain and raw cotton further.
9.Hossain, Mahabub.	Primary Survey of 62 Villages of Bangladesh	1987 to 1988.	Fall in the relative price of rice helped to increase the welfare of those who spend greater portion of income on rice. It also encouraged cropping diversity.
10.Atiqur Rahman.	Sample Villages and Macro Data.	1980.	Subsidies and price support by the government failed to benefit the smaller farmers much and could not also initiate a self sustaining agricultural growth led by the large farmers.
11.Osmany and Quashem.	Bangladesh As a Whole.	1983	Input subsidy was enjoyed by both poor and rich farmers and perhaps relatively more by the poor farmers but the price support policy was relatively more beneficial for the rich surplus farmers.

TABLE 2.5

EVIDENCES ON INCOME-DISTRIBUTION EFFECTS

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
1. C. H. HANUMANTHA RAO.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 TO 1970.	All classes were able to improve their incomes through GR. But the income gain of the pure tenants, landless labourers and small farmers were relatively less. However the distribution of operational land in Punjab had become slightly more egalitarian during 1953/54_1961/62.
2. BARDHAN, PRANOB.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON WEST BENGAL.	1965 TO 1975.	Proletarianization is not significantly correlated with GR. Actually the proportion of agri. labour was lower in the more successful areas of GR. But the absolute number of proletariat increased in Punjab over time due to either eviction of tenants or drying up of the employment opportunity of the artisans and traditional craftsmen.
3. T. J. BYERS.	PUNJAB AND HARYANA.	1966 TO 1971.	Distribution of operational land during 1966-71 had become further unequal due to eviction of small tenants and inverse sharecropping. The distribution of non land inputs also became more unequal. Increased incidence of pauperization among the artisans was observed. The gain of the poor from the adoption of MV. was considerably less than that of the rich.
4. BIPLAB DASGUPTA.	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1965 TO 1970.	New technology accentuates inequality by: a) making distribution of income more skewed. b) Making the distribution of the operational land more unequal. c) Making non-land resource distribution more unequal. d) Weakening and/or replacing the traditional inverse relation between farmsize and productivity with direct relation.
5. FRANCIS FRANKEL	DIFFERENT STATES OF INDIA WITH SPECIAL FOCUS ON PUNJAB AND HARYANA.	1960 TO 1970.	In punjab majority of the farmers had 15 to 20 acres of land So they could maximize their gain from the GR. by adopting widely, accumulating surplus and investing them productively to ensure a self sustaining growth. But in other places although small farmers did adopt MV. in the longrun yet the gain was so small that atbest they could only attain a slightly better balance between the rising demographic pressure and the rising income. In the absence of counterveiling policies such trend would continue.
6.G. S. BHALLA AND CHADHA.	PUNJAB.(India)	1974 TO 1975.	The gains of the new technology has been distributed more or less in proportion to the initial land holding position. Since land was distributed unequally so the gain was also distributed unequally. The exception was the small farmers of Punjab. They were able to increase as much total output and farm income per acre as their bigger counterpartsThey were able to achieve this by attaining a much higher cropping intensity through a year round rational use of their family labour.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
7. RAMASAMY. PARAMASIVAM AND KANDASWAMY.	TAMIL NADU. SOUTH INDIA.	1987 TO 1988.	Although labour income tends to be equalized. income inequality arising from the differential returns to land contributes to accelerate overall income inequality under MV. technology. This effect is partly mitigated by alternative income from non MV. sectors for the poor.
8.HAZELL AND RAMASAMY.	NORTH ARCOT. TAMILNADU. SOUTH INDIA.	1973\74 TO 1983\84.	Sizable gain in terms of income. employment and quality of diet were achieved by all rural households. Inter household income and land distribution did not worsen. Following features were instrumental in realizing this favourable equity effect of GR. a) The absence of domination by a few large farmers and absence of tenant eviction. b) The proportion of agri. labour declined due to large scale shift in their occupation towards off-farm sector. c)Real wage of agri. labour increased but not as much as to induce tractorization. d) Govt. actively tried to make credit and modern inputs available to the small farmers .
9. BLYN. GEORGE.	PUNJAB.	1966 TO 1979.	In terms of gross output value per hactar the gain of the small farmer was larger. In terms of net farm income per hactar the evidences were contradictory. Gain of the labour also increased more due to increase in employment than rise in wage rate.
10. M. H. KHAN.	PUNJAB AND INDUS BASIN.(PAKIST AN)		GR. accentuated the inequality of income and land. Govt's pro-rich policies further fuelled the process.
11.LESLIE NULTY.	VARIOUS PROVINCES OF PAKISTAN WITH SPECIAL FOCUS ON WEST PUNJAB.	1948\49 TO 1970.	The benefits of GR. was distributed unequally due to rich biased adoption. pro-rich credit and price policy and absence of landreform.
12. M. GHAFFER CHAUDHRY.	DO.	1960 TO 1980.	GR. instead of widening , reduced income inequality in Pakistan. For example. a) Use of fertilizer and MV. seeds were invariant with respect to farmsize. b) Tubewells and tractors though physically indivisible but their services are divisible and they have been used by the small farmers to achieve required degree of cropping intensity. c) Higher labour input. more intensive land use. greater manure application and lower managerial costs have made the small farms more productive than large farms. d) Decrease in the number of tenant households was more due to availability of alternative jobs than eviction. e) Average agri. real wage rate had increased at a higher rate than agricultural income and f) The policies of price support and input subsidy were helpful for both small and large farmers.

AUTHORS/RESEARCHERS	STUDY AREA	STUDY PERIOD	FINDINGS
13.MD. ASADUZZAMAN.	BANGLADESH AS A WHOLE.	1980.	Gross yield rate does not vary systematically with variation in farmsize among the MV. farmers. In terms of net yield rate small farmers are more efficint. Thus as a whole greater portion of the incremental gain of GR. went to the small farmers. However the non adopting landless labour, smallfarms and tenants relatively went down so much that the overall income inquality did not improve. But absolute level of income improved for all classes.
14.ATIQUR RAHMAN.	DO.	1980.	The larger the farm size, the higher is the gross yield or net yield or profit per acre on account of transition to MV. from LV. The large farmers were able to consolidate their position further by lending their surplus at a high interest rate and also by charging a higher rent for the leased out land.
15.MAHABUB HOSSAIN.	62 VILLAGES IN BANGLADESH.	1987 TO 1988	MV. reduces absolute poverty. The total gain of MV. is shared by all factor, relatively more by the capital and land at the expense of labour. Gini ratioes across the different villages with different levels of adoption were same, implying that the MV. had a neutral impact on the distribution of income. However the inequality in household income from rice cultivation alone increased with the adoption ofMV.

CHAPTER III

METHODOLOGY

3.1 Objectives

The general objective of this thesis is to reconcile the conflicting views on MV-Technology/Green Revolution by reexamining some old areas of controversy .

The specific objectives are:

a) To ~~Examining~~ examine the differential patterns of adoption across classes and regions.

b) To ~~Examining~~ examine the different patterns of factor market adjustments in the post adoption phase.

c) To ~~Examining~~ examine the implications of the rural factor market adjustments for the relative inequality across classes.

An in-depth examination of the above processes may unearth the real issues and help to bridge the conflicting views on the nature and consequences of the Green Revolution/Mv-Technology.

3.2 Broad Approaches For Assessing MV Impact

~~So far we observe~~ There are mainly three different approaches towards the study of relative gain from the M.V. technology across classes and regions [Lipton and Longhurst, 1989].

1. Adding up of partial equilibrium results,
2. General Equilibrium Approach and
3. Political economy approach.

Each of the above approaches has been identified and critically reviewed by Lipton and Longhurst [Ibid. 1989]. Lipton ~~was~~ and Longhurst were most critical of the first approach, pointing that the rosy picture suggested by the first approach about the effects of M.V. for the poor was not fully consistent with the reality. According to him ~~them~~ the two major limitations of the "adding up approach" were its failure to reconcile the various effects of M.V. on the poor as farmer, consumer and worker before adding them up. Stet

Lipton and Longhurst,
According to ~~them~~ the second approach is superior to the first because of two reasons:

1) It examines not only the direct short-run impacts of the M.V. technology on its adopters,(e.g. change in the production consumption and allocation of resources of any adopting household in isolation from others and summing up the results!) but also examines the long-run chain effects transmitted through various markets (b ~~B~~oth factor markets and product markets) on the non adopting as well as other adopting households within the same locality. Moreover, if the local markets are integrated with markets of other regions, then the study should encompass the long run chain effects upon the non M.V. regions too. But ~~we should not forget that~~ the second approach also has its own limitations. For example, any neoclassical general equilibrium model as developed by its original authors (Walras 1902, Arrow 1968) has ~~have~~ to abide by ~~quite~~ a few restrictive assumptions such as :

a) No economic agent can influence the price.

b) Everybody tries to maximize utility as a consumer and profit as a producer.

c) Except land all factors of production are perfectly mobile and even land can also easily shift from one use to another.

comment: Sophisticated models can now take care of these problems.

d) No resources are left unused unless it's net return is negative. etc.

It is wellknown that such assumptions hold good only under perfectly competitive product and factor markets with no transaction cost. But in most of the developing countries the rural market structure does not approximate these ideal characteristics of a perfect market. For example generally we find extra labour force involuntarily unemployed in almost all rural labour markets in less developed countries coexisting with a non decreasing positive wage rate. We also find highly unequal distribution of resources along with highly unequal market power among the economic agents, competing in the same markets. This unequal market power is generally further intensified by biased policy interventions of the state in the market processes.There is also a relatively higher degree of asymmetry of information, risk and transaction costs among the participants of a rural market.Finally we find persistent presence of various special tenurial arrangements like sharecropping, mortgaging, interlocking of labour and land transactions, etc. all of which are quite different from the relatively homogeneous system of owner operated competitive capitalist enterprises.Because of the non fulfilment of the assumptions of perfect competition as well as the presence of the above mentioned particular characteristics, in the rural markets of the less developed countries, the actual consequences of M. V. adoption may deviate there considerably from what is predicted by a perfectly competitive general equilibrium model.

2) Besides like all other timeless static equilibrium models it can't describe the real adjustment processes. and the time required for such adjustments. Thus though general equilibrium predictions are often claimed to be true in the long run but the actual duration

of this long run remains unknowable. But in spite of all these limitations general equilibrium model of measuring M. V. induced changes in the distributions of income and wealth is superior to the commonly used method of adding up partial equilibrium results. Moreover these weaknesses mentioned above can also be cured partly by replacing the unrealistic assumptions of the neoclassical general equilibrium models with more realistic ones and/or supplementing it with other variants of general equilibrium models e. g. keynesian model of equilibrium with unemployment, input-output model with detailed tracing of linkages [Lipton et. al., 1989].

However there is still one incurable weakness of C.G.E. models for which we need to supplement it with the political economy approach of assessing impacts. This weakness lies in it's inability to incorporate the interactions between state policies and the beneficiaries of those policies as an endogenous variable. However, in an interesting exercise on simulative C.G.E. model made by Allain De Janvry and Sadoulet E., it was even possible to incorporate various alternative policy variables in order to examine their differential impacts on the overall equilibrium situation. But there it had been treated as an exogenous variable. But in practice the new technology does not operate in a social vacuum. Since there is always present a definite power structure in every village society which is also highly responsive to any new technology introduced in the village, so the final effect of the M.V. adoption would considerably depend upon their response pattern especially, on how the local power blocs interact with the national power blocs to influence the policy regime in favour of itself. But these aspects fall outside the domain of traditional neoclassical economics and have been more successfully analyzed by the political scientists and sociologists. However not all of these politico-economic studies are equally

reference ? It is also not there in your reference list.

would you refer to some of them to illustrate your point ?

worthy. Some of these studies are highly subjective and have a tendency to overestimate the power of the power blocs. It was predicted by most of the political economists that after the introduction of M.V. the powerful classes of the village would be able to control the product and factor markets completely and even if the natural economic forces of market go against them, they would be able to compensate that loss by obtaining special favours from the government, in the form of subsidized inputs, tax rebates, price support, favourable exchange rate etc. Some of the overenthusiastic political economists even went as far as to see the long run possibility of turning the green revolution into a red one due to it's socalled polarization and/or pauperization effects on the countryside. But they also did not define the "longrun" specifically.

where? and who?

Meanwhile careful empirical studies showed that these predictions did not come true in many places ~~within a reasonable period of time.~~ The longrun outcome for the poor was also found to be not as worse as was predicted by their early proponents on the basis of just first round impacts of M.V.

Thus it is believed that the general equilibrium approach and the political economy approach may supplement each other and also overcome the limitations of short run single round impact studies. This then may pave way to a more holistic assessments of the impacts of M.V. technology on the distribution of income, assets and rural power in the rural areas of the developing countries. ~~Although Lipton et. al. in their review~~ ~~and Longhurst~~ of these approaches ~~did not make~~ such a choice explicit, yet it follows from their discussion that the best approach to asses ~~the M.V. impact on the distribution of income, asset and~~

no need to repeat the same point

power would be the combination of the second and the third approaches i. e. general equilibrium approach supplemented by political economy.

3.3 Limitations Of Former Approaches Of Studying MV Impact

The most common method of studying technological impact is to choose two sample areas of which one has a considerable progress in the adoption of the technology and the other has none or lags far behind. Then the relevant impact indicators for the two areas are compared to find out the significant differences that may be attributed to the technology factor. This method is very common and already a few studies have been done in Bangladesh by using this method.[Hossain,1988 and Hossain. Quasem. Mokaddem and Jabbar, 1991] However the most common limitation of this type of studies is the lack of a proper control.These studies intrinsically assume that the two areas compared differ only with respect to their technological development level. But this is rarely true. Hence other factors may come into play and modify the original consequences of the MV. technology in the relevant areas.

good

This is indeed a familiar problem and is termed as "lack of proper control". Generally researchers try to solve this problems by focusing on " Before-After" comparison of the same area. Since this type of survey is based on the dynamic longitudinal data for the same area, so the problem of proper control becomes partly solved. The another utility of such dynamic longitudinal data is it's superior ability to address the questions regarding "dynamic tendencies" of the relevant variables. In our context a dynamic longitudinal data set can enlarge the scope of empirical analysis and provide answers to the following set of non traditional but relevant questions:

However, there may be other dynamic factors may be at play such as population growth

1) What happens to inter-regional adoption disparity? Does the gap increase, decrease or remain constant over time?

2) As time passes on, what happens to the inter-regional wage gap and land price gap?

3) What type of factor market adjustments take place in :

   a) region which remains static at a high level of MV technology for a long time.

   b) region which remains static at a low level of MV technology for a long time.

4) What happens to the distribution of income and wealth of a village when it climbs up through the ladder of MV adoption?

5) Are the so called "positive impacts" (e.g. reduced absolute poverty, increased real wage and/or employment, increased productivity, increased cropping intensity, increased marketable surplus, lower incidence of distress sales, increased incidence of efficient tenancy, etc.) of MV technology real and sustainable over time?

6) If these "positive impacts" are not sustainable, then which factors or what new changes were responsible for offsetting them?

7) Are those factors or changes intrinsically connected with the MV technology or arises from exogenous sources?

3.4 <u>New Type Of Survey Data</u>

Since the present thesis also aims to find out answers to the special set of questions mentioned in the previous section so traditional cross-section data covering one

MV. area and another non MV. area will prove to be inadequate. We shall need an appropriate type of longitudinal survey data. What we mean by "appropriate longitudinal survey data" can best be illustrated with the help of the following 3*3 matrix.

CHART: 1

APPROPRIATE LONGITUDINAL DATA: AN ILLUSTRATION

PAST TECHNOLOGICAL STATUS	PRESENT TECHNOLOGICAL STATUS		
	High	Medium	Low
High	1	4	7
Medium	2	5	8
Low	3	6	9

The above "3 by 3" matrix is based on the possible technological status of an area chosen for study during two different points of time. From this Chart we can easily identify nine possible paths of technological progress for an area within the period chosen for the study.It will also be clear from the Chart that category-1, category-5 and category-9 represents those areas which remain persistently at the same level of technological status. Possibly these areas can be taken as the areas where technological development has reached relatively a stable state.

Among the six other possible non stable cases category-3 and category-7 are most interesting. They represent the two most common paths of technological change. Category-3 represents those areas where a considerable technological progress has been taking place within the chosen time period. While category-7 represents those areas where a significant technological reversal has been taking place within the chosen period of study.

Now, if we can have longitudinal panel data about atleast four different types of areas e.g.

a) technologically stagnant villages:

   1) stagnant at a low level of technology (Category 9)

   2) stagnant at a high level of technology (Category 1 and 5)

b) technologically dynamic villages:

   1) technologically progressive village (Category 2, 3 and 6)

   2) technologically regressive village (Category 4, 7 and 8)

then we can easily make before-after comparative exercises of the relevant variables for the progressive, regressive and stagnant villages. All these comparisons are relatively free from the limitations of the previous studies and may shed new light on the prevailing controversies about the longrun holistic impact of MV. If such a set of data is available then we will also be able to address the relevant non traditional questions raised by us before.

3.5 <u>Sources Of Panel Data</u>

Panel data generation requires at least two surveys of the same unit of study at two different points of time . Since village is the natural unit of our study, so we have to carry out a survey of the same village atleast twice with a considerable time gap between them.[22]

Fortunately at the beginning of this study we had with us a primary base-line survey data on the impact of MV. technology for 62 randomly selected villages of Bangladesh. That data referred to crops grown in 1987. This survey was carried out jointly by Bangladesh Development Institute (BIDS.) and the Bangladesh Rice Research Institute(BRRI.) It was financed by IRRI. under it's cross country "Differential Impact Study" project. A multi stage random sampling method was used to select 62 sample villages for the study. Prior to an in-depth survey at household level, a census of households residing in all these 62 villages was conducted to gather data on the size of the household, ownership and the utilization of land, major sources of income , the type of housing, the age and educational status of the head of the household. The households were then classified into four landownership groups (1) functionally landless i.e. having less than 0.2 hectares, (2) small owner,i.e. having 0.2 to 1.0 ha., (3) medium owner, i.e. having 1.0 to 2.0 ha., (4) large owner i.e. having 2.0 ha. or more. Each of the landownership groups was again classified into two groups according to whether the household is engaged in tenancy cultivation or not. After that 20 households were selected out of these 8 strata using the proportionate random sampling technique from each village. In a few village the sample size was 21 because of rounding error. The total size of the sample so selected was 1245 households, who were subjected to in-depth enquiry.

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[22] Since the longrun impact of MV. technology is also influenced by the interactions with the national factor market, national product market and national policy variables so we should supplement our micro study with macro study as far as possible.

In addition, a detailed survey on input- output was done for a small sample of purposively selected plots for studying the cost and return of MV's as compared to that of the traditional varieties(TVs). This input-output information was collected from five cultivators from each of the 62 villages for the major crop varieties grown in the village. The sample respondent was asked to give information about atleast one plot which was relatively free from draught and flood. One respondent was selected from each of the following five tenurial groups e.g. (a) small owner cultivator, (b) small tenant cultivator, (c) medium owner cultivator, (d) medium tenant cultivator, and (e) large owner cultivator. Thus, 60% of the sample plots has been drawn from the owner-cultivator group, which is the proportion of owner farmers in the country as a whole. Later on the above mentioned surveys in these 62 villages have been used by many other researchers repeatedly as a suitable benchmark study for further studies.[23] This is so because some of the estimated parameters of this sample were remarkably close to their national counterparts [see the Table 3.1]. This also implies the highly representative nature of the DIS' villages survey data.

We use this benchmark study to generate panel data. As mentioned before we administered a new census of all households in each of the five purposively selected villages.[24] We used the same questionnaire which was used five years ago by the DIS researchers for an in-depth survey of their selected 20 households coming from each village. These households as described before, were previously selected carefully by

[23] Please see the study on POVERTY SITUATION IN BANGLADESH by Hossain, Zillur, and Sen.

[24] The selection criteria for these villages have been discussed in detail in a latter section of this chapter.

using stratified random sampling technique so that they could represent the class structure of their villages as much as possible. However in our later census instead of twenty we covered all the households residing in the village at the time of the survey. In this way we hoped to generate panel data for the 100 DIS households from the five selected villages at least for two different periods. But after the new census we could re-identify only 16 households out of the old 20 from Darikamari, 13 out of the old 21 from Patardia, 14 out of old 20 from Baikunthapur, 17 out of old 20 from Shankarpasha and 16 out of the old 19 from Mailmara. In all we could re-identify seventy six old households out of the old set of hundred belonging to the old DIS sample. Thus we were able to generate longitudinal panel data for at least seventy six households from our five different selected villages. The panel size of each village is very small indeed. But we could not help it because we were constrained by the small number of the selected villages as well as by the sample size of the previous survey of each of these villages under DIS. But we hope that they will still be helpful in tracing the significant changes over time at household level. And also, whenever possible, we can supplement our panel findings with that from our village censuses. Our village censuses had covered respectively 181 households from Darikamari, 131 households from Patardia, 120 households from Baikunthapur, 269 households from Shankarpasha and 149 households from Mailmara. Thus altogether we covered 850 households, which as a study sample is not at all small by any standard. Even when the villages are divided into two broad groups such as technologically developed and technologically non developed, the respective sample sizes remain large enough (432 for the MV. villages and 418 for the non MV. villages).[25]

[25] The definition of MV and non MV villages are discussed in detail in a latter sections of this chapter.

3.6 Selection Of Sample Villages

It would have been best if we could resurvey all the 62 DIS villages and generate a panel of 1245 households for our study. But financial constraint did not allow that. Instead, we selected only five villages purposively with chosen physical characteristics from the set of 62 villages. The villages that we selected are of three types. One type consists of villages with high level of modern variety cultivation. The other type consists of villages with medium level of MV and the last type is the low MV village. The two out of five villages are high MV villages and their native names are "DARIKAMARI", and "PATARDIA". The two other selected villages are named "SHANKARPASHA" and "MAILMARA" and they were selected as low MV villages. The last other village "Baikunthapur" was selected as a medium level of MV Village.

DIS researchers previously tried to characterize the production environments of all the 62 villages, they had surveyed. Their exercise led them to identify broadly five types of production environments. They are -:

1) IRRIGATED VILLAGES.
2) DROUGHT-PRONE VILLAGES.
3) FLOOD-PRONE VILLAGES.
4) SALINE AFFECTED COASTAL VILLAGES.
5) FAVOURABLE RAINFED VILLAGES.

The exact definition of these production environments are reproduced below:
Irrigated Villages: "This group includes villages where more than 50 percent of the arable land have been covered with modern irrigation facilities. This group has been separated

out because unfavourableness due to natural factors (e. g., flood or drought or low rainfall.) would be compensated by man made interventions for water control."

Drought-Prone Villages: "This group includes villages where average rainfall is less than 1800 m.m., and more than 50 percent of land are not flooded at all, irrigation coverage is less than 50 percent".

Flood-Prone Villages: "This group includes villages where more than 50 percent of the land is flooded at a depth of more than 30 cm., and where irrigation coverage is less than 50 percent".

Saline Affected Coastal Villages: "This group includes villages that are situated near the coastal belt. Since only ground water can be used here for irrigation, so the extent of irrigation in these villages is far below 50 percent. These villages generally suffer from saline water intrusion particularly during the dry season".

Favourable Rainfed Villages: "This group includes villages which are not covered under any of the above mentioned groups. These villages are shallowly flooded and have medium or high intensity of rainfall."

It would be interesting to see how our selected villages are placed in the above classification scheme and whether there exists significant correlation between these production environments and their corresponding extent of MV cultivation. In order to find, that we have used the village level extensive and intensive survey data of DIS collected in 1987-88. The relevant data from these sources pertaining to our sample villages are presented in the Table- 3.2.

The Table shows that the extent of MV cultivation was in general higher in the dry season for all the villages in our sample. It also shows that the extent of MV cultivation varied widely among the sample villages in 1987-88. In three of the five villages the extent of MV during the wet season varied between 15 to 50 percent. In the remaining two villages the extent of MV in the wet season was actually nil! In the dry season the extent of MV varied in the first three villages from 25 percent to 90 percent while that in the remaining two villages varied from only 2 percent to 8 percent. These findings denote that in terms of the level of technological development there actually exists different types of villages in our sample. The first two villages (Darikamari and Patardia), in spite of their wide intra-household disparity in MV adoption can be distinctly separated from the remaining three villages as relatively "High MV" villages. On the other hand two other remaining villages (Shankarpasha and Mailmara) can safely be put under the "Low MV" category of villages on the basis of the 1987-88 data. The last remaining village Baikunthapur, as the Table 3.2 shows, has an in-between medium level of MV cultivation.

Table 3.2 also presents the findings of the DIS extensive village level survey on the extent of irrigation, salinity and rainfall in the respective villages. Combining these physical features with the extent of MV. cultivation we can easily locate each of these villages into one of the five production environments defined before. As expected the "High MV" villages are located in either "irrigated zones" or in the so called " Favourable rainfed zone".[26] Of the two "Low MV" villages one (Mailmara) is located

[26] We have called the production environment of Patardia "Favourable" rainfed instead of simply "Rainfed" because it was a borderline case between "Irrigated" and simple "Rainfed" production environment.

in the "saline prone" zone and the extent of MV. cultivation was naturally nil there. The other "Low MV" village(Shankarpasha) although located in the so called "rainfed zone" had only 8 percent of area under MV. during the dry season in 1987-88 which may be due to it's extremely low level of irrigation at that time. In the wet season the extent of MV. was also nil in Shankarpasha which can also be explained by natural factors. Table 3.2 also shows that the average land height of Shankarpasha is medium and the average rainfall intensity is as high as 1867 mm per year. The village is also very near from the mighty river Padma. Thus in the rainy season MV. cultivation is not possible in most of the land of this village since they get shallowly flooded with rain and overflowing river-water. The so called medium MV village is situated in the "Draught-Prone" North Bengal and naturally it's extent of MV was contingent upon the availability of irrigation water. Our above analysis of the DIS data for the period of 1987-88, on our sample villages, shows clearly why Dis researchers had given such a critical importance to the "irrigation facility" for determining the extent of MV. It also shows that man made irrigation can easily overcome the natural constraint of draught-proneness against MV. specially during the dry season.But the constraint of flood often requires other physical constructions which may be harder to manage at individual level. That is why in Bangladesh the prospect and extent of dry season MV is better.

3.7 Sample Villages: Socio-Economic Features

The village level 1987-88 extensive data collected under DIS can be used to have a broad overview about the initial socio-economic characteristics of our selected village in 1987-88. The relevant information from the survey are presented in the Table 3.3.

From our previous discussion we know that the first village in the Table called "Patardia" was a high MV. village and is situated in "Favourable rainfed" environment. Now from the Table 3.3 we also see that it was in 1987-88 a relatively densely populated area as compared to our other sample villages. Average per capita owned land availability was only .085 hectares. The average farmsize was also as low as .52 hectares. The cropping intensity of this village was about 169 percent. Ninety percent of households of this village had farming as their main occupation. The distribution of land was more egalitarian than what it was in other sample villages. The proportion of functionally landless households was only 26 percent and there was no big farmer(i.e. farmers with owned land above 750 decimals) in the village. The real harvesting wage rate was equal to 4.49 kg. of MV. paddy. The incidence of out-migration of labour was as low as 5 percent of the total agricultural labour households. The village had access to electricity and it is also well connected with urban centres.

The second village in our sample is called Darikamari. According to our previous classification it is also a high MV. village, situated in the "Irrigated" production environment. The per-capita owned land as well as the average farmsize were also low here and quite similar to that of Patardia. Cropping intensity was 157 percent which was slightly lower than that in Patardia. However the major difference from Patardia lied in the non-farm character of its population. Almost 50 percent of its households had non farming as their main occupation. The land distribution was also not like Patardia. It was highly unequal. Sixty three percent of all households in this village belonged to the functionally landless group and the top land-owners owned 22 percent of the total owned land. In spite of such a high inequality the harvest wage rate in this village was significantly high (almost 8 kgs. of MV. paddy) in 1987-88. The incidence of out-migration of labour households was also nil. The village got access to electricity in 1987-88 and was well connected with the urban centre.

The third village of our sample called "Baikaunthapur" is technologically the medium level village among the set of our five MV. villages. It is situated in the unfavourable draught-prone northern zone of Bangladesh. The density of population is relatively lower in this part of our country. This village had .25 hectares of per capita owned land which is the highest in our sample. The average farmsize is also the highest ;it is about 1.09 hectares. In spite of a lower level of MV. adoption the cropping intensity of this village was higher than that of other MV. villages(189 p.c.). But that did not necessarily imply higher agricultural affluence since it might be a result of non profiTable minor cropping. However the land in this village was distributed very unequally. About 56 percent of households were functionally landless and about 52 percent of all land belonged to the big land-owners. The real harvesting wage rate of this village was also the lowest in our sample; only about 4kgm of MV. paddy. The village is situated in a remote area and even the nearest bus-stop is 8.3 miles away from the village. Yet the labour households in this village had a higher rate of seasonal out-migration. In 1987-88 virtually all the households of this village were mainly engaged in farming.

The fourth village in our sample is a low MV. village named Shankarpasha; situated in the "rainfed" production environment. It faces shallow flood problem in the wet season. It is the most land scarce area in our sample. The size of per-capita owned land was only .073 hectares and the average farmsize was only .39 hectares in 1987-88.

The cropping intensity of this village was also the lowest among our sample villages (only 108 p.c.) The land was distributed quite unequally. The real harvest wage rate for the agricultural labour was dismally low (only 3.73 kgs. of MV. paddy). Even then the extent of out-migration among the labour households was only 10 percent. The village did not have any electricity connection till 1987-88. But it had a good communication with the nearby urban centre through buses. Overwhelming majority of this village (about 75 percent) had farming as their main occupation.

The last village in our sample is named "Mailmara". It is situated in the saline-prone area and MV cultivation was naturally impossible here. But still it was not as backward and poor as the other low MV. village "Shankarpasha". It's average per capita land, average farmsize and cropping intensity all were higher than that of Shankarpasha in 1987-88. The land distribution was also relatively more equal in this village. Functional landless constituted only 23 percent of all households. 90 percent of all households have farming as the main occupation. The harvest period nominal wage rate was only taka 30 which was still 50 percent higher than that in Shankarpasha. The real wage rate in terms of MV. paddy could not be estimated, because the village lacked any MV. cultivation. The village had access to electricity but was not well connected with the urban centres. The nearest bus-stop was 8.3 miles away from the village.
From the brief overview of the socio-economic features of our five sample villages, based on 1987-88 DIS data it becomes clear that our sample villages initially not only varied with respect to their extent of MV cultivation but also with respect to some other important socio-economic variables like density of population, farmsize, cropping intensity, distribution of land, labour market situation and the extent of involvement in

the non farm sector. These differences are clearly revealed by the extensive survey data of the year 1987-88. Since we also have our own survey data for the year 1992-93 so we shall have the chance to see latter how these inter-village differences developed over time. Besides, this brief overview also establishes our old methodological point that simple comparison of a high MV. village with a low MV. village may become misleading because there often exists some significant socio-economic differences between them which generally influences the over all impact of the MV technology.

3.8 Sample Villages: Technological Dynamics

DIS

We have used the 1987-88 Dis extensive survey data and our own 1992-93 survey on the same five villages to find out first the extent of MV. cultivation in our sample villages for the two survey periods. Then after comparing these average village level adoption with the national average figures of the extent of MV. cultivation in Bangladesh during both dry and wet seasons we made an appropriate classification of the technological status of a village into "high", "medium" and "low" for both seasons. We defined a high MV. village during the boro or dry season as a village having 50 percent or more of it's operational land devoted to MV. cultivation during that season. Similarly the medium MV. village has the extent of MV. lying in between 25 to 50 percent and the low MV. village has the same below 25 percent. Using this classification we can easily determine the technological mobility of our sample villages during the Boro season during the period of 1987-88 to 1992-93.

Table 3.4 presents the findings for the Boro season. From that Table we see that three of our sample villages were placed on the diagonal of the matrix implying that they do not have significant technical dynamism in the sense of making a fundamental transition from one MV status to another. For example the village Patardia had 90 percent extent of MV. in 1987-88 and that declined to become 83 percent in 1992-93. So it's pattern of mobility is considered to be still within the confine of the "High" MV status. That is why we shall treat Patardia in our sample as a village which has remained static at a more or less high level of MV. cultivation.

Another technologically static village is the "Mailmara". It is the saline-prone village in our sample. In 1987-88 the extent of boro/dry season MV. in that village was only two percent and in 1992-93 it became one percent. So this village can safely be treated as an example of a technologically static village at a very low level of MV. cultivation.

The third technologically static village in our sample is "Baikunthapur". Actually the extent of Boro season MV. at this village did not remain fully static during the period of our study. It had a mobility from 25 percent to 44 percent; but our classification scheme has put it under "Medium" MV. group for both 1987-88 and 1992-93. Thus it's mobility though according to our definitional scheme is characterized as "static" should yet be more specifically stated as the mobility from a lower-medium to upper-medium technological status.It is also noteworthy that Baikunthapur even though characterized as a medium MV. village in our sample; is situated in an unfavourable draught-prone area with a highly unequal distribution of land as well as a relatively high density of population. In spite of these problems it is showing significant technological mobility.

The two other villages in our sample "darikamari" and "Shankarpasha" have been placed at the right or above of the diagonal of the Table, hence implying truly significant mobility across MV status. For example the extent of dry season MV. in Shankarpasha was quite low in 1987-88: only 8 percent. But in 1992-93 through using mainly irrigation, the extent of MV. in that village jumped to a level of 51 percent. Thus "Shankarpasha "in our sample will represent the village that has the highest technological progress in the dry season. Thus it can also serve us as a suiTable case for finding the impact of MV. technology expansion during the dry season.

The other technologically highly dynamic village in our sample is "Darikamari." It was almost a high MV. village in 1987-88 with 48 percent of operational land under MV. during the dry season. It was also situated in the "irrigated" production environment. By 1992-93 It's extent of MV. reached the highest level of 91 percent among all sample villages. Thus it made a transition from medium MV. status to a very "high" MV. status. Though it's technological progress was not as dramatic as that of "Shankarpasha" yet it also can serve as a case of significant positive mobility in terms of technological status.

The above analysis of technological progress at the village level were based on dry season MV. cultivation. A similar exercise can be undertaken on the basis of wet/aman season MV. cultivation. Such an exercise, presented in Table 3.5 shows that the pattern of dynamics remain same for four out of our five sample villages. Only for Shankarpasha the nature of mobility changes drastically. Although in terms of dry season MV this village showed dramatic positive mobility yet in the wet/aman season it could not show any progress at all. In fact it's MV. status remained static at the absolute level of zero during the wet season for both 1987-88 and 1992-93. We had discussed before that "Shankarpasha" has a problem of flood during the wet season which naturally precludes any MV. cultivation. Any how Shankarpasha may still serve as a typical case of highly positive technological mobility because in Bangladesh MV. is expanding mostly in the dry season.

3.9 Panel Households: An Overview

As explained before we have 76 households across five villages for which detail data is available. The first set of intensive survey data on these households were collected under DIS project and relates to the year 1987-88. On the basis of that previously collected data we have calculated the same set of socio-economic parameters which we did before at village level. Our village wise calculated results for each panel of households are presented in Table 3.6.

If we compare these results with their corresponding village level aggregates as computed from the 1987 extensive survey under DIS project, we find quite a high level of congruence between them. For example the village level per capita own land for Patardia, Darikamari, Baikunthapur, Shankarpasha and Mailmara was respectively .08 ha., .06 ha., .25 ha., .07 ha. and .17 ha. On the other hand the corresponding figures for the panels were respectively .10 ha., .07 ha., .20 ha., .07 ha. and .13 ha. The cropping intensity measured at village level also matches the cropping intensity measured at panel level. The same holds more or less true for three other parameters e.g., average farmsize, proportion of functionally landless households and harvest price of MV. paddy.

Only two of the panel level parameters do not match closely with that at the village level. They are "percentage of non farm households" and "the percentage of land owned by big farmers". This is possibly because in the sampling procedure of 1987-88 these dimensions were not taken into consideration. In spite of these discrepancies the basic character of our sample villages in 1987-88, as described in section 3.3 are well represented by the corresponding panel households.

We also subsequently calculated the extent of MV. cultivation during both dry and wet seasons for panel households from each of the selected villages for both the years of 1987-88 and 1992-93. The relevant information were collected from the 1987-88 DIS intensive survey data and from our own census of the same villages in 1992-93.The Tables 3.7 and 3.8 present the pattern of technological progress for each set of panel households belonging to the same village during our reference period.

The Tables show a high level of similarity between the pattern of technological advancement in the villages and the same in the respective representative set of panel households. For example, the two panels as well as the two corresponding villages namely Darikamari and Shankarpasha experienced significant across status technological mobility in the positive direction during dry season.

Shankarpasha at the village level as well as panel level experienced the most dramatic improvement in it's dry season MV. status.But it's technological mobility during the wet season was consistently static at a very low level for village as well as panel.

Darikamari though experienced less dramatic but still quite a significant positive mobility during both dry and wet seasons. This also holds good at both village and panel level. Of the two other villages the panel from Mailmara did not experience any technological mobility during both dry and wet seasons.This was also found to be true at the village level.

The Baikunthapur panel was the only exceptional village panel statistics which perfectly corresponded with the village level statistics. And here over time the panel showed a reversal from a high level of MV to a medium level during the wet season. But in the dry season the observed mobility for the panel was so small that it could be considered static. However at village level the pattern of technological mobility was found to be "static" during both seasons. Thus, at least for the dry season the village and the panel dynamics corresponded with each-other since both patterns could be characterized as static; but for the wet season such correspondence was absent. This is actually due to the limitation of our discrete method of categorization. Looking more closely we find that in Baikunthapur there was actually a negative mobility in the MV. status at the village level in the wet season too. But it was very small and confined within the class boundaries set by our definition, hence it was treated there as "static". Thus the negative mobility found at the panel level for the village Baikunthapur was not so out of mark!

Our last panel from Patardia experienced positive technological mobility during both dry and the wet seasons. But at village level the technological dynamism of Patardia was characterized as static at a high level for both the wet and the dry seasons. This difference is not easy to explain and may be perhaps due to small size of the sample panel from Patardia.[27]

Since technological dynamism at the village level as well as for the panel of households generally corresponded with each other so we can safely classify our sample villages (and thereby also the panels from each village) in the following manner:

1) Darikamari situated in the irrigated environment in 1987-88, may represent a technologically dynamic village for both seasons during our study period i.e., 1987-88 to 1992-93.

2) Shankarpasha, situated in a rainfed environment represents a case of dramatic technological progress but limited to dry season only.

3) Baikunthapur, situated in a draught prone area may represent a case of relatively technologically semi-static village at the medium level of adoption during both seasons.

4) Patardia may be considered as a case of technologically static village at a high level of attainment.

5) Mailmara, situated in a saline-prone zone represents the case of a technologically static village at an extremely low level of adoption.

[27]The panel from Patardia consisted of only 13 households since most of the old households had left the village for good and therefore could not be relocated.

Introductory chapter should have provided this organization detail.

3.10 Design of The Empirical Chapters

The analysis of the relevant data will be presented in the chapters from four to eight.

Chapter four will be devoted to an analysis of the inter regional differences in adoption as well as the intra regional differences in adoption across various socio-economic classes. Together they will give some idea about the direct effects of MV technology upon the pre-MV inter-regional as well as intra-regional equity situation in the rural sector.

Chapter five and six tries to catch the indirect effects of MV technology on equity via any possible labour displacing mechanization induced by the MV technology and also through adjustments in the labour market.

Chapter seven and eight analyzes the other indirect effects of MV occurring via various adjustments in the land market and also briefly looks into some important issues pertaining to the credit and rice markets respectively.

The last chapter wraps up the thesis by presenting the summary, and conclusions of the thesis.

TABLE: 3.1

REPRESENTATIVENESS OF THE DIS SAMPLE WITH REGARD TO DISTRIBUTION OF LAND OWNERSHIP.

Size ofland owned (Hec.)	Census of household in selected villages		Sample households for indepth study		Bangladesh Agricultural Census: 1983-84 (Th.)	
	No. of HHs	Percent of HHs	No. of HHs	Percent of HHs	No. of HHs	Percent of HHs
Less than 0.20	4825	48.9	581	46.7	6398	46.3
.20 to 1.0	3179	32.2	418	33.6	4639	33.6
1.0 to 2.0	1088	11.0	143	11.5	1598	11.6
2.0 and above	782	7.9	103	8.3	1183	8.6
Total	9874	100	1245	100	13818	100

Sources: 1) Bangladesh Bureau of Statistics, The Bangladesh Census of Agriculture And Livestock, 1983-84 Vol-1, Dhaka, May, 1986.

2) Bangladesh Institute of Development Studies and Bangladesh Rice Research Institute, Unpublished information from the project on "Differential Impact of Modern Rice Technology in Bangladesh" (Henceforth called DIS survey report).

TABLE: 3.2

PRODUCTION ENVIRONMENTS OF THE SELECTED FIVE VILLAGES (BASED ON 1987, EXTENSIVE SURVEY DATA.)

VILLAGES	MV IN DRY SEASON (%)	MV IN WET SEASON (%)	EXTENT OF IRR. (%)	RAIN (mm)	SALINITY	PRODUCTION ENVIRONMENT
PATARDIA	90	50	80	2047	NO	IRRIGATED
D.MARI	48	19	54	1719	NO	FAVOURABLE RAINFED
B.PUR	25	15	20	1700	NO	DRAUGHT PRONE
SH.PASHA	8	0	7	1867	NO	FLOOD PRONE
MAILMARA	0	2	0	1691	YES	SALINE PRONE

TABLE: 3.3

BROAD SOCIO ECONOMIC FEATURES FOR THE SELECTED VILLAGES:1987-88

Indicators	Patardia	Darikamari	B.Pur	Sh.Pasha	M.Mara
Per-capita Own Land (Ha.)	.08	.07	.25	.07	.17
Av. Farm Size (Ha.)	.52	.50	1.o9	.39	.86
Cropping Intensity (%)	161	157	189	108	125
% of Functional Landless Households	26	63	53	56	23
% of Non Farm Households	10	50	0	25	10
% of Land Owned By Large Farmers*	0	22	52	16	18
Distance of the Busstop From the Village(M)	3.3	0	8.3	0	8.3
Availability of Electricity	yes(1982)	yes(1987)	yes (1986)	no	yes (1986)
Harvest Price of MV(TK)	6.68	5.75	4.81	5.25	N.A.
Harvesting Wage Rate(TK)	30	45	20	20	32
% of Labour Migrating Out	5	0	25	10	20
Labour Shortage	yes	yes	yes	no	no

TABLE: 3.4

TECHNOLOGICAL MOBILITY OF SAMPLE VILLAGES (DRY SEASON) DURING 1987-92.

Past Technological Status	Present Technological Status		
	Low	Medium	High
Low	Mailmara		Shankarpasha
Medium		Baikunthapur	Darikamari
High			Patardia

Note: For dry season "low" MV status signify below 25 percentof operational land devoted to MV cultivation, "Medium" stands for 25 to 50 percent and "High" is above 50 percent.

TABLE: 3.5

TECHNOLOGICAL MOBILITY OF SAMPLE VILLAGES (WET SEASON) DURING 1987-92

Past Technological Status	Present Technological Status		
	Low	Medium	High
Low	Mailmara+ Shankarpasha		
Medium		Baikunthapur	Darikamari
High			Patardia

Note: For Wet season "Low" MV status signify below 10 percent of operational land devoted to MV cultivation, "Medium" stands for 10 to 25 percent and "High" stands for above 25 percent.

TABLE: 3.6

BROAD SOCIO-ECONOMIC FEATURES OF SELECTED PANELS OF HOUSEHOLDS FROM DIFFERENT VILLAGES, 1987-88

Indicators	Patardia	Darikamari	B.Pur	Sh. Pasha	M.Mara
Per Capita Own Land	.10	.07	.20	.07	.13
Av. Farmsize	.64	.57	1.33	.29	.77
Cropping Intensity	162	154	191	107	132
% of functional Landless Households	15	62	43	50	20
% of Land Owned By Large Farmers*	34	48	27	34	33
% of Non Farm (**) Households	23	50	28	59	25
Harvest Price of MV Paddy	6.70	5.76	4.82	5.36	5.63
Harvest Wage Rate	N.A.	N.A.	N.A.	N.A.	N.A.

Note: * By "Large" farm we mean farms above 3 hactres.
** Here "Non-Farm" households are those whose main source of income is non agricultural.

TABLE: 3.7

TECHNOLOGICAL DYNAMISM OF THE SELECTED PANEL OF HOUSEHOLDS FROM DIFFERENT VILLAGES: (FROM 1987-88 TO 1992-93, DRY SEASON)

Technological status in 1987-88	Technological Status in 1992-93		
	Low	Medium	High
Low	Mailmara	Shankarpasha	
Medium		Baikunthapur	Darikamari +Patardia
High			

Note: See the notes below the previous table 3.4

TABLE: 3.8

TECHNOLOGICAL DYNAMISM OF THE SELECTED PANEL OF HOUSEHOLDS FROM DIFFERENT VILLAGES (FROM 1987-88 TO 1992-93, WET SEASON)

Technological Status in 1987-88	Technological Status in 1992-93		
	Low	Medium	High
Low	Shankarpasha + Mailmara	Patardia	Darikamari
Medium			
High		Baikunthapur	

Note: See the note below the previous table:3.5

CHAPTER: IV

ADOPTION OF MODERN VARIETIES

4.1 The Issue Of Inter-Regional Adoption Disparity

The MV. technology is more suitable for favourable irrigated environment with good water control than for non favourable environment subject to droughts. floods and poor drainage. Economists also argue that this regional bias is strengthened further through policy biases in macro level policies.

Are these dictums against MV. really true? This chapter examines these issues with village level and panel data pertaining to rice farming in both irrigated and non-irrigated environments.

In section 3.7 we have characterized the production environment of Patardia and Darikamari as "Favourable Rainfed" (the adjective "favourable" signifies that which in our case actually stands on the brink of irrigated environment) and "Irrigated" respectively. The rest of the three villages fall under rainfed, draught-prone and saline-prone environments. However we should keep the saline-prone village Mailmara out from consideration while studying inter-regional adoption gap. Because the low level of adoption in the saline-prone zones is mainly due to the exogenous natural circumstances.[28]

[28] The researchers are till now trying hard to discover other new type of modern varieties which will be more tolerant of salinity and various similar natural hazards. Pending the new discovery, the available modern varieties could not be grown in the so called fragile environments such as deeply flooded areas or saline-prone areas or extremely water scarce areas. But this kind of natural constraints are endemic to any other agricultural crops including the local variety paddies and therefore it should not be blamed specifically on MVs.

4.2 Evidences From Village Level Data:Inter Regional Disparity

Table 4.1 shows that the increase in the area of MV. land as well as the irrigated land for both dry and wet seasons during our study period(1987/88 to 1992/93) for all the five villages in our sample. The Table shows that the total MV land of the two initially advanced or high MV adopter villages, have actually declined by (-)nine percent during the dry season of our study period. But during the same period the growth rate of dry season MV land for the draughtprone medium MV village and the rainfed low MV village were fifty six percent and three hundred and sixty percent respectively. This clearly proves that at least for our sample of four potential MV villages the inter-regional gap in adoption for the dry season MV was decreasing during our study period. This is not hard to explain at all because the rate of growth of MV land for highly irrigated villages might have naturally petered away as time passed on. After completing the easy frontiers of expansion, the irrigated and the high MV. villages entered into the relatively difficult domains of expansion and that might have constrained the pace of MV. expansion in these villages at a latter period. On the other hand irrigation picked up in the dry season in the less advanced villages which enabled them to catch up the forerunners.

However, our data shows instead of just a slower rate of growth, an actual absolute decline in the total MV. land for the irrigated villages. This may happen if the farmers find other crops more profiTable or/and if the availability of cultivable land declines absolutely. Ofcourse here we must also assume that the total operational land for the sample villages have remained constant or declined at the same rate.[29] In our sample both the draught prone and the rainfed villages could not afford to remain technologically stagnant for a long time in the face of rising population pressure on the land. Presumably the initial subsistence pressure was higher in the rainfed village (see Table 3.3) so it shot ahead more dramatically with a very high pace of MV. expansion in the dry season through the expansion of it's irrigation and thereby reduced the inter-regional gap more quickly at least for the dry season.

However, in the wet season the gap had continued to increase between the irrigated villages and both of the non irrigated villages possibly because the constraint of the depth of flooding and poor drainage condition in the wet season was relatively harder in the later villages. It is true that one of these two villages i.e. the draught-prone village in our sample was not so much constrained by flood and hence was able to expand MV. cultivation in the wet season at a higher rate than that of the flood-prone rainfed village. But still the rate of wet season MV expansion was lower there than that of the irrigated villages. Thus at least for our sample of four potential MV villages the relative inter-regional gap during the wet season was increasing over the period of our study.

4.3 Evidences From Panel Data:Inter Regional Disparity

Our data on the panel of households, although small in size, is relatively more reliable and free from any measurement problem. So we can use them to verify whether the above findings at the village level also hold good for the respective panels of

[29] Actually our data shows that during 1987/88 to 1992/93 the operational land declined by 32 percent in the irrigated villages,by 29 percent in the rainfed village and by only 11 percent in the draught-prone village.

households. The Table 4.2 shows that if we keep the panel from the saline-prone village Mailmara out of consideration then the inter-regional disparity among the remaining villages tends to decline atleast for the dry season. The rate of expansion of MV. land during the dry season was about 40 percent for the irrigated villages during 1987/88 to 1993/94. Whereas the same had been increasing at the rates of 62 percent and 117 percent respectively for the two draught-prone and the flood-prone rainfed villages. However during the same period the operational land of the sample panels of households had been decreasing or increasing at varying rates which ultimately determined the respective adoption intensities of the different panels of households. During 1987/88 to 1993/94 the operational land of the panels from the irrigated and the rainfed villages had declined by 28 p.c.but that in draught-prone village increased by 48 p.c.

Thus in terms of adoption intensity it is found that the inter-regional gap in the dry season to be certainly decreasing between the panels of rainfed and irrigated villages. On the other hand the gap between the irrigated and the draught-prone village panels was found to be increasing during both the wet and dry seasons in spite of the higher rate of expansion of the MV. acreage in the latter. Actually the high MV. expansion in the draught-prone village panel was completely offset by the unusually higher rate of expansion of the operational land among it,s panel households.

We also examined the trend of the number of adopters in each panel of households from the different villages. We defined a household as an adopter if it has atleast some MV. land either in the wet or in the dry season. The results of our inter temporal across panel comparisons are presented in Table 4.3. From the Table we find that the numerical extent of adoption for the irrigated villages had declined marginally from 75 percent to

72 percent. And the same had declined in the rainfed village from 29 percent to 25 percent. This marginal change in the numerical adoption rate in all the sample villages under study is easily explainable. Because as soon as a modern variety of seed is introduced in a village we find that almost all farms who are not technically excluded adopt it very quickly although the intensity of adoption increases over time relatively slowly and that also for a fraction of the holdings. Thus the gap in terms of numerical strength had changed marginally between the irrigated village panel and the rainfed village panel. In the case of the draught-prone village panel the numerical rate of adoption remained constant at 71 percent over the study period.Thus the gap in terms of the numerical strength of MV. adoption between the draught-prone and the irrigated village panel had actually decreased marginally over time. We have kept the saline prone village panel out of consideration for reasons discussed before. It is difficult to draw any general conclusion from these conflicting findings on the regional trend of the numerical strength of MV. measured in terms of the simple adopter ratio. In one case adopter ratio gap had been increasing and in another case it had been decreasing. However in both cases we found the "increase" and "decrease" quite insignificant. So we can conclude that there was no significant trend in terms of either decline or increase in the inter-village adopter ratio gap.

4.4 Common Trends At Both Village And Panel Level:Inter Regional Disparity

Thus our village level dynamics and panel level dynamics both together reveal a few common trends:

First, the dry season adoption intensity gap between the rainfed villages and the irrigated villages has ~~been waning away with~~ waned over time. Secondly, the adoption intensity gap during the wet season between the two irrigated villages and the two non-irrigated villages has been increasing over time. But the across region average rice yield gap in the wet season was decreasing in spite of the increase in the inter-regional adoption intensity. Thus the net effect of the increase in the wet season adoption intensity would also be partly offset by the partial reduction in the average rice yield gap during the same season.

4.5 Macro Trend: Inter District Adoption Intensity Gap In Bangladesh

The above findings are based on only 4 villages and 4 panels from those villages. We shall have to find out whether we can support them with macro level data before extending or generalizing them further. Fortunately we also have district wise over time figures of adoption intensity from 1969 to 1987 which can be easily used to see whether the coefficient of variation in the adoption rates among the different districts had actually declined or increased over time. The results of such an exercise are presented in a series of Tables and figures: 4.4a, 4.4b, 4.5a, 4.5b, 4.6a, 4.6b, 4.7a and 4.7b.

The data for this macro analysis was gathered from the various official publications of Bangladesh Bureau Of Statistics. However a note of caution should be given regarding the comparability of pre 1974 official data with the post 1974 data. In 1974 a task force on ~~H.Y.V.~~ HYV was appointed by the then Government of Bangladesh to examine the exact extent of H.Y.V. Amon land all over Bangladesh. At that time they reported of a considerable over-estimation bias in the official estimates of Amon land[30]. On that basis a new method of estimation were followed in the subsequent period to correct the overestimation bias. Since the pre-1974 data was not revised accordingly. so the sudden decline in Amon land visible in the official time series data after 1974 is more a statistical decline than real. In our context the analysis of the long term trend of the coefficient of variation of the MV land for the wet season (i.e. the season when the Amon crop is cultivated) may therefore get affected by this revision of data. We may observe a sharper decline in the coefficient of variation in the wet season which in this case would be partly statistical. Keeping all these qualifications in our mind, let us now have a look at what the actual data says?

Our primary exercise on the trend of coefficient of variation in adoption as well as irrigation in the dry season reveals clearly a long term sharp declining trend in both of these coefficients (See Table 4.4a, figure 4.4b, Table 4.5a and figure 4.5b). This actually implies that in the dry season as there is less risk of flood, the non irrigated and non MV districts after a time lag also came ahead to adopt irrigation and MV cultivation. That is why as time passed away the inter district relative dispersion of MV adoption as well as that of irrigation declined considerably. The dry season coefficient of variation for MV cultivation had declined by fifty eight percent(from 1.04 to .44). And at the same time that of irrigation had also declined by fifty two percent(from .94 to .46). This is partly due to the special attention of the Government to the non-irrigated draught-prone

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[30] The task force reported " It is impossible for the task force to provide a reliable estimate of the H.Y.V. Amon acreage actually grown in 1974....... However it seems possible that over the country as a whole the over estimation might be as much as three times.In other words the actual acreage achieved in 1974 may be 5 lakh (.5 million) instead of 17 lakh(1.7 million)."

districts. For example in 1980's Bangladesh Government invested a lot under the North Bengal Deep Tubewell irrigation project to irrigate the Northern draught-prone districts. One study in one of the sample areas in 1987 also found that not only the irrigated land was increasing there but also "...the distribution pattern of irrigated land among head. middle and tail farmers and among small, medium and large farmers in 1989-90 are not in general different from what they were in the past years..." A glance at the Table: 4.8a taken from that study also proves that not only inter regional disparity in irrigation was decreasing but also the intra regional disparity in irrigation across different classes of farmers were decreasing in the backward regions.

The corresponding situation in the wet season is presented in the series of Tables and figures: 4.6a, 4.6b, 4.7a and 4.7b. From these Tables and graphs it is clear that in the wet season there is no such systematic long run declining trend in the coefficient of variations of both adoption intensity and irrigation over the period of 1967/68 to 1988/89. At best we can say they were erratic if not increasing.

However the average rice yield gap between the LV and MV in Bangladesh was in general had remained stable if not narrowing down over time. This is also not an unexpected occurrence. The MVs when first introduced are adopted by entrepreneurial farmers and on the better quality land, hence they have a very high yield rate, but with further diffusion of MVs, the average yield naturally goes down. From the figures of BBS it is roughly found that the average yield rate of MV Boro had remained more or less stable around 4000 kg per Hectre during the last thirty years(1976 to 1996). On the other hand the yield rate of Local Transplanted Amon remained stable around 2000 kg during the last thirty years. (Agricultural Commission, 1999, see fig:4.1.2) Therefore, although the yield gap is stable in the dry season yet the decreasing adoption disparity observed before during this season may cause a decline in the over all rice yield gap across MV and non MV regions.

4.6 Synthesis of Micro and Macro Findings On Inter-Regional Disparity

Finally on the basis of the above mentioned micro and macro evidences we may conclude that the main constraint to ~~against~~ MV expansion in Bangladesh is the availability of irrigation, i.e. of right quantity of water at right time. Wherever this condition is satisfied, MV would soon be expanding and whatever inter-regional gap is observed in MV adoption among these areas at the initial period, would wane away today or tomorrow.

It may be noted ~~We would also like to remind our readers~~ that water availability ~~here~~ does not mean the actual presence of Irrigation technology. For example, even in a draught prone village initially lacking irrigation equipment but having enough ground water can easily install a shallow tubewell through private initiative. This is feasible in Bangladesh because private buying of shallow tubewell and the selling of water to the private clients is at present a highly profitable investment in Bangladesh.[31]

[31] There are several evidences on the high profitability of selling water for irrigation. A good summary of all these findings are available in Quasem (1987).

But in a deeply flooded area only private initiative is not sufficient for MV. expansion. Same is true for saline prone area. That is why the convergence of MV. adoption levels over time is specifically observed among those special set of areas which fall under flood-free and saline-free zones. Since flood is a problem for the wet season, so inter-regional adoption disparity problem mainly pertains to the wet season adoption dynamics.

From this it also follows that public policy for flood control would be a necessary pre-requisite for decreasing the inter-regional adoption disparity during the wet season.[32] The inability of the MVs to expand in the fragile environments should not be blamed upon the MV. technology. The real sources of such problems lie in the historically inherited natural ecological system of the concerned areas and the absence of public initiatives to counter that.

The argument that the yield gap between the LV and the MV will be naturally declining over time and thus partly counteract the income disparity impact of unequal adoption across regions is only partly correct. For the early period it is correct for both wet and dry seasons, but latter on the dry season MV yield rate becomes stable at an almost hundred percent higher level and thus the gap also becomes stable. In the wet season the gap is relatively narrower and the decline in the gap may also continue for a longer period.

[32] During it was also found that at aggregate national level the dry season MV. land had increased at a rate. On the other hand the wet season MV. land increased only at rate. These figures indirectly testify the fact that MV expansion is relatively difficult in the wet season. In the dry season many non MV regions were able to adopt MV and this not only contributed to a higher growth rate of the dry season MV. land but also decreased the inter-regional adoption intensity gap.

4.7 The Issue Of Adoption Disparity Across Classes

Generally the studies on Green Revolution use land-ownership and land-tenure based classifications of the peasant community to examine across class disparity in the level of adoption. Different authors have so far used different methods for measuring the extent and intensity of adoption. The following three indices are most popular.[33]

1) Incidence of Adoption: It is the ratio between the number of adopter farms and the total number of farms within a class. A farm becomes an adopter of MV. if it has placed any part of his operational land under the modern rice variety.

2) Intensity of Adoption: This measures the proportion of operational land (instead of cultivators) brought under MV. rice.

3) Modern Variety Participation Index: It is a combination of the "Numerical Extent of Adoption" and the "Intensity of Adoption" and is obtained simply by multiplying the value of one ratio by the other.

Besides these measures of adoption levels, multi-variate logit analysis at household level is sometimes used to derive another index of MV. known as "Propensity to Adopt MV". It actually measures the probability of a cultivator adopting MV. By using multi-variate logit analysis we can also identify and rank more than one explanatory variables in terms of their relative influence on a farmer's "Propensity to Adopt." While using multiple regression analysis one should clearly distinguish between two different aspects of adoption. Logit model of regression should be used for analyzing the factors that makes a farmer adopter. Here the data should include both adopter and non adopter farm households. But if one is interested to analyze the factors influencing the intensity of adoption then the model of regression would be the simple multiple regression model

[33] See Iftikhar Ahmed (1981)

where the data should cover only the adopter households. But if the sample data includes non adopters whose adoption intensity is zero, we should then use the more complex tobit model of regression to analyze the factors influencing the intensity of adoption.[34]

We have repeated all the three traditional exercises for each of the four potential MV villages and also in some cases (e.g. regression analysis) do our analysis taking all five villages together to settle the issue of "Across class disparity in the adoption of MV". All these exercises have been undertaken for both dry and wet seasons. The results of these exercises are presented in the Tables 4.8 to 4.20.

4.8 Across Class Adoption Disparity:Village Level Data

From the Tables: 4.8-4.11 at first it may seem that the small farmers as a group has lesser propensity to adopt since everywhere except the most developed MV village(i.e. Darikamari) they are lagging behind both the large and the middle farmers at least in terms of the "Incidence Of Adoption" criterion. This is obvious. Since the smaller farmers have fewer number of parcels of land than larger farmers, the probability of at least one parcel being allocated to MVs would be higher for the latter compared to the former. Moreover this criterion does not cover the more important aspect of adoption namely the "Intensity of Adoption". To cover that aspect as well we have also calculated the more complex indicator of "Participation Index" and presented them in the same Tables.

[34] The special kind of multi-variate analysis for these purposes are known as "logit" and "tobit" models.

From the fifth and the eighth columns of these Tables it clearly comes out that in terms of the more complex and combined indicator "MV Participation Index" the large farmers generally lag behind either the middle or the small farmers in the two irrigated villages and the draught prone village (see Tables 4.8, 4.9 and 4.10). And this is true for both dry and the wet seasons. Regarding the aggregate participation index at farmer level (See Tables: 4.8-4.11), we found as expected, a relatively higher level of MV participation index in the two irrigated villages during both dry and wet seasons. A more detailed examination of the Tables: 4.8 and 4.9 i.e. the Tables of the irrigated villages, reveal that in the two high MV villages both the classes of middle farmers and the small farmers have on average a higher MV participatory index value than the large farmers in the dry season, which is in fact the main MV rice growing season in these villages. Moreover in one of the irrigated villages(Darikamari) which has the highest level of MV participation in our sample, the small farmers were able to have a higher participation index value even during the wet season. But in general the middle farmers always had a higher MV participation index than the large farmers in all seasons in all the three villages. In terms of the simpler criterion of "MV Adoption Intensity" all the above conclusions stand more strongly.[35]

However in one of our sample villages i.e. Shankarpasha , a rainfed village, we find that the large farmers have the highest index value of participation during the dry season only. But in the wet season all classes of farmers equally refrained from any MV cultivation due to flood. It would be interesting to see what has been happening to the

[35] The only exception is the wet season "MV Adoption Intensity" in the case of the irrigated village D.Mari. Here the classes of small, middle and large farmers have 94, 97 and 98 percent of adoption intensity respectively. However the differences are marginal.

different classes of farmers in this village as the average level of MV adoption in the village as a whole was going up over time. An important question in this regard is whether the initially observed gap between the large and small farmers was a persistent one ~~or waning away over time?~~

Before moving to this interesting issue we want to draw the attention of the reader to another relevant finding on the aggregate village level adoption pattern across classes. The results of our aggregation over four villages for the sample of 383 farm households and for only 1992-93 are presented in the Tables: 4.12a and 4.12b. This aggregate level analysis clearly shows that by 1992-93 at aggregate level the small farmers were definitely ahead of the Large as well as the middle farmers in terms of at least the "Adoption Intensity" indicator during both dry and wet seasons.[36] However during the wet or in other words more risky season the gap was smaller and almost insignificant. It possibly implies that as there is a transition from the dry season to wet season, the small farmer class backs out of MV cultivation relatively more than the large ones while still retaining an insignificant superiority. The over all picture on relative gap in adoption does not change even if we include the saline prone fifth village in our aggregation (See Tables 4.12c and 4.12d), except that the average absolute level of adoption goes down uniformly for all the classes. Since data for comparison was not available for the whole village so we shall have to look into our panel data to supplement this finding.

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[36] The importance of "Intensity of Adoption" indicator and it's negative relationship with the farmsize is well established in the literature. In a similar study on Bangladesh Iftekhar Ahmed (19) wrote, "The intensity criterion warrants the more weight as it helps answer the question: do small or large farmers take more advantage of HYV technology? It is clearly the small farmer who do so in view of the fact that they plant a greater percentage of rice area under HYV. No doubt a higher proportion of large farmers adopt HYV, the crude adoption rate would be interesting to look at only when intensity of adoption is constant per adopter."

4.9 Adoption Dynamics Across Classes: Panel Level Findings

The Table 4.13 prepared on the basis of the panel data for the period of 1987-88 to 1992-93, clearly shows that the gap between the small and the large has been decreasing significantly in at least one village named Shankarpasha. Originally the village Shankarpasha had a panel of seventeen households. In 1987-88 in that small panel, the average participation index of the large farm household was 187 as compared to only 88 for the class of the remaining small farmers. But by 1992-93 the lone adopter large farmer gave up MV cultivation. Thus the new panel of farm households in 1992-93 became smaller and all belonged to the class of small farmers! But what is significant in the Table 4.13 is to see that in 1992-93 among the small farm households both the adoption intensity and the adopter ratio were significantly higher than what it was in 1987-88.

However the panel size of Shankarpasha is so small that all our above findings can merely be treated as some indications only. But if we add up all the members of all the panels of all five villages together, then our aggregate panel farmer number becomes seventy six which is a respectable size. Of these seventy six households sixty one had been engaged in farming in 1987-88 and 59 households had been still continuing farming in 1992-93, which is the period of our second round of observation.

Similar exercises can be done by using this larger set of panel data for both dry and wet seasons. The results are presented in Table 4.14a and 4.14b. Several significant and also more reliable conclusions can be drawn from the examination of these two Tables: 4.14a and 4.14b.

a) In terms of the complex indicator of participation index the large farmers of the aggregate panel possess an obvious superiority to the small farmers during both dry and wet seasons in both the years. But in terms of the single "adoption intensity" indicator we find that either the small or the middle farmers were able to supersede the large during our observation period i.e. within only four years from 1987-88. This confirms the old finding that large farmers usually have a higher "Propensity to adopt" but a lower "Intensity of Adoption" than the small farmers at least in the long run.

b) If we look at the dynamic trend of adoption by the different classes between 1987-88 and 1992-93 then we find that in terms of all indicators by and large the gap between the large and the small or middle farmers were closing up slowly. For example in 1987-88 the participation index of the large farmers as a whole was 233 which was 216 percent higher than that of the small farmers during the wet and dry season respectively. But in 1992-93 they were only 187 and 39 percent higher respectively. As expected the gap during the dry season had been closing down more quickly.

Thus we can safely say that if the above dynamic trend continues then whatever gap between the small and the large may be observed at present, is not going to last for a long time . And in most of the cases the small farmers would not only catch up the large ones but also outrun them. Actually our village level findings have already shown that to be partly true even in terms of the so called complex indicator of "Participation Index".

4.10 Adoption Statistics For Tenure Based Classes

From the lower row figures of the previous Tables 4.8 and 4.9 we find that in terms of overall MV participation index the class of owner-cum-tenants do not lag behind the pure owners in both of the irrigated villages during the dry season. In one of the irrigated villages (Darikamari) owner-cum-tenants have higher MV participation index value during the wet season as well. The owner-cum-tenants also have a higher MV participation index value in the rainfed village during the dry season, which is the only rice growing season in that village. Only in the case of the draught-prone village the pure owners could retain their supremacy over the owner-cum-tenants with respect to the participation index for both seasons.

More interesting is that the pure tenants showed a higher participation index than the owner operators during the dry season in both the irrigated villages. The same is also true for the rainfed village. All these facts show that the so called lower status of the pure tenant or the negative effect of tenancy upon the owner-cum-tenant could not in general prevent them from having as high an adoption level as that of the owner-operators. And this was particularly true during the less risky dry season. For example, our aggregate data shows that the pure tenants as a whole had devoted 58 percent of their cultivated land to MV in the four MV growing villages. And the intensity of adoption for the owner-operators and the owner-cum-tenants were also on average equal to 59 and 62 percent respectively (See Table 4.15a).

But at aggregate level in the wet season, the pure tenants show a significantly lower intensity of adoption than the owner operators (See Table 4.15b). This is probably due to the low risk bearing capacity of the relatively poorer pure tenants and relatively higher risk involvement in the wet season.

To examine further whether tenancy really acts as an obstacle against MV. adoption we have divided the cultivated land of each class of farmers into 'owned land' and 'leased land' and then calculated the adoption intensity for each type of land under each class of farmers. The results of this exercise are presented in the Tables: 4.16a, 4.16b, 4.16c, 4.16d, 4.17a, 4.17b, 4.17c and 4.17d.

The figures of these Tables also show clearly that at least in the dry season there is no systematic preferential treatment of the owned land to leased in land for the MV cultivation. In both the irrigated villages (Darikamari and Patardia) the intensity of MV. adoption during the dry season does not differ significantly between the leased in land and owned cultivated land. Actually in these two villages the intensity of adoption was found to be a little bit higher in the leased in land during the dry season and that was true for farms of all sizes. The same conclusion also holds true for tenants from three size-classes out of four in the rainfed village (Shankarpasha). In the case of the draught-prone village (Baikunthapur) it was true for the tenants from the two median size-groups during the dry season.

To be more precise, at aggregate village level, for 1992-93 dry season, we find that the intensity of adoption in the owned land to be 86 and 81 percent respectively for the two irrigated villages, while the same for the leased in land in those two villages were 98 and 88 percent respectively (See Table 4.16a and 4.16b). In the rain-fed village the owned-land intensity of MV adoption during the dry season was also found to be lower than that of the leased in land (See Table 4.16d). In the draught-prone village the adoption intensity was more or less same across both types of land during the dry season (See Table 4.16c).

However in the Aman or the wet season the picture is not so neat and uniform. In the wet season, for only one village we find no significant differences in the adoption intensities across leased land and owned land. That village is Darikamari, a highly irrigated village with the highest MV participation index in our sample (See Table 4.17b). But in the other irrigated village i.e. Patardia the intensity of adoption in the owned land as a whole was about 79 percent whereas that of the rented in land was nil (See Table 4.17a). A similar picture is also observed in the draught-prone village. Here the intensity of adoption for the owned land as a whole was 30 percent while that of the rented in land was nil (See Table 4.17c).

How do we explain this dramatic discrepancy in the intensity of adoption between leased land and owned land during the amon season in these two villages of our sample? In other words why in the said villages the leased land are not at all cultivated with MV by both the small and the large tenants during the wet season and also what induces both of them to cultivate it with MV in the dry season only?

The question itself indicates that here the crucial explanatory factor must lie in seasonality or some other factors directly associated with it. Actually in both of these villages and also in general in Bangladesh MV cultivation is more risky and sometimes even impossible in the wet season due to flood. That is why MV adoption intensity is lower in the wet season in our sample villages as well as in Bangladesh.[37] In the case of the two above mentioned villages we observe that all farmers from all size-groups to curtail their MV land in the wet season as compared to that of the dry season. But curiously the reduction takes place exclusively for the rented land only. The owned land MV intensity does not change much from season to season!

It can easily be argued that at all times and for all farmers there must be a level of flood or risk at which MV cultivation becomes technically and/or economically non-feasible due to negative rate of expected return. The literature on adoption of technology argues that the risk factor should actually encourage both the tenants and the landlords to cultivate MV more in the leased land in the risky season due to the presence of risk sharing opportunity (Hayami and Otsuka, 1993). But this argument may not be valid if the landlords offer only the very risky marginal lands in the lease market. In that case we may find that in the dry season as the risk is considerably minimized so adoption becomes profiTable for the tenant even if the cost of production is not shared by the landlord and half of the output is taken by him. But the risk in the wet season may become so overriding that the tenant is not induced to cultivate MV. in spite of the opportunity of risk sharing. On the contrary the owners may be willing to bear the extreme risk and cultivate MV either because the land under owner operation are relatively risk free or they have a higher ability to bear risk or simply because unlike their tenants they do not get only half of the output while bearing the full cost of

[37] In our sample the only completely flood free village is Darikamari and that is why it has high level of MV adoption in both dry and wet seasons in both leased and owned farmland.

production. These explanations are indirectly supported when we look at the other irrigated village "Darikamari" where such a discrepancy between the leased land and owned land in respect of MV cultivation in the wet season is completely absent. This is because of not only complete absence of flood in this village but also the very high level of irrigation which considerably minimizes the risk of uncertain rainfall in the wet season.

Thus it seems that in the floodprone villages, at least in the more risky wet season, tenancy may affect the intensity of adoption negatively.[38]

4.11 Propensity To Adopt: Logit Analysis

Previous Bivariate analys~~i~~es of "Adoption Propensity" and "Intensity of Adoption" were based on simple association of pairs of variables. But propensity to adopt or intensity of adoption are complex phenomena and are generally influenced by many factors. So we r~~u~~an multi-variable regression models in order to ascertain the really significant factors and their relative importance in determining these complex outcomes. Since the "Propensity to Adopt" is a binary variable and economic theory suggests that it has a non-linear logistic functional form with respect to time as well as the most of the characteristic variables of the farm households so we shall use the logit model of regression for analyzing it.

[38] Our Logit and Tobit functions of adoption presented in the section:4.11 and 4.12 also testify this.

The specific form of the logit function used is:

ADPT = F(IRGR, SUBP, TOWNLN, FSZ, TNC, AGE, EDN, DPNDC, DRAUGHT, SALINE, FLOOD)

ADPT = PROPENSITY TO ADOPT is a binary variable defined for three periods. If the farm household cultivates MV in either wet season or dry season then he is an adopter of MV during that year and the dependent variable "Propensity to Adopt" takes the value of one otherwise it's value is zero. Similarly "Propensity to Adopt" was defined for the dry season as well as the wet season.

IRGR = The percentage of cultivated land that is irrigated.

SUBP = An inverse indicator of subsistence pressure defined as per capita operated land available for the household.

LND = Total owned land.

FSZ = Total cultivated land.

TNC = Percentage of rented in total cultivated land.

AGE = The age of the household head.

EDN = The education level of the household measured by the number of years of formal schooling.

DPNDC = Ratio between dependent consumers and workers.[39]

DRAUGHT = A Dummy variable taking value 1 for the draught prone village of Baikunthapur else 0.

[39] Pure consumer is defined as the dependent member of the household having an age either less than 15 or more than 65 years. The age of worker members is from 15 to 65 years.

SALINE= A Dummy variable taking value 1 for the saline prone village Mailmara else 0.

FLOOD = A Dummy variable taking value 1 for the flood prone village of Shankarpasha else 0.

The above model was run first for the four villages excluding the saline prone village. The size of the sample farm households for all the three periods was same i.e. three hundred and eighty three. The same model was also run for the five villages for all three periods while including the saline Dummy along with the households from the saline prone village who were shown before to be almost universally non adopter. The sample size of the farm households for the five village models were five hundred and eight. However, because of "convergence" problems in the computation of the regression parameters, the dry season function could not be estimated in the case of five villages.

All the model functions were estimated by using maximum likelihood estimation procedure which gives asymptotically unbiased estimates of the parameters for large samples. The estimated parameters, their T-values, their level of significance and the maximum likelihood ratio test for the overall fitness of the models are presented in the Table: 4.18.

From the MLR. score presented in the Table, it becomes clear that all the five estimated equations were statistically significant at less than one percent level of significance. Besides the MLR test, the overall fitness of the logit equations can also be judged with the help of the "Contingency Tables" generated for each model by the software package of SAS. Those Tables show that the rate of correct prediction for the different equations range between 85 to 97 percent![40]

From the Table 4.18 it also becomes clear that almost all the socio-economic variables of our model e.g. owned land, farm size, education level of the household head, age as a proxy for experience, consumer-worker ratio, etc. have in general not only very low influence upon the "Propensity for Adoption" but also their level of significance are always below 10 percent. The only socio-economic variable that has a statistically significant negative influence upon "Propensity for Adoption" is the "Tenancy". However this is valid during the wet season only which is not unexpected since it was already found from the bivariate analysis and was explained.[41]

But on the other hand "IRGR" (the percentage of cultivated land irrigated) parameter is the highest valued and also has less than 1 percent level of significance. Besides "IRGR" all the environmental dummies also come out as statistically significant at less than 1 percent level of significance. Their effects are mainly negative and confined to the wet season only. For example, as expected the flood Dummy has a very high negative value as well as a very high level of significance during the wet season but it's value becomes positive and non significant during the dry or the either season case.

[40] There are two ways of defining the so called "correct prediction" under a logit regression model. Firstly if the estimated probability for a sample household is less than .50 and that household also actually does not adopt, then the prediction of the model is taken to be approximately true. Conversely, if the estimated probability is more than .50 and the household is an adopter then also the prediction is considered true. The rate of correct prediction to the total number of predictions.

[41] The negative influence of tenancy on wet season adoption of MV. has already been noted and explained in the last section.

Similar pattern exists in case of "Draught". Paradoxically this implies that a draught-prone village can overcome the obstacles against adoption in the dry season but not so in the wet season. This actually implies that irrigation was mainly available during the dry season but in the wet season it was not sufficiently available in the draught prone village while rain was also very low. The saline Dummy, unlike the flood or draught Dummies remains strongly effective for both wet and dry seasons. For the dry season it.s effect was also highly negative but we could not estimate it because as mentioned before the logit function itself were not estimable for the dry season.

4.12 Logit Analysis: Hypothetical Probability Calculations

Given the average values of the set of independent variables, the logit analysis can be used to find out the probability of adoption for an "average household" in the sample. An "average household" means a hypothetical household for whom all the independent variables take the average values of the sample. We made certain hypothetical exercises along that line too. For four village either season logit model we found that the logit score of the average farmer of our sample is Z=4.525, implying 98.92 percent probability of adoption. If we raise the average values of the flood Dummy and the Draught Dummy then the probability of adoption does not decrease at all because in "either season case" their coefficients are positive (although statistically insignificant). This indirectly implies that in our saline free villages, neither flood proneness nor draught proneness can ultimately prevent adoption of MV in at least one season. Our previous bivariate analysis also confirmed this for the flood-prone village Shankarpasha as well as the draught-prone village of Baikunthapur.

On the other hand the importance of irrigation is everywhere so high that it's absence may become a binding constraint for an average household even with the average level of flood and draught condition. For example when we put the value of IRGR zero and keep all other average conditions unchanged the estimated logit score for our four villages drastically comes down from Z=4.525 to Z=(-).084 implying only 48 percent probability of adoption instead of 98.92 percent! In the standard vocabulary of logit it means that the average farmer is actually not going to adopt MV. if there is no irrigation.

The estimated logit equation for the four villages also shows that any increase or decrease of LND, FSZ, and TNC has a minor effect on the over all probability of adoption when the other variables remain constant at the average level (It is noteworthy that in our sample covering the four villages the average value of IRGR is .71 which was actually responsible for such a high average probability of adoption). For example, if the average owned land of our 383 sample farm households (155 decimals) is increased to the level of 500 decimals (the threshold level for our definition of a large farmer) then the logit score increases from 4.525 to only 4.537 implying a probability change from 98.92 percent to 98.94 percent only. Similarly if farmsize becomes 500 decimals the probability of adoption increases negligibly.

According to this same model if TNC becomes zero or in other words if the average farmer who in our sample is defined as an owner-cum-tenant with 41 percent rented in land somehow turns into a pure owner then the probability of adoption in either season would increase from 98.92 percent to 99.24 percent only. All these hypothetical exercises reconfirms the overwhelming importance of IRGR in determining the probability of adoption of MV in either season.

Hypothetical exercises with the seasonal logit functions for the saline free four villages reveals the following : The probability of adoption in the dry season for an average farmer is 87 percent while the same for the wet season is almost zero. The zero probability in the wet season actually results from the very high absolute value of the coefficient of the negative flood DUMMY and the non zero average value of the dummy variable (The average value of the flood DUMMY was .308 in our model).

Since in the irrigated two villages we have no flood at all so there the appropriate average value of the flood dummy should be zero even during the wet season and in that case the probability of adoption would increase dramatically from zero to 81 percent! The dry season logit equation also shows that the coefficient of the flood dummy is not only very low but also positive although it is statistically insignificant. Here the positive value of the flood dummy coefficient indirectly denotes that, ceteris-paribus, the probability of adopting MV will be higher during the flood free dry season for even the flood-prone areas vis a vis other areas. The high rate of adoption in the flood prone village of Shankarpasha during the dry season testifies this truth. Variation in the values of the socio-economic variables such as TENANCY, FSZ, TOWNLN, etc does not affect the logit score so much as to change the probability of adoption significantly in either dry season or wet season.

However IRGR and TENANCY plays a statistically significant role in the wet season in determining the probability of adoption. If we transform the average farmer from the owner-cum-tenant to a pure owner (i.e. the average value of TENANCY becomes zero), then the probability of adoption in a flood free area (we also assume that the average value of the flood DUMMY to be zero, otherwise only change in the tenancy is ineffective and the adoption probability remains always zero.) during the wet season increases from 81 percent to 95 percent.

The importance of IRGR becomes still higher in the dry season. Calculation shows that if IRGR becomes zero for an average farmer during the dry season while all other variables yet remain constant at their average value then the probability of adoption comes down from 87 percent to only 4 percent.

All the above exercises were based on the four village logit equations presented in the first three columns of Table 4.18. We need not repeat these hypothetical exercises further for the five village equations since the values and pattern of significance of the estimated parameters of those equations do not vary qualitatively from our already discussed four village models. The only new factor which was incorporated in the five village equations was the SALINE DUMMY and as expected it had a strong negative impact on the adoption probabilities although not as strong as the FLOOD Dummy.[42]

[42] From the five village equations the estimated probabilities of adoption for an average farmer in a saline free zone during "either seasons" or during the "wet season" (but in only flood free villages) were respectively 93.52 percent and 59.26 percent. However if the village is saline prone, these estimated probabilities come down 56 percent and 22 percent respectively.

4.13 Intensity Of Adoption: Multiple Regression And Tobit Analysis

Our previous logit analysis proves that "Propensity to Adopt" is no more a problem in general in even the draught prone or flood prone areas if irrigation is available. In case of flood people may refrain from adoption in the wet season but they will not do so in the dry season. Thus the truly important question is once a farmer decides to adopt, what are the important factors that determines his level or intensity of adoption as defined earlier. Whether socio-economic variables play any significant role here?

In order to see that we at first run multiple regressions on the dependent variable "Intensity Of Adoption" for farm households of both four and five villages using the same set of independent variables as used in the Logit model.[43] The estimated parameters, their significance in terms of their T-values, R-square statistics and the F-value to test the overall fit of the models are presented in the Table: 4.19.

Since multiple regression model may produce biased estimates of parameters for this type of limited dependent variable (i.e. the "Intensity of Adoption" has a limited range from zero to one) so we supplement this exercise by running "Tobit" model of regressions using the same set of observations and variables.[J. Tobin, 1954][44] The

[43] Only one variable was redefined to make it easily intelligible. We redefined SUBP as the ratio between the family size and farmsize i.e. just the reciprocal of the previous definition of per capita available farm land. This makes the variable a direct indicator of the subsistence pressure upon the household.

[44] "Intensity Of Adoption" is a ratio between the MV cultivated land and the farmsize. Thus for one season case it must remain less than or equal to one while that for whole year may exceed one depending upon the cropping intensity of the respective households.

estimated parameters, their significance, R-square statistics and log-likelihood scores for each of the tobit equations are presented in the next Table: 4.20.

From the first Table: 4.19, it is observed that for the "Whole Year" cases the statistically significant (at less than one percent level of significance) variables in the model are IRGR, FLOOD, DRAUGHT, SALINE, SUBP and TNC. And except IRGR all other coefficients have a negative value. This implies that like "Propensity" the "intensity Of Adoption" is also basically determined by the technical and environmental conditions of the farm household. The only two socio-economic variables that influences the level of adoption are SUBP and TNC. We defined the variable SUBP in our logit model as the per capita availability of cultivated land which was actually an inverse indicator of the subsistence pressure upon the concerned household. But in our multiple regression and the tobit models we redefined SUBP as the number of household members per unit of land so that the variable here becomes a direct indicator of the subsistence pressure on the farm households. Thus the negative value of the coefficient attached to SUBP implies an inverse relation between the level of adoption and the subsistence pressure. Another similar variable to catch the consumption pressure on the earners in the model DPNDC has sometimes a positive and sometimes a negative coefficient attached to it but all the time statistically insignificant.

Actually in our case households with very high subsistence pressure are the extremely land poor households and they usually opt for non agricultural occupation whenever possible and have little time or resources to go for MV. This is specially true for the wet season when MV cultivation becomes more risky and hazardous. Thus, after plotting the level of predicted as well as the actual value of the "Intensity" of MV adoption against SUBP we find that there is a range of subsistence pressure at the lower side. variation within which, actually affects the "Intensity" of adoption randomly like that of DPNDC or in other words have neither positive nor negative systematic effects. But as explained before, if SUBP goes beyond the upper limit of that range especially for the land poor non farming families , then the "Intensity of Adoption" starts decreasing systematically. Although the number of such households are not very large in our sample yet in order to account for their strong anti adoption bias the SUBP variable in our model got a negative coefficient attached to it and that negative impact was also higher in the wet season as compared to the dry season.Thus the negative coefficient attached to SUBP should be interpreted with caution.

The only other socio-economic variable that affects the intensity of adoption negatively and significantly is TNC. But if we again look at the seasonal regression equations then it becomes clear that this negative effect is confined to the wet season only. In the dry season the coefficient is actually positive implying that farmers prefer to cultivate MV in the rented in land during the dry season. This type of negative effect of Tenancy on "Intensity of Adoption" during the wet season has already been explained before.

If we now also look into the details of the seasonal regression equations we find that besides the parameters of IRGR and environmental DUMMIES the parameters of socio-economic variables SUBP, TOWNLN and FSZ are also statistically significant at less than 5 percent level of significance during the wet season. However the size of the two parameters attached to the last two socio-economic variables are so small (always with three zeroes after the decimal) that to really matter the farmsize or owned land will have to be increased by a margin of atleast 10 acres decimals which is rarely possible in a country like Bangladesh where the average farmsize is only 2.27 acres or below. But the effects of SUBP on adoption intensity in the wet season is negative and too large to be ignored. It is plausible that the households with higher SUBP have a relatively higher risk avoiding tendency which again influence them to have a relatively low intensity of adoption in the wet season. But this logic is not accepTable since the risk free dry season coefficient is also negative for SUBP although non significant.

To correct the possible estimation biases of OLS we run "Left censored" regressions or the so called "TOBIT" models on the same data using same model. The results do not vary much from our multiple regression models. The set of significant variables remain same. Only the positive effect of IRGR and the negative effects of SUBP (during wet season), TNC (during wet season) and SALINE dummy (during all seasons) gets more magnified.

4.14 Synthesis Of Village Level And Panel Level Findings:Across Class Disparity In Adoption

In general our data supports the findings of DIS project (1994) according to which the socio-economic factors symbolized by the land-ownership and tenurial status have very little influence on the propensity or the intensity of adoption among the different classes of farmers in a village at least in the dry season which is also the main season of adoption in Bangladesh. By and large they are determined by the technical factor of irrigation and the natural environmental factors.

Most of the early investigators who found that socio-economic constraints like small land ownership or low tenurial status had actually prevented the poor and the weak from the adoption of the highly profitable MV technology forgot that those constraints were not as binding as the technical and the natural ones. They also forgot that with time the risk of the unknown decreases and the new technology reveals it's immense potentiality while side by side the pressure for more output from the fixed land increases tremendously and all these changing factors create greater incentive for adoption. Finally because of the divisible nature of the inputs such as water, seed and fertilizer the poor always somehow could manage the required first round of investment from informal or formal credit markets. And after the first round of investment the future earnings from it may release the resource constraint further and make the continuation of MV cultivation easier. In the eighties as compared to seventies the general credit availability also increased much which slackened the resource constraint considerably.[45]

It is true that irrigation is the leading input for MV and requires lumpy investment. But once it is installed by either the rich or the government it becomes available at a very low marginal cost to all farms in and around it, irrespective of their class status. This is so because water from the ground or from the surface costs the owner of the irrigation equipment nothing and whatever excess he can get over and above the operational cost of the equipment by selling water, actually helps him to recoup his investment cost. Thus wherever and whoever sets up the technical infrastructure of irrigation, it soon induces new institutions (e.g. water markets or cooperatives or any

[45] In Bangladesh the total disbursement of agricultural credit went up eight times in nominal terms during the period between 1976/77 and 1982/83, and by the end of the period such credits accounted for nearly 40 percent of the cost of the material inputs.(Osmani S. R., 1993)

other type of social arrangements) for water transactions among the nearby farmers. Actually this is the reason why everywhere the initial breakthrough had to be made by either the rich or the government and that generally in specially pockets of favourable water regime. The early studies on green revolution reflected that truth correctly but most of them (with a few exception) projected this truth wrongly upon the future as well.[46] What the present exercise actually shows is that, the time has changed enough to loosen the old constraints or/and the poor has become conscious enough to avail the new opportunities. Hence now a days we no more find any serious class disparity in the adoption propensity or intensity of MV. in the irrigation based dry season MV cultivation.

But in the wet season there is in general a low level of adoption in Bangladesh and that is mainly due to the high risk arising from the uncertainty of rainfall and flood in that season. And this uncertainty coupled with lower risk bearing capacity of the pure tenants, small landowners and other poor or weaker sections may cause a relatively higher socio-economic disparity in adoption propensity and intensity during the wet season.

An exception to this trend was

who studied

46 ~~Let me quote here from the Ph. D. thesis of my guide Dr. Mahabub~~ Hossain ~~as an example~~ of exception~~.~~ This quotation ~~shows that unlike~~ others he tried to formulate his conclusions more carefully and less ~~categorically. This is what he wrote~~ about adoption disparity among the farmers in the mid seventies. Hossain (1977) noted: "In the area under study a considerable difference was found among cultivators with respect to adoption of new technology and the utilization of irrigation facilities provided by the government...... The relatively greater reluctance of small owner cultivator and tenants to grow hyv (IR-8) seems to be mainly the result of their inferior financial status. It is found that hyvs require much more capital per acre of land and also per unit of labour. As the supply of institutional credit which is obtainable on reasonable terms is very low , and the interest rate is very high, it is not possible for the cultivator with no personal resources to invest in hyvs. The findings that the small owners and tenants adopted the non irrigated hyv (IR-20) in which requirement of capital per unit of land is lower relatively than irrigated hyv supports the argument. Thus, the inadequate provision of credit facilities to cultivators who need finance (and they are a very large proportion of agricultural producers in Bangladesh) seems to be the most serious obstacle in the way of the spread of the new technology.(~~Hossain M.,~~ p 266)

TABLE: 4.1

INTER REGIONAL ADOPTION DISPARITY: THE TREND DURING 1987/88-1992/93 (FOR SAMPLE VILLAGES)

VILLAGE	Amnt. of Irrigated Land			Amnt. of MV Land in Dry Season			Amnt. of MV Land in Wet Season.		
	1987-88	1992-93	growth rate (%)	1987-88	1992-93	growth rate (%)	1987-88	1992-93	growth rate (%)
Irrigated (Patardia +D.Mari)	21074	20067	(-)5	21513	19207	(-)9	10632	17443	137
Draught-Prone (B.pur)	6264	16125	157	7830	12224	56	4698	6068	29
Rainfed (Sh.Pasha)	1534	8697	466	1753	8061	360	0	0	0
Saline-Prone (M.Mara)	0	265		0	0	0	58	423	629

Note: Although absolute amount of MV boro land decreased in the irrigated villages yet in terms of proportion of farmsize it increased during 1987/87-1992/93 period. This obviously imply that there was either an overestimation of 1987-88 operational land or it declined at a higher rate. Since the data was collected from the extensive survey for the year 1987-88 where average farmsize was defined as simply the total owned land of the village divided by the number of Households. So it was obviously an overestimation as compared to own 1992-93 datawhere farmsize was defined as self-cultivated land plus leased in land. But this should not affect our regional gap analysis since same 1987-88 definition holds good for all the villages in our sample.

TABLE:4.2

INTER-REGIONAL ADOPTION DISPARITY: THE TREND DURING 1987/88 -1992/93 (FOR PANEL OF HOUSEHOLDS)

Village Panel	Amount of Irrigated Land			Amount of MV Boro Land			Amount of Amon Land		
	1987-88	1992-93	growth rate (%)	1987-88	1992-93	growth rate (%)	1987-88	1992-93	growth rate (%)
Irrigate (Patardia + D.Mari	2248	2815	(-)25	1926	2695	40	544	2223	308
Draught-Prone (B.Pur)	2346	3960	69	2025	3285	62	2569	2335	(-)10
Rainfed (Sh. Pasha)	148	442	198	198	430	117	0	o	0
Saline-Prone (M.Mara)	0	0	0	0	0	0	123	34	(-)73

TABLE:4.3

THE TREND OF NUMERICAL EXTENT OF ADOPTION AMONG PANEL OF HOUSEHOLDS FROM THE SELECTED VILLAGES: 1987/88 - 1992/93.

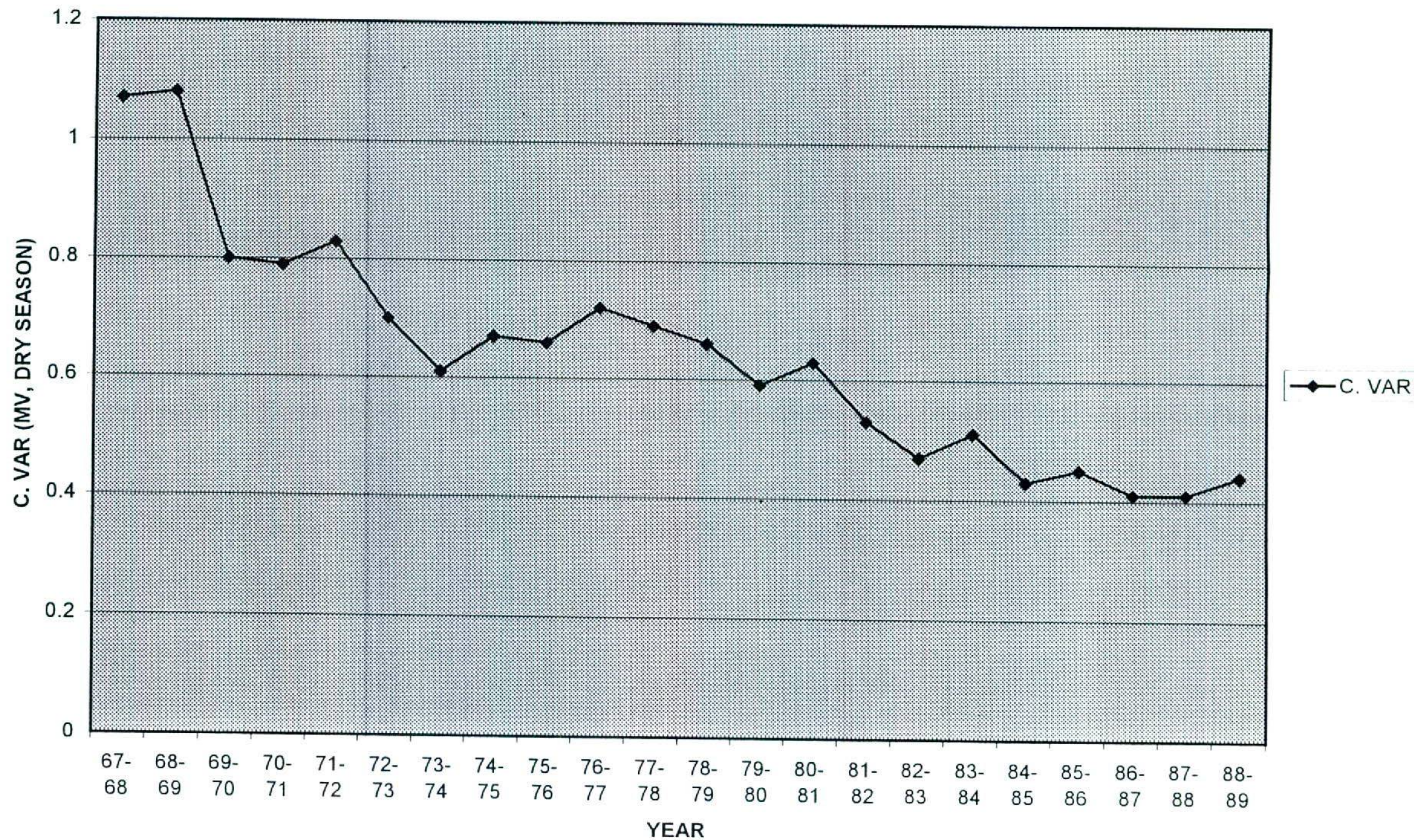
VILLAGE	Percentage Of MV Adopters	
	1987-88	1992-93
Irrigated (Patardia+D.Mari)	75	72
Rainfed (Sh.Pasha)	29	25
Draught-Prone (B.Pur)	71	71
Saline Prone (M.Mara)	6	6

TABLE 4.4a

COEFFICIENT OF VARIATION OF MV CULTIVATION IN DRY SEASON (ALL DISTRICTS)

YEAR	STD. DEVIATION	MEAN	COEFFICIENT OF VARIATION
1967-68	0.02	0.01	1.07
1968-69	0.05	0.04	1.08
1969-70	0.05	0.06	0.80
1970-71	0.08	0.10	0.79
1971-72	0.09	0.11	0.83
1972-73	0.10	0.14	0.70
1973-74	0.12	0.19	0.61
1974-75	0.16	0.23	0.67
1975-76	0.15	0.23	0.66
1976-77	0.18	0.24	0.72
1977-78	0.18	0.26	0.69
1978-79	0.18	0.27	0.66
1979-80	0.17	0.29	0.59
1980-81	0.19	0.30	0.63
1981-82	0.17	0.32	0.53
1982-83	0.16	0.35	0.47
1983-84	0.18	0.35	0.51
1984-85	0.17	0.39	0.43
1985-86	0.18	0.40	0.45
1986-87	0.17	0.42	0.41
1987-88	0.19	0.45	0.41
1988-89	0.22	0.49	0.44

FIGURE 4.4B



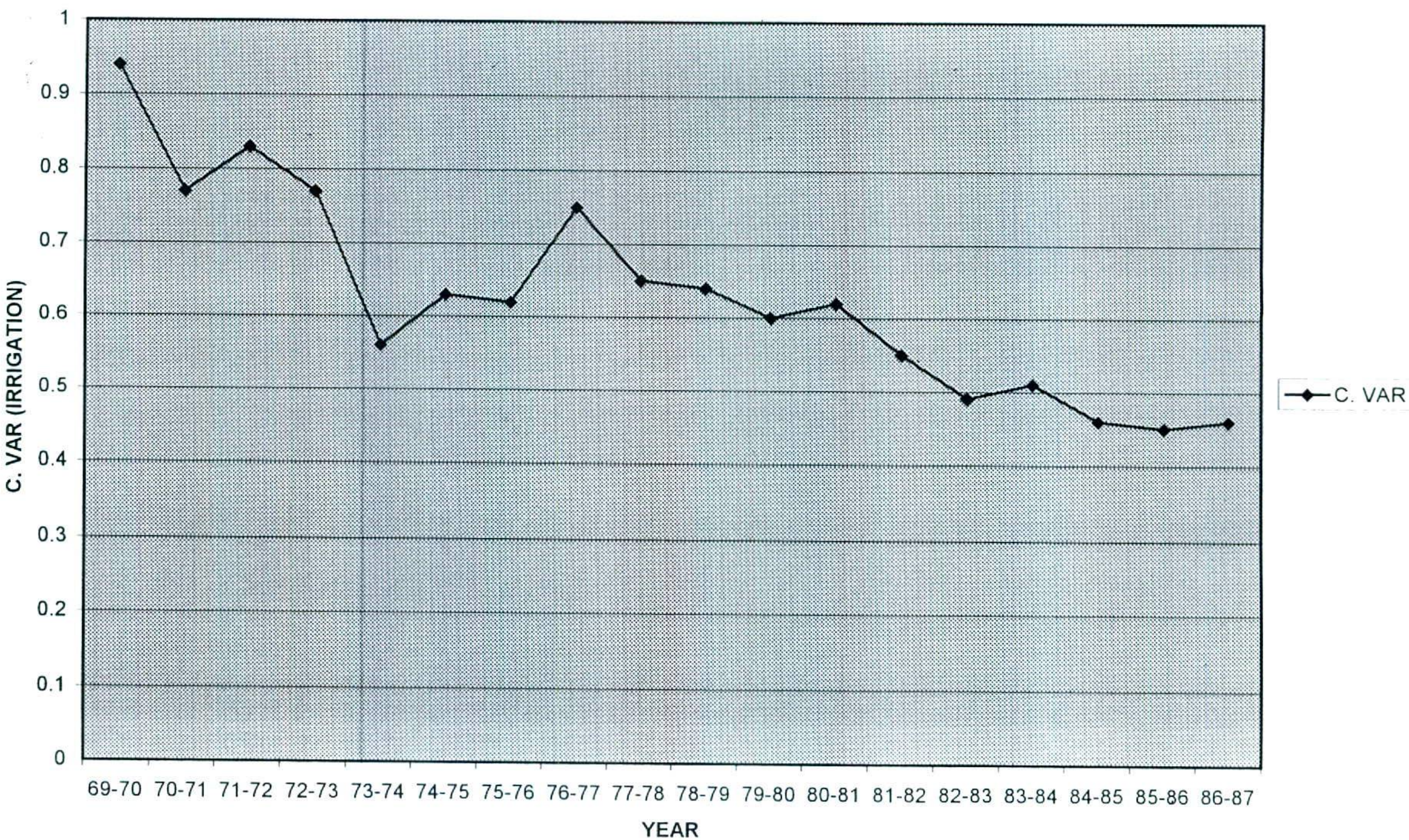
1.2
1
0.8
0.6
0.4
0.2
0
C. VAR (MV, DRY SEASON)
67-68
68-69
69-70
70-71
71-72
72-73
73-74
74-75
75-76
76-77
77-78
78-79
79-80
80-81
81-82
82-83
83-84
84-85
85-86
86-87
87-88
88-89
YEAR
C. VAR

TABLE 4.5a

CO-EFFICIENT OF VARIATION OF IRRIGATION IN DRY SEASON (ALL DISTRICTS)

YEAR	STD. DEVIATION	MEAN	COEFFICIENT OF VARIATION
1969-70	0.15	0.16	0.94
1970-71	0.15	0.20	0.77
1971-72	0.17	0.21	0.83
1972-73	0.17	0.22	0.77
1973-74	0.15	0.26	0.56
1974-75	0.16	0.26	0.63
1975-76	0.15	0.24	0.62
1976-77	0.16	0.21	0.75
1977-78	0.16	0.25	0.65
1978-79	0.16	0.24	0.64
1979-80	0.16	0.26	0.60
1980-81	0.15	0.24	0.62
1981-82	0.14	0.25	0.55
1982-83	0.13	0.27	0.49
1983-84	0.14	0.28	0.51
1984-85	0.14	0.31	0.46
1985-86	0.14	0.32	0.45
1986-87	0.14	0.33	0.46

FIGURE 4.5B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0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
C. VAR (IRRIGATION)
69-70 70-71 71-72 72-73 73-74 74-75 75-76 76-77 77-78 78-79 79-80 80-81 81-82 82-83 83-84 84-85 85-86 86-87
YEAR
C. VAR

TABLE 4.6a

CO-EFFICIENT OF VARIATION OF MV CULTIVATION IN WET SEASON (ALL DISTRICTS)

YEAR	STD. DEVIATION	MEAN	COEFFICIENT OF VARIATION
1969-70	0.00	0.00	
1970-71	0.01	0.02	0.94
1971-72	0.04	0.05	0.85
1972-73	0.07	0.11	0.68
1973-74	0.10	0.15	0.68
1974-75	0.07	0.10	0.75
1975-76	0.11	0.12	0.89
1976-77	0.13	0.10	1.34
1977-78	0.13	0.11	1.10
1978-79	0.13	0.15	0.90
1979-80	0.18	0.18	0.99
1980-81	0.22	0.21	1.04
1981-82	0.20	0.20	1.00
1982-83	0.21	0.23	0.92
1983-84	0.21	0.23	0.92
1984-85	0.21	0.24	0.89
1985-86	0.20	0.24	0.86
1986-87	0.21	0.25	0.86
1987-88	0.21	0.25	0.81
1988-89	0.24	0.32	0.73

FIGURE 4.6B

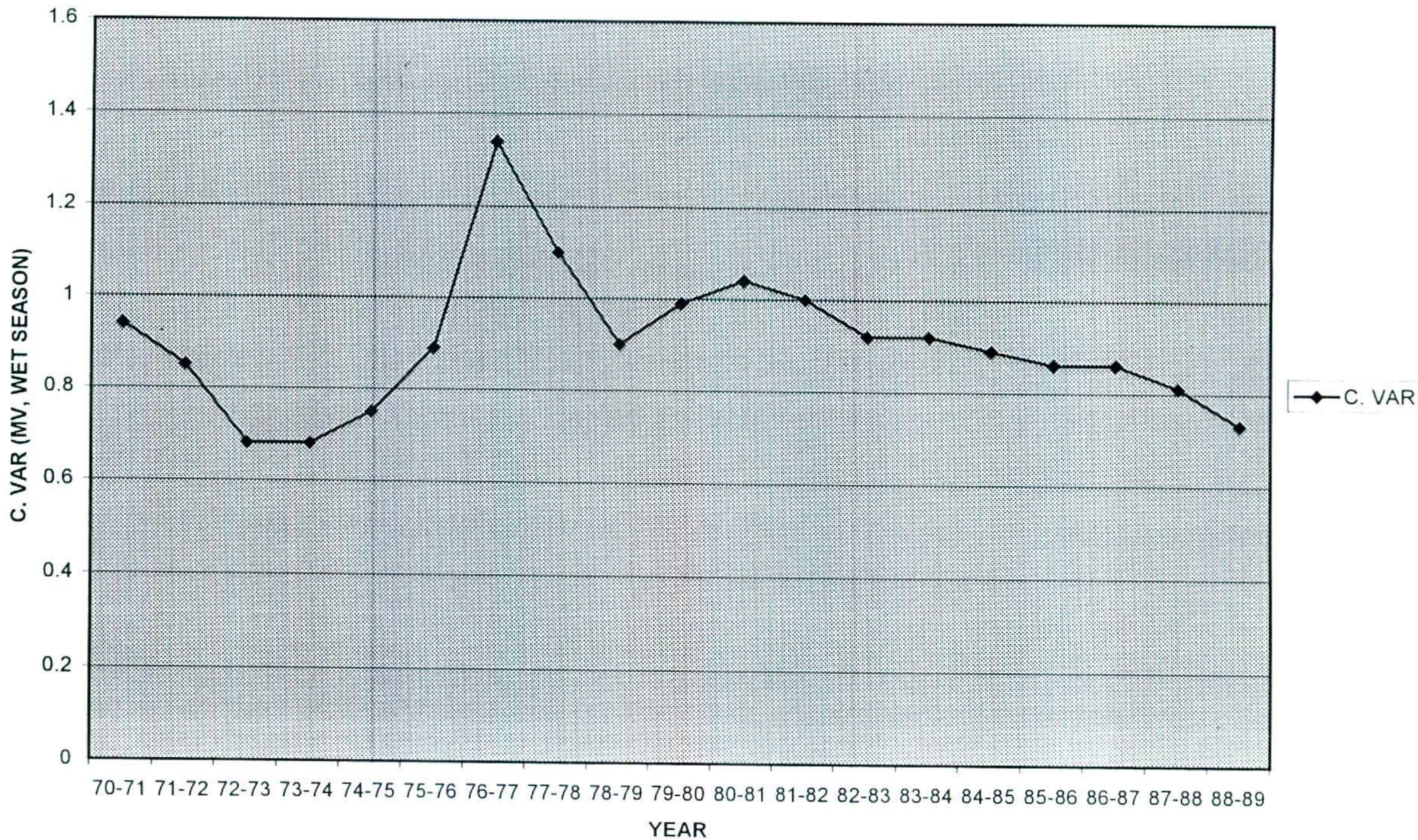
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
C. VAR (MV, WET SEASON)
70-71 71-72 72-73 73-74 74-75 75-76 76-77 77-78 78-79 79-80 80-81 81-82 82-83 83-84 84-85 85-86 86-87 87-88 88-89
YEAR
C. VAR

TABLE 4.7a

CO-EFFICIENT OF VARIATION OF IRRIGATED LAND IN WET SEASON (ALL DISTRICTS)

YEAR	STD. DEVIATION	MEAN	COEFFICIENT OF VARIATION
1969-70	0.04	0.03	1.54
1970-71	0.05	0.03	1.82
1971-72	0.03	0.02	1.45
1972-73	0.05	0.03	1.72
1973-74	0.04	0.03	1.62
1974-75	0.04	0.03	1.66
1975-76	0.03	0.02	1.51
1976-77	0.05	0.02	2.17
1977-78	0.05	0.02	2.21
1978-79	0.08	0.03	2.43
1979-80	0.12	0.04	2.77
1980-81	0.05	0.03	1.55
1981-82	0.07	0.05	1.55
1982-83	0.07	0.05	1.61
1983-84	0.09	0.04	2.08
1984-85	0.09	0.04	1.98
1985-86	0.08	0.05	1.74
1986-87	0.09	0.05	1.85

FIGURE 4.7B

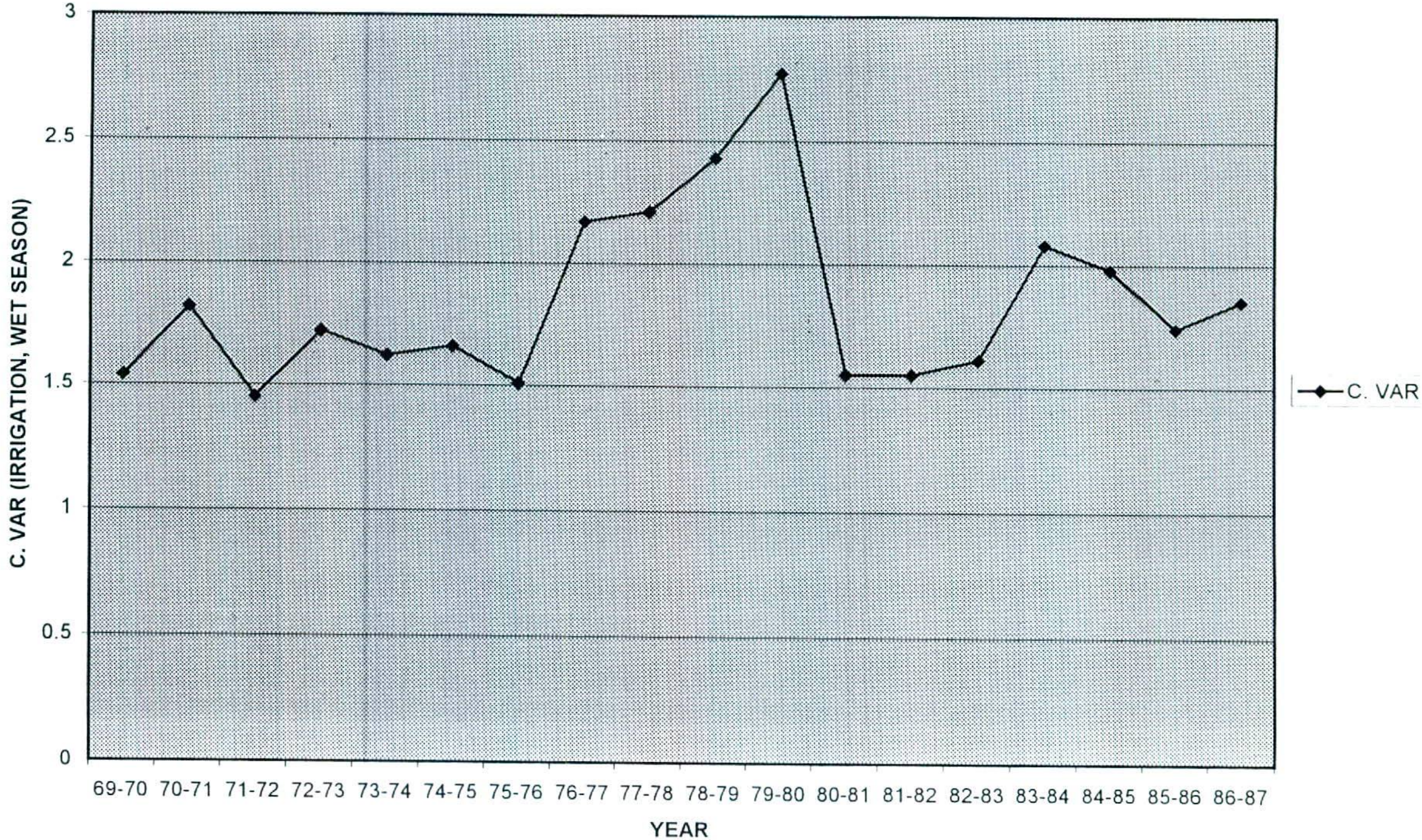
3
2.5
2
1.5
1
0.5
0
C. VAR (IRRIGATION, WET SEASON)
69-70 70-71 71-72 72-73 73-74 74-75 75-76 76-77 77-78 78-79 79-80 80-81 81-82 82-83 83-84 84-85 85-86 86-87
YEAR
C. VAR

TABLE:4.8a

DISTRIBUTION OF IRRIGATED LAND
(THAKURGAON DEEP TUBEWELL PROJECT AREA)

YEAR	SMALL FARMER	MIDDLE FARMER	LARGE FARMER	TOTAL
1986-87	8.60	61.30	30.1	100
1987-88	11.00	57.60	31.3	100
1988-89	12.50	59.90	27.6	100
1989-90	12.10	59.6	28.30	100

NB: a) Small farmer means farmers who have .02 to 1.01 ha. of farm land, Middle farmer posseses 1.02 to 3.03 ha. and the large posseses 3.04 ha. or more.

b) The total number of sample farmers were 325 of which 160 were from Thakurgaon (the same subdivision where one of our sample village Baikunthapur is situated) and 165 were from Rajshahi. (Source: M. A. Hakim, D. E. Perker and M. A. Ghani, 1990).

TABLE: 4.8

VILLAGE PATARDIA: ACROSS CLASS ADOPTION DISPARITY

Land Based Classes	Total No. of Farm HHs	Dry Season			Wet Season		
		% of Adopter HHs	Av. Intensity of Adoption	Participation Index	% of Adopter HHs	Av. Intensity of Adoption	Participation Index
Small	98	95	84	101	70	55	95
Middle	2	100	100	126	100	84	210
Large	1	100	61	77	100	64	160
Total	101	95	83	1oo	71	57	100
Owner Operator	51	94	81	96	88	80	174
Owner Cum Tenant	29	100	83	105	90	45	100
Pure Tenant	21	90	90	102	o	0	0
Total	101	95	83	100	71	57	100

Notes: a) We divided the farm households (i.e. households having some cultivated land) into three classes. The HHs who own up to 250 decimals of land(cultivated+non-cultivated) are categorized as small farmers. The HHs owning more than 250 decimals but less than 500 decimals are categorized as middle farmers. The HHs owning more than 500 decimals of land are categorized as large farmers.

b) Definitions of "Adopter Household", "Intensity of Adoption" and "Participation Index" are presented in the section.

c) The base index value of "Participation Index" has been taken as 100 and it represents the average for all classes/tenure groups.

TABLE: 4.9

VILLAGE DARIKAMARI: ACROSS CLASS ADOPTION DISPARITY

Land Based Classes	Total No. of Farm HHs	Dry Season			Wet Season		
		% of Adopter HHs	Intensity of Adoption	Partici-pation Index	% of Adopter HHs	Inten-sity of Adopti-on	Partici-pation Index
Small	75	93	96	105	93	94	99
Middle	6	100	92	108	100	97	109
Large	4	75	74	66	75	98	83
Total	85	93	91	100	93	95	100
Owner Operator	31	81	81	87	87	97	95
Owner Cum Tenant	33	100	96	loo	100	98	110
Pure Tenant	21	100	96	90	90	88	90
Total	85	93	91	100	93	95	100

Notes: See the notes below Table 4.8.

TABLE: 4.10

VILLAGE BAIKUNTHAPUR: ACROSS CLASS ADOPTION DISPARITY

Land Based Classes	Total Farm HHs	Dry Season			Wet Season		
		% of Adopters	Intensity of Adoption	Participation Index	% of Adopters	Intensity of Adoption	Participation Index
Small	47	94	39	87	30	8	21
Middle	14	100	51	121	93	33	263
Large	18	100	44	104	83	25	178
Total	79	96	44	100	53	22	100
Owner Operator	28	96	49	111	89	31	236
Owner Cum Tenant	31	97	39	89	55	15	71
Pure Tenant	20	95	32	72	o	0	o
Total	79	96	44	100	53	22	100

Notes: See the notes below Table 4.8.

TABLE: 4.11

VILLAGE SHANKARPASHA: ACROSS CLASS DISPARITY

Land Based Classes	Total No. of HHs	Dry Season			Wet Season		
		% of Adopters	Intensity of Adoption	Participation Index	% of Adopters	Intensity of Adoption	Participation Index
Small	99	74	49	92	0	0	0
Middle	15	93	51	120	0	0	0
Large	4	100	61	155	0	0	0
Total	118	77	51	100	0	0	0
Owner Operator	53	77	50	98	0	0	0
Owner Cum Tenant	39	90	51	116	0	0	0
Pure Tenant	26	58	50	73	0	0	0
Total	118	77	51	100	0	0	0

Notes: See the notes below Table 4.8.

TABLE: 4.12A

LAND OWNERSHIP AND MV INTENSITY IN DRY SEASON: FOUR VILLAGES (1992-93)

Land Ownersip Status	Total Cultivated Land	MV Land In Dry Season	Intensity Of MV Cultivation
Small	35154	23178	66
Medium	11202	6733	60
Large	19379	9581	49
Total	65735	39492	60

Notes: See the notes below Table 4.8.

TABLE: 4.12B

LAND OWNERSHIP AND MV INTENSITY IN WET SEASON: FOUR VILLAGES (1992-93)

Land Ownersip Status	Total Cultivated Land	MV Land In Wet Season	Intensity Of MV Cultivation
Small	35154	13200	38
Medium	11202	3885	35
Large	19379	6426	33
Total	65735	23511	36

Notes: See the notes below Table 4.8.

TABLE: 4.12C

LAND OWNERSHIP AND MV INTENSITY IN DRY SEASON: ALL VILLAGES (1992-93)

Land Ownersip Status	Total Cultivated Land	MV Land In Dry Season	Intensity Of MV Cultivation
Small	52440	23178	44
Medium	17262	6733	39
Large	24397	9581	39
Total	94099	39492	42

Notes: See the notes below Table 4.8.

TABLE: 4.12D

LAND OWNERSHIP AND MV INTENSITY IN WET SEASON: ALL VILLAGES (1992-93)

Land Ownersip Status	Total Cultivated Land	MV Land In Dry Season	Intensity Of MV Cultivation
Small	52440	13623	26
Medium	17262	3885	23
Large	24397	6426	26
Total	94099	23934	25

Notes: See the notes below Table 4.8.

TABLE: 4.13

VILLAGE SHANKARPASHA: ACROSS CLASSES DISPARITY IN DRY SEASON ADOPTION AND IT'S TREND OVER TIME

Land Based Classes	1987 (Dry Season)				1992-93 (Dry Season)			
	No.of HHs.	% of Adopter HHs.	Av. Intensity of Adoption	Participation Index	No.of HHs.	% of Adopter HHs.	Av. Intensity of Adoption	Participation Index
Small	9	44	16	88	8	50	48	100
Medium	0							
Large	1	100	15	187				
Total	10	50	16	100	8	50	48	100
Owner Operator	2	0			2	50		
Owner Cum Tenant	4	75			1	100		
Pure Tenant	4	50			5	40		
Total	10	50			8	50		

Notes: See the notes below Table 4.8.

TABLE: 4.14a

CLASS DISPARITY IN DRY SEASON ADOPTION AND IT'S TREND OVER TIME (FOR AGGREGATE PANEL HOUSEHOLDS)

Land Based Classes	1987-88 (Dry Season)				1992-93 (Wet Season)			
	Total Farm HH	% of Adop-ter HH	Av. Inten-sity Of Adopt-ion	Partici-pation Index.	Total Farm HH	% Of Adop-ter HH	Av. Inten-sity Of Adopti on	Partici-pation Index.
Small	48	48	25	72	40	55	46	97
Medium	7	71	28	118	7	57	36	79
Large	6	83	46	228	9	78	45	135
Total	61	54	31	100	56	59	44	100
Owner Operator	23	65	43	167	24	54	45	94
Owner Cum Tenant	25	48	16	46	24	63	40	97
Pure Tenant	13	46	32	88	8	63	62	150
Total	61	54	31	100	56	59	44	100

TABLE: 4.14B

CLASS DISPARITY IN WET SEAON ADOPTION AND IT'S TREND OVER TIME (FOR AGGREGATE PANEL HOUSEHOLDS)

Land Based Classes	1987-88 (Wet Season)				1992-93 (Dry Season)			
	Total No. of Farm HHs.	% of Adopter HHs.	Av. Intensity of Adoption	Participation Index	Total No. of Farm HHs.	% of Adopter HHs.	Av. Intensity of Adoption	Participation Index
Small	48	31	13	45	40	40	23	62
Medium	7	57	48	304	7	57	43	165
Large	6	50	27	150	9	78	34	178
Total	61	36	25	100	56	48	31	100
Owner Operator	23	57	38	241	24	54	33	160
Owner Cum Tenant	25	32	9	32	24	54	33	160
Pure Tenant	13	8	16	14	8	12	7	8
Total	61	36	25	100	56	36	31	100

TABLE: 4.15A

TENURIAL STATUS AND MV INTENSITY IN DRY SEASON: FOUR VILLAGES (1992-93)

Tenurial Status	Total Cultivated Land	Total MV Land In Dry Season	Intensity Of MV Cultivation
Owner Operator	28990	17133	59
Owner Cum Tenant	28116	17316	62
Pure Tenant	8629	5043	58
Total	65735	39492	60

TABLE: 4.15B

TENURIAL STATUS AND MV INTENSITY IN WET SEASON: ALL VILLAGES (1992-93)

Tenurial Status	Total Cultivated Land	Total MV Land In Dry Season	Intensity Of MV Cultivation
Owner Operator	38719	12589	33
Owner Cum Tenant	46175	9592	21
Pure Tenant	9205	1753	19
Total	94099	23934	25

TABLE: 4.16A

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (DRY SEASON, PATARDIA)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	395	1493	297	1369	75	92
Small	5036	996	4147	816	82	82
Medium	387	0	387	0	100	
Large	552	17	333	17	60	100
Total	6370	2506	5164	2202	81	88

TABLE: 4.16B

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (DRY SEASON, DARIKAMARI)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	359	2557	311	2484	87	97
Small	3193	2580	2951	2565	92	99
Medium	1546	366	1398	366	90	100
Large	2394	0	1766	0	74	
Total	7492	5503	6426	5415	86	98

TABLE: 4.16C

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (DRY SEASON, BAIKUNTHAPUR)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	273	4302	129	1526	47	35
Small	1627	2061	438	1134	27	55
Medium	4142	1041	2014	656	49	63
Large	14257	280	6300	27	44	10
Total	20299	7684	8881	3343	44	44

TABLE: 4.16D

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (DRY SEASON, SHANKARPASHA)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	293	2425	104	1367	35	56
Small	4639	2925	1972	1568	43	54
Medium	3077	643	1557	355	51	55
Large	1762	117	1111	27	63	23
Total	9771	6110	4744	3317	49	54

TABLE: 4.17A

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (WET SEASON, PATARDIA)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	395	1493	285	0	72	0
Small	5036	996	4053	0	80	0
Medium	387	0	324	0	84	0
Large	552	17	366	0	66	0
Total	6370	2506	5028	0	79	0

TABLE: 4.17B

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (WET SEASON, DARIKAMARI)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	359	2557	344	2324	96	91
Small	3193	2580	3015	2522	94	98
Medium	1546	366	1490	366	96	100
Large	2394	0	2354	0	98	
Total	7492	5503	7203	5212	96	95

TABLE: 4.17C

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (WET SEASON, BAIKUNTHAPUR)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	273	4302	88	0	32	0
Small	1627	2061	569	0	35	0
Medium	4142	1041	1705	0	41	0
Large	14257	280	3706	0	26	0
Total	20299	7684	6068	0	30	0

TABLE: 4.17D

MV INTENSITY: OWNED LAND VERSUS RENTED IN LAND (WET SEASON, SHANKARPASHA)

Land Ownership Status	Owned Farm Land	Rented Farm Land	Owned MV Land	Rented in MV Land	MV Intensity In Owned Land	MV intensity in Rented Land
Marginal	293	2425	0	0	0	0
Small	4639	2925	0	0	0	0
Medium	3077	643	0	0	0	0
Large	1762	117	0	0	0	0
Total	9771	6110	0	0	0	0

TABLE: 4.18

ESTIMATES OF THE ADOPTION PROPENSITY FUNCTION (LOGIT MODEL, 1992-93)

Variables	PROPENSITY TO ADOPT (FOR FOUR VILLAGES)			PROPENSITY TO ADOPT (FOR FIVE VILLAGES)	
	Either Season	Dry Season	Wet Season	Either Season	Wet Season
CONSTANT	-1.401 (1.02)	-3.65* (2.13)	-.202 (0.21)	-1.188 (1.10)	.80 (.09)
IRGR	6.31*** (6.33)	6.93*** (6.16)	2.97*** (3.94)	6.04*** (7.09)	2.57*** (3.71)
SUBP	.008 (.27)	.036 (1.12)	-.011 (1.44)	.0009 (.08)	-.006 (.92)
TOWNLN	.004 (.90)	.006 (1.14)	-.004 (1.56)	-.0002 (.11)	-.003* (2.11)
FSZ	.004 (.60)	.003 (.40)	.001*** (3.45)	.002 (.60)	.006** (3.00)
TENANCY	-.848 (.98)	-.140 (.16)	-3.85*** (5.62)	-.927 (1.40)	-3.57*** (6.07)
AGE	-.007 (.36)	-.001 (.05)	.015 (1.05)	.003 (.20)	.017 (1.38)
EDN	-.035 (.31)	-.029 (.29)	-.007 (.12)	.019 (.31)	.0004 (.009)
RATIO	-.050 (.08)	.403 (.66)	.155	-.194 (.40)	.085 (.25)
DRAUGHT	2.302 (1.61)	1.163 (1.05)	-1.54*** (3.25)	2.96** (2.32)	-1.25** (2.92)
SALINE	N. Ap.	N. Ap.	N. Ap.	-2.39** (2.80)	-3.61*** (4.96)
FLOOD	.220 (.27)	1.023 (1.10)	-43.37***	N. A.	-41.59***
2 Log L (Const. only)	-238.75	-256.40	-530.95	-624.98	-679.34
2 Log L (Full Model)	-96.943	-101.54	-195.91	-157.33	-255.79
MLR (Chi-Sq. Pr.)	141.807(. 0001)***	154.86 (0001) ***	335.03 (.0001) ***	467.65 (.0001) ***	423.55 (.0001) ***

NB. Figures in parentheses below parameter estimates are T values.
*** indicates significant at 1 percent level of significance.
** indicates significant at 5 percent level of significance.
* indicates significant at 10 percent level of significance.

TABLE: 4.19

ESTIMATES OF THE ADOPTION INTENSITY FUNCTION (MULTIPLE REGRESSION MODEL, 1992-93)

Variables	INTENSITY OF ADOPTION (FOR FOUR VILLAGES)			INTENSITY OF ADOPTION (FOR FIVE VILLAGES)		
	Whole Year	Dry Season	Wet Season	Whole Year	Dry Season	Wet Season
CONSTANT	.839*** (8.43)	.066 (1.30)	.771*** (9.55)	.828*** (10.24)	.095** (2.36)	.730*** (11.04)
IRGR	.979*** (15.71)	.858*** (27.16)	.119** (2.36)	.948*** (17.13)	.833*** (30.08)	.114** (2.52)
SUBP	-.360*** (3.12)	-.076 (1.30)	-.282*** (3.01)	-.329*** (3.39)	-.069 (1.43)	-.257** (3.25)
TOWNLN	-.0002 (1.31)	.00006 (.67)	-.0003** (2.09)	-.0001 (1.33)	.00003 (.66)	-.0002** (2.06)
FSZ	.0003 (1.54)	-.00005 (.48)	.0003** (2.26)	.0001 (1.41)	.00002 (.39)	.0002** (2.00)
TENANCY	-.264*** (5.05)	.034 (1.29)	-.295*** (6.96)	-.225*** (5.31)	.028 (1.30)	-.250*** (7.19)
AGE	-.001 (.94)	.0005 (.69)	.002 (1.64)	-.0005 (.52)	.0002 (.59)	-.0009 (1.04)
EDN	.003 (.57)	-.0007 (.26)	.004 (.91)	.002 (.45)	-.0003 (.16)	.002 (.68)
RATIO	.013 (.35)	-.004 (.20)	.016 (.53)	.017 (.57)	-.003 (.19)	.020 (.81)
DRAUGHT	-.677*** (12.17)	-.155*** (5.51)	-.519*** (11.51)	-.669*** (13.71)	-.164*** (6.72)	-.502*** (12.58)
SALINE	N. Ap.	N. Ap.	N. Ap.	-.707*** (16.21)	-.126*** (4.05)	-.591*** (11.60)
FLOOD	-.69*** (13.99)	-.052** (2.09)	-.634*** (15.84)	-.719*** (11.55)	-.061*** (2.79)	-.643*** (18.00)
R-Square	.758	.777	.609	.830	.871	.633
Adj. R-Square	.752	.771	.598	.826	.868	.625
F-Value	117***	130***	58***	220***	305***	77.79***

NB: Figures in parentheses below parameter estimates are T values.
* indicates significant at 5 percent level of significance.
** indicates significant at 10 percent level of significance.
*** indicates significant at 1 percent level of significance.

TABLE: 4.20

ESTIMATES OF THE ADOPTION INTENSITY FUNCTION (TOBIT MODEL, 1992-93)

Variables	INTENSITY OF ADOPTION (FOR FOUR VILLAGES)			INTENSITY OF ADOPTION (FOR FIVE VILLAGES)		
	Whole Year	Dry Season	Wet Season	Whole Year	Dry Season	Wet Season
CONSTANT	.674*** (6.31)	-.025 (.46)	.56*** (3.38)	.68*** (6.30)	-.043 (.89)	.56*** (3.28)
IRGR	1.19*** (6.64)	.96*** (25.78)	.44*** (3.65)	1.64*** (15.82)	.95*** (30.38)	.42*** (3.26)
SUBP	-.519** (3.47)	-.25** (2.52)	-.42** (2.24)	-.55*** (3.48)	-.134* (1.19)	-.47** (2.31)
TOWNLN	-.0003 (1.59)	.00006 (.63)	-.001** (2.51)	-.0002 (1.53)	.0001* (1.72)	-.001** (2.34)
FSZ	.0004* (1.94)	-.00004 (.38)	.001*** (2.94)	.0003 (1.53)	-.0001 (1.45)	.001** (2.51)
TENANCY	-.32*** (5.70)	.022 (.77)	-.67*** (8.26)	-.31*** (5.43)	.07*** (3.06)	-.64*** (7.68)
AGE	-.001 (.70)	.0006 (.89)	-.001 (.72)	-.004 (.60)	.0008 (1.42)	-.0007 (.41)
EDN	.002 (.27)	-.001 (.43)	.0007 (.10)	.004 (.70)	-.0003 (.12)	.003 (.47)
RATIO	.012 (.31)	-.001 (.05)	.046 (.85)	.010 (.26)	.016 (1.14)	.039 (.70)
DRAUGHT	-.63*** (10.94)	-.13*** (4.42)	-.63*** (8.03)	-.62*** (10.36)	-.15*** (5.88)	-.62*** (7.52)
SALINE	N. Ap.	N. Ap.	N.Ap.	-1.13*** (11.52)	-.85*** (4.23)	-1.01*** (6.95)
FLOOD	-.70*** (13.62)	-.042 (1.52)	-3.84 (.001)	-.70*** (13.17)	-.06*** (2.62)	-4.03 (.001)
R-Square	.753	.770	N.A.	.804	.789	N.A.
Log-Liklihood	-153.40	65.54	-147.41	-195.54	51.045	-185.93

NB: Figures in parentheses below parameter estimates are T values.
* indicates significant at 5 percent level of significance.
** indicates significant at 10 percent level of significance.
*** indicates significant at 1 percent level of significance.

CHAPTER: V

MODERN VARIETY AND MECHANIZATION

5.1. The Issue Of Mechanization

In Bangladesh context the issue of mechanization is a marginal one.[47] Only three and half decades ago in the name of "modernization" two tractors were brought into the famous Comilla-Kotwali cooperative (which later on developed as the pioneer of Green Revolution in Bangladesh) run by the then government. Historically mechanization started in this country not as an MV induced natural process but rather as a government sponsored experiment long before the introduction of the MV. But technically, tractor based ploughing was and is still infeasible in Bangladesh because of the fragmented nature of the plots and also because most of these plots remain waterlogged for at least some part of the year.

So the imported tractors remained under government ownership mainly as a liability and from there it's service was hired out to the peasants from time to time at a subsidized rate. Meanwhile the successive governments continued to encourage private import of one axle power tillers which are more popular for small scale ploughing. The ~~estimates of~~ exact number of running tractors and power-tillers in Bangladesh is very difficult to determine. The agricultural census which is not done very frequently, supplies a broad figure, which is often not ~~so~~ reliable. For example the 1977 agricultural census absurdly estimated that there were in all 35000 tractors and 12000 power tillers in the country at

[47] In Bangladesh context mechanization is defined very narrowly, meaning mechanical replacement of only bullock ploughing with either tractor or power-tiller.

that time. But during the period of 1974-76 the total number of tractors and tillers altogether was estimated by FAO to be only three thousand and fifty-three! Bangladesh does not produce any tractor or tiller. Hence an indirect way of checking the census figure is to look into the relevant import statistics. Import data shows that the total imported number of tractors and power-tillers were also far less than the census figure.[48] Thus census figures are absurd ~~and of not much help~~. Therefore most authors have taken the FAO estimates as more realistic. The last available statistics from the FAO Production Yearbook suggests that in 1992 Bangladesh had 5300 mechanical ploughers at use in the field.[Fao, 1993] But FAO did not present any disaggregation of the total figure into power tillers and tractors. We also have another relatively more conservative estimation of the extent of mechanization in Bangladesh based on a survey of all upazillas in Bangladesh regarding tractor operation. From that survey carried out by BIDS in 1985, ~~Dr~~. Asaduzzaman estimated the number of tractors and power-tillers altogether to be only 2500 of which only 833 were tractors.

The figures mentioned above may vary from each other but they confirm the central fact that mechanization is still ~~in all sense at a marginal level~~ extremely limited in Bangladesh. Even the over biased census report of 1983-84 mentioned: "Only 0.14 percent of the total holdings of the country reported the use of tractors and only 0.13 percent holdings reported that they used power tillers. Only 0.11 percent area was tilled by tractors and almost the same percentage was tilled by power tillers."

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[48] A total of only 6362 power tillers were imported in Bangladesh up to 1980. Even if we assume that all of them were in use at the time of the census the figure then should never exceed this limit. [M.A. Jabbar, 1981]

The census of 1983-84 also reports that mechanical cultivation was as a whole decreasing in the country since 1977. The decrease was faster in case of tractors (while the use of power tillers might even have increased slightly). [BBS, 1986]

At present the principal form of mechanization in Bangladesh (i.e. mechanical ploughing) may account for less than two percent of the cultivated land. [Hossain, ~~Mosharraf~~ 1991]

This reference does not appear in the list

5.2 Causes Of Mechanization

As our review of the literature suggests, there are

In ~~our review of literature~~ section we pointed out four different paths towards mechanization:

a) Introduction and spread of MV. ------> Increase in labour use-----> Labour Shortage and rising wages -----> Labour displacing mechanization (complete or partial)

b) Introduction and spread of MV ------> Increase in cropping intensity -----> Turn around time problem especially when harvesting and land preparation coincides ----> Mechanical ploughing and/or harvesting.

c) Introduction of MV from the top i.e. government ------> Favourable policies for introducing mechanical equipments -----> Premature mechanization (Partial).

d) Introduction and spread of MV -----> Increase in the power of the Kulak lobby ------> Influencing Govt. policies in favour of subsidized mechanization -----> Premature mechanization (Partial). There may also be some other local reasons for localized partial mechanization, e.g., cropping pattern, soil condition, plantation, etc.[49]

We do not have relevant primary data of our own to prove or disprove the above hypotheses. Thus we shall have to depend on secondary sources and theoretical reasoning. On the basis of empirical evidences from the secondary sources the following conclusions can be drawn ~~more or less safe~~ly:

1) At least pattern "C" is clearly visible in the macro level policies of the government. We have already mentioned that tractorization were mainly a government sponsored process. And they were run with subsidy. A study by Gill (1981) offers ~~Gill's study gives~~ some data to prove this point. According to Gill, official charge for cultivating one acre of land with spell out govt. tractors varies from 25 tk. to 60 tk. Whereas cultivating it with hired bullocks (Taking the generally accepted norm that two ploughings and two harrowing with animals is the approximate equivalent of one power tiller/tractor cultivation) generally costs at minimum tk. 90. Sometimes in the peak season it goes up to tk. 160. Even the private power tillers also charge from tk 100 to tk. 150 per acre. ~~[Gill, 1981]~~

There were also many indirect subsidies for the power tiller users in Bangladesh. For example,

[49] In reality we may not find such neatly classified patterns of induced mechanization. There may be overlapping of two or more processes. For example in Pakistan the scholars pointed out that tractorization took place due to both wage increase and tightness in the rural labour market as well as wrong policies of the government. However, the tightness in the labour market was not caused by the expansion of MV only; rather the main cause was the then huge outmigration of poor rural households to the Middle East. Some of these poor households later also invested a part of their remittances for buying tractors.[Renkow, 1991]

a) Power tillers (which have been provided under technical assistance) were priced at the official yen-taka exchange rate which overstates the value of taka at least by 25 percent.

b) A concessional rate of duty of only 15 percent (compared to 75 percent levied on trucks and buses).

c) Cheap credit to the buyers of power tillers at only 11.5 percent rate of interest.

d) Subsidy for spare parts.[50]

by Jabbar & et. al (1985

Another study tried to estimate the extent of underpricing of power-tillers in Bangladesh. This study ~~For their sample they~~ found that 18 percent of the power tillers were bought on full credit and another 44 percent on part credit. All other cash purchases were second hand purchases. On average the tillers were forty to fifty percent under-priced due to overvaluation of the local currency.[~~M. A. Jabbar, et. al. 1985~~]

2) Regarding the private buying of power tillers, the question may arise whether it is at least partly MV induced or not? 6

Farmers at the field differ in their answers to the question " Why do you buy the power tiller?" In Gill's survey of 122 owners, drawn from five different agro-ecological zones of the country, the most common three ~~three~~ motives ~~found~~ were as follows:

a) In Bangladesh the large farmers were the usual adopter of power tillers. In Gill's sample the av. farm size of the users was 4.9 acres which is not only large but

[50] All these policies were valid at least up to 1980. Up to 1980 in total 6362 power tillers were imported into Bangladesh of which 4278 were sold on credit to private sector mainly through Bangladesh Krishi (Agricultural) Bank. [Gill, 1981, Jabbar M. A., et.al. 1985]

also significantly higher than that of the non users. And the large farmers opined that they resorted to mechanization for saving their family labour from the drudgery of bullock ploughing or for avoiding the management problem of a large cattle group or/and a large number of ploughmen. This was mentioned as the primary reason by the large farmer users. For the few small farmers, the primary cause was the absence of enough draught power for cultivation. However most of the small farmers did not have enough means to either buy or hire a power tiller. Facing a shortage of bullocks, they generally began using the milch cows for ploughing which is alleged to be of low quality.[51]

b) The second important reason was the relative cost advantage of mechanical power ploughing. Gill calculated the internal rate of return of a private power tiller to be 254 percent while the BKB loan rate was only 11.5 percent. But this cost advantage is mainly valid for large farm households who have to hire ploughman or permanent labourer if they do not mechanize.

c) The third reason was the special cropping pattern of the user farmers. For example those who cultivated cotton or potatoes reported that ploughing with Bullock is not technically feasible or even if that is feasible it's cost is too high.

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[51] But Gill also contested against this so called " low quality" of cow ploughing and pointed that "...in response to population pressures average farmsize is declining, the smallest kind of farms, that which can not support a pair of bullocks economically, is increasing in number. <u>Such farms may however still support cows,</u> since they are multi-purpose animals and hence problems of capacity utilization would be less severe than with bullocks. Moreover on a small farm there is proportionately less work to be done, so that problem with fertility and lactation which arise when cows have a good deal of work to do may not be severe in this case." [Gill ~~G.E.,~~ 1982]

Thus in special pockets of Dhaka(The potato area) and in some areas of North Bengal (The cotton pockets) the farmers largely resort to power-tiller.[52]

Thus, the farmer's response in general shows that MV induced mechanization is not a plausible hypothesis in Bangladesh. Gill also found a negative correlation between the use of power tiller and the cropping intensity of the farm ~~in question~~. Since cropping intensity is positively correlated with irrigation intensity and MV intensity, So in Bangladesh MV intensity automatically becomes negatively correlated with the use of tractor/powertiller. The negative correlation between MV intensity and tractor/powertiller use is also indirectly inferred from the mutually opposite relationship of these two variables with the common variable farmsize. For example, the number of tractor/ powertillers used in a farm is positively correlated with farmsize while farmsize is negatively correlated with MV intensity, hence tiller/tractor use must be negatively correlated with MV intensity. However, a mere positive or negative correlation does not imply presence or absence of causation. Therefore, one may ask the valid question, "Would not a large farm with MV be more induced to mechanize than another large farm without MV ?" The answer to this question should be "YES" with some qualifications. If and only if MV cultivation in a large farm starts an additional new crop in the farm and thus increases the requirement of bullock labour for ploughing, which is, we found

[52] It is worth mentioning that in 1985 the BIDS upazila survey of the whole country found that about 33 percent of the total power tillers in the country was located in Dhaka. And another 14 percent was located in Faridpur. These areas were obviously not the most high MV areas in the country.[Asaduzzaman, 1988] 1983-84 census also showed overwhelming concentration of mechanical ploughing in only four districts: Dhaka, Barisal, Patuakhali and Chittagong two of which at least had a quite low level of MV in 1983-84. In general these evidences support the hypothesis of marginal mechanization due to local reasons.

earlier , abhorred by the large farmers, then perhaps MV introduction may create extra incentive to mechanize.[53]

But if MV cultivation just replaces one old variety of paddy in the large farm and does not lead to an increased cropping intensity (which is an usual case for the large farmer) then overall bullock labour requirement would remain constant and there would arise no extra inducement to mechanize. Whatever little empirical evidences we have, also shows that MV cultivators in general does not use mechanical power for land preparation. For example, IFDC farm survey carried out in 1978/79-1981/82 has shown that although the MV producing farms use mechanical power three times more than the LV producing farms but that amount is still very negligible(only 24 hours per acre) and that also is confined to only irrigation and threshing operations. [Hossain, M, 1988]

One further small evidence against "MV induced mechanization" may be indicated from our own survey data. It shows that the number of power tiller owners are only three in our sample areas. Of them two are in the village of Baikunthapur and one in Shankarpasha. But we know Baikunthapur is a draught-prone medium MV village with a highly unequal distribution of land and is situated in the Northern zone and the village of shankarpasha is also a flood prone low MV village with actually zero MV in the wet season. These village features automatically rules out the possibility of MV induced mechanization in these villages. The all three power tiller owners found in our survey

[53] Even that incentive may not be a sufficient ground for mechanization in Bangladesh unless the Govt. policy of subsidy for agricultural machinery and the lucrative market for hiring out the powertillers are also available. Thus the macro level finding covering both small and large farms about the negative correlation between cropping intensity and tractor/powertiller use may still stand valid in general.

belongs to the landlord class that is, they own more than 750 decimals of land. This also conforms with our macro and micro level findings.

On a priori basis,

~~Theoretically~~ one can argue that a necessary condition of mechanization is "large size of the farm" and since large farmsize is a result of the historical evolution of the ownership structure of the land which is largely autonomous of MV technology, so high level of MV can never act as a sufficient inducement for mechanization.[54]

5.3 Employment Effects of Mechanization

we have a few is

Since in our sample ~~the number of~~ mechanized farms ~~are a few~~, so for studying the effects of mechanization we shall again ~~use~~ rely on the limited number of secondary studies available in this field. The main controversy centres around the employment effect of MV. These studies suggest ~~Everybody agrees~~ that per acre labour use may fall in case of switching to mechanical ploughing but that may or may not affect the hired labour employment negatively. Some even suggest that hired labour employment may increase. The ~~respective~~ arguments of ~~the~~ different authors ~~parties~~ were already sufficiently explained ~~before~~ in chapter 2. hence we are not going to repeat them here. [~~See Chapter 2~~]

does suggest

Now what the evidences ~~say~~? We have at hand at least four village level studies that tried to resolve the issue by comparing per acre employment level and it's

(1990), an in-depth

[54] ~~Indergit~~ Singh after ~~a long~~ review of the issue, reached the following correct conclusion, " Ultimately, however mechanization reflects the enormous inequality in the distribution of owned and operated holdings, a phenomenon that can be corrected only by the redistribution of rural assets". [~~Indergit Singh, 1990~~, p. 195]

composition across two sets of farms one using tractor and/or power tiller and the other not. The results of ~~their~~ these studies are not conclusive.

One of the studies carried out in Sylhet ~~area~~ reported that the total labour use per unit of land was reduced from 188 mandays per hectare to 171 mandays per hectare and all these decreased 17 mandays were saved by replacing family labour being used previously for bullock ploughing. [~~A.H.M. Mahbub~~ul Alam, 1981] Thus the total labour use of the mechanized farm households on average declined by 9 percent while the family labour used for ploughing prior to mechanization decreased by 100 percent. This fits the usual hypothesis well.

But another study carried out in Dinajpur and based on relatively larger samples found that the per acre labour use for crop production in the irrigated non mechanized village was on average 110 man days whereas the same in the irrigated mechanized village was 125 man days i.e. almost 14 percent higher. Actually this 14 percent increase was the net result of 35 percent increase in the use of hired labour and 52 percent decrease in the use of family labour. However one should not attribute the 14 percent net employment increase totally to mechanization because the cropping intensity was not same in both the villages. The cropping intensity of the irrigated mechanized village was 227 percent which was almost 23 percent higher than that of the non mechanized irrigated village. In other words if one isolates the positive impact of the cropping intensity increase on employment then probably the impact of mechanization will become negative

who did the study? please document

again and it will be mainly confined in the land preparation labor of the family members.[55] The most extensive study on mechanization carried out by Gill in five agro-ecological regions of the whole country, covering both mechanized and non mechanized farms, found that casual labour use in the mechanized farms were not significantly less than that in the non mechanized farms even when the other relevant variables such as cropping intensity and farmsize effects are controlled. And whatever decline in casual labour hiring took place was due to mainly replacement of the family labour used for ploughing which was on average found to be accounting for only 10
previously, it was widely believed
percent of the casual labour hired. ~~Many people used to argue~~ theoretically before that
a
tractorization may lead to reduction in weeding labour hiring which on average accounts for a considerable part (25%) of the total hired casual labour. But empirically Gill
The study
found no such negative impact on weeding labour use due to tractorization. ~~So Gill's~~
of Gill that empirically, there is
evidences ~~in general~~ suggests little or negligible negative impact of mechanization on employment.

5.4 Mechanization and eviction of tenants

The usual hypothesis is mechanization leads to a reduction in the incidence of
the an
tenancy, eviction of old tenants and increase in the incidence of inverse share cropping.
a propositions
All these ~~hypotheses~~ are corroborated by the findings of two studies while one study suggests exactly opposite! Gill's study supports the usual hypothesis. It found that the power tiller owners were in general eager to increase there operational area. In fact his

[55] Logically this isolation is valid because as shown before mechanization in Bangladesh is not contributing to increase the cropping intensity. Nor it is undertaken to release the turn around time constraint which also indirectly contributes to increased cropping intensity.[Gill, 1981]

sample power tiller owners were able to increase their operational area, by proportions ranging from 28 to 92 percent. According to Gill this was done by:

a) Declining to renew share or other leases.

b) Leasing in additional land.

c) Mortgaging in land.

d) Outright purchase of land.

Another study carried out by M.A. Jabbar et. al. (1988) in the two districts of Mymensingh and Dhaka also supports the usual hypothesis. They found that in Dhaka where almost all the sample user of power tillers were from small or medium farm size group generally engaged in intensive potato cultivation , actually had no scope for increasing their farmsize through eviction of their tenants. Thus the proposed hypothesis was not testable in Dhaka. However, in Mymensingh most of the power tiller owners were ~~of~~ large landlord s ~~type~~ and they actually resorted to extensive cultivation once they became the owner of power tillers. The two main sources of extension of their farmsize were fallow land and the previously rented out land. Jabbar et al actually tried to measure the incidence of tenant eviction and calculated " On average each tiller evicted four tenants and on regular hired labourer/ploughman in Mymensingh." [M. A. Jabbar, et. al., 1981, p=16]

which one is the correct reference?

The only study that contradicted the usual findings ~~are~~ is that of Asaduzzaman, carried out in Dinajpur in 1985. He found that the ~~average~~ incidence of tenancy was higher in the irrigated mechanized village than that in the irrigated non mechanized village. And both villages had the usual practice of leasing in by the small landowners from the large land owners. These exceptional findings can be explained partly by the exceptionally high inequality in the distribution of land ownership in these areas, relatively lower density of population and partly by the historical institutional factors such as the "Jotdari-Adhiari" system much prevalent in these areas.

Finally from our own survey we also find that two of the three power tiller owners in our sample are " Jotdars" (i.e. LANDLORD).

5.5 Concluding Synthesis

Our brief review of primary and secondary evidence~~s~~ related to mechanization in Bangladesh shows that MV technology has not induced mechanization in Bangladesh. Whatever limited mechanization has taken place in Bangladesh is due to artificial encouragement of the government, large farmer's negative attitude towards ploughing labour and livestock management and a few other localized reasons. The labour displacing effect of mechanization was in general negative but small enough to be offset by the effect of increase in cropping intensity. However the effect of cropping intensity increase on employment should be associated with irrigation intensity and labour intensity rather than mechanization. Mechanization in some places ~~does~~ really ~~lead~~ led to eviction and further concentration of land in the hands of the few. But this can not be attributed to the MV technology even indirectly since none of the direct causes of mechanization identified above were directly influenced by MV.[56]

[56] One may argue that MV technology by increasing the income of the large farmers may increase their leisure preference and thus indirectly push them further towards mechanization. Although the second part of the argument is true, but the first is not since large farmers have resorted to mechanization in spite of less MV while the small did not mechanize inspite of high MV.

CHAPTER VI

MODERN VARIETY AND LABOUR MARKET

6.1 Rural Labour Market: A Brief Overview

Rural residents who earn the major share of their income through a combination of wage employment in agriculture and non agricultural sectors may be termed as a rural wage labour. Among them those who earn their major share from wage employment in the agriculture are the hard core rural agricultural wage labour .

Besides the rural wage labor, there are also some casual participants in the rural labour market who sell labour power from time to time as a minor supplementary source of their income.

Are these characteristics based on some empirical studies. If so, please cite them.

The general characteristics of the rural labour market in Bangladesh are as follows:

The bulk of the rural wage labour households are either landless or in the process of becoming landless or belong to the class of small farmers.

As the demographic pressure grows the landholding of one family naturally gets fragmented into many and there comes a time when a rural household can no more manage it's subsistence with it's meagre land unless it acquires a new technology to enhance the productivity of the declining stock of land. At a certain point it tries to supplement it's income from wage employment outside it's own farm. In this way a small or marginal farmer enters for the first time into the rural labour market not as a full fledged rural labourer but as a part time participant in the rural labour market. Thus the part time wage earning is an endemic phenomenon in the rural economy of Bangladesh.

In Bangladesh agriculture the casual or temporarily hired rural labour is the predominant form of hired agricultural labour which is supplied by not only the "rural wage labour" households but also by the non-viable farmers who may even possess up to 2 acres of land. These small and marginal farm households generally sell their labour power in the slack season when they have nothing to do in their own farms.

In the peak season the labour market in many places becomes tight due to both withdrawal of a part of the work-force as well as the increase in the workload. Even a deficit farmer may need to hire wage labour during the peak season. Thus the supply of labour, demand for labour and the wage rate vary seasonally in the labour market of Bangladesh.

A Real wage labour in general always engages himself in both agriculture and non agricultural work. Depending upon the weight of their employment measured by the relative share in the income they are put under either agricultural wage labour or non agricultural wage labour.

Unlike the industrial sector labour transaction in agriculture is basically informal in nature.In Bangladesh also, we have a bewildering diversity in labour transactions. However analytically we can distinguish four principal forms of labour transactions in the rural labour market. The Table: 6.1 illustrates the similarities as well as the distinctions among these four different types of labour transactions.

Another not very common but much discussed type of labour transaction in the recent literature is the so called " Interlinked labour transaction". An interlinked labour transaction is defined as a transaction of labour which is essentially linked with any other

transaction between the same partners in any other markets such as credit, land or product. (Basu, K., 1983, Bardhan and Rudra, 1987) In Bangladesh they exist but very little work has so far been done on their nature and extent.
see Taslim's paper in World Development

During the peak season in Bangladesh there occurs a considerable labour mobility from the labour surplus areas to labour scarce areas. These seasonally mobile labour has been given a special name because of their certain special characteristics. They are called "MIGRANT LABOUR". They usually move and negotiate in a group, generally works during the harvest season under a piece rate contract and are paid in kind i.e. a share of the harvest.

6.2 Rural Labour Market in Bangladesh: Macro And Micro Trends

The main sources of rural labour statistics in Bangladesh is the agricultural census which is carried out once in every ten years. Besides we also get some information from the " Man Power Surveys" carried out occasionally at a smaller scale. The relevant infirmations from these two sources are presented in the Table: 6.2 which covers the period between 1974 (The first post independence agricultural census) and 1992. Those infirmations reveal the following macro trends:

The absolute size of the employed agricultural labour force (family labour in agriculture + wage labour in agriculture) has been increasing at snail's pace up to 1983-84.[57] and their relative proportion in the aggregate employed labour force in the country

[57] However between the census of 1974 and 1981, the labour force in agriculture actually declined in absolute terms for the first time in known history! [Khan and Hossain, 1989]

was all along declining, reflecting the usual pattern of structural transformation of any developing economy. Recently i.e. after 1983-84, both absolute agricultural employed labour force as well as it's relative proportion in the aggregate employed labour force has begun to decline. Although the 1991 figures shown in the Table: speaks differently, but that is misleading and does not reveal the actual trend. Because in 1991 census many females in the rural areas doing productive domestic jobs in the household were enumerated as agriculturally employed for the first time and hence agricultural employment figure suddenly jumped up. If we deduct these new female entrants (16.1 m !), then the level of agricultural employment in 1990-91 would really come down to only 17.20 m. which is absolutely less than that in 1983-84. After due adjustments in the aggregate employment figure, there is thus observed a faster decline in the share of the agricultural employed labour in the total employment from 57.14 percent in 1983-84 to somewhere between 34 percent and 50 percent within the short span of only six years. This decline in the case of Bangladesh actually reflects more the push effect of the over crowded agriculture than a dynamic transformation or pull effect of the non agricultural sector.[58] The proportion of hired labour [casual labour + permanent labour] in the total agricultural employment has increased from only 25 percent in 1974 to almost 40 percent.

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[58] However a recent study carried out by Mahabub Hossain et.al. found it partly different. They wrote, " It will thus be inappropriate to conclude that the entire non farm rural sector in Bangladesh is a sponge for absorbing surplus labour.... A large part of the rural non farm sector does have the potential for increasing productivity and incomes through occupational mobility from agricultural wage labour to self employment in non agriculture." [Hossain et.al., 1994]

The proportion of the permanent labour in the hired agricultural labour was only 5 percent in 1974. The rest 95 percent were casual labour. But in 1983-84 the proportion of the permanent worker slightly declined and became only 4.48 percent. In 1978 the proportion of functionally landless rural households was 50 percent.The same in 1983-84 increased and became 56.5 percent. In our agricultural census they are treated as non-farm households and on average almost two-third of them are estimated to be agricultural labour household.The rest is considered as non agricultural wage labour. Micro evidences suggest that non agricultural employment has been increasing further among the land less and marginal farmers.[See RISP-Final Report 1984, Ahmed,hossain. et.al., 1990]

The proportion of small farmers owning less than two and a half acres who sell labour power occasionally was 32.5 percent in 1978. It remained almost same, 33 percent in 1983-84.[59]

The micro sample under study covers 850 HHs from five villages and 75 households with panel data covering two different years 1987-88 and 1992-93. We have calculated the value of some of the above mentioned macro indicators, using our panel data for these two years in order to reveal important trends pertaining to the rural labour market. [see Table 6.3A]

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[59] No macro account is available about the extent of participation of these small farmers in the agricultural labour market. One study carried out by in villages reports that percent of the small farmers occasionally sells labour power to the other farmers. Although the average mandays sold by them to outside employers are only.

Total population of the panel HHs has declined absolutely which is obviously a sign of a trend of outmigration from the villages at a faster rate than the population growth rate. This is however nearly similar to the macro trend of stagnant rural population observed before 1983-84. Most of the small farmer HHs of the panel were able to sustain their landholding during the last six years and remained in the same class. This is also similar to the macro trend. At the same time an occupational shift was going on among them from agriculture to non-agriculture. [See Table 6.3A)

A

Similar pattern was also observed in the case of landless HHs. Their number remained stable or declined marginally while many of them shifted from agricultural wage labour to non-farm jobs. Lack of data prevents us from drawing any such conclusions at macro level. The number of Non-farm HHs were increasing at a very high rate. And most of them were coming from the small and the landless HHs. The number of professional agricultural wage labour has declined. They come increasingly from the landless HHs. Since the total workload of agriculture did not decline in the villages under study during the last six years, this trend imply a greater degree of specialization among the agricultural workers during that period i.e. a fewer landless worker carrying out a higher agricultural workload.The specialization seems to have been induced by the reduction of seasonal pattern of demand for agricultural labour due to phasing of the transplanting and harvesting of rice as the modern varieties are not photoperiod sensitive as the traditional ones, and the availability of irrigation reduced the dependence of agricultural activities on rainfall. This trend has permitted shift of some workers to non agricultural sector, especially those who had to be kept before for meeting demand during peak period agricultural activities. Many agricultural workers belonging to the small and the landless group have thus moved to the non-farm sector.

If we disaggregate the panel data further into two broad groups of technologically dynamic [shankarpasha and Darikamari] and technologically static [patardia, baikunthapur and Mailmara] regions and look into them separately, then we also observe important variations in trends that are not revealed by the aggregate trends presented above. The points emerge from the Table 6.3b.

The size of population did not decline absolutely in the technologically progressive villages whereas the absolute decline was as high as 9 percent in the static villages. It shows that there was a lesser incidence of outmigration in the dynamic villages or the outmigration rate did not exceed the natural population growth rate in those areas.

Both the numbers of landless and small farmers were stable over time in both the regions. And the number of nonfarm HHs was doubled during the last 6 years in both types of villages due to occupational shift among the landless and small farmer HHs. However shifting from agriculture to non agriculture was more prominent among the landless and small farmer groups in the technologically progressive villages. out of the 14 new entrants to non agricultural jobs all but one were from these classes. On the other hand half of the new entrants to the non farm occupation were from other higher landholding classes in the technologically static villages.

The agricultural wage labour declined at a faster rate in the technologically dynamic villages while their total number remain almost same in the static villages. The above mentioned trends together indirectly also implies that after the occupational shifts the remaining small and landless households had to carry a higher agricultural workload, specially in the progressive villages where the demand for labour had increased. In other words the trend is towards fewer full-time agricultural workers from a large number of part time workers previously dominating the agricultural scene.

6.3 Labour Market: The Issue Of Demand

Even the critiques of Green revolution agree that MV technology, if not mechanized , should increase the demand for agricultural labour. The reason is two fold. Firstly, the introduction of irrigation needed for the adoption of MVs enables the farmers to grow a new crop in the dry season. Thus more employment is generated in the cultivation of new crops on the same size of cultivated holding. This type of positive employment effect would take place even if the farmers were cultivating traditional varieties (LV). as the second crop instead of MV. In other words if cropping intensity of a farm doubles without any change in the crop and technology type then labour use per unit of land during one year is also expected to be doubled naturally. Some economists have called it positive employment effect of MV via increase in cropping intensity.

Secondly, we also know that MV like the traditional varieties follows more or less the same sequence of operations. But in each stage in the sequence of those operations MV requires additional amounts of Labour. For example, since MV has a comparatively higher amount of output per unit of land, so it requires higher amount of labour for harvesting and threshing too. MV also requires additional labour for irrigation and fertilizer application which is either absent or very low in the case of TV. MV indirectly contributes to further use of extra weeding labour because increased use of fertilizer often leads to an extensive growth of weeds. The higher labour requirement of MVs was recognized in 1970's even by the critics of "Green Revolution".[60]

Although the MV definitely increases the employment level for various operations, the extent of increase is not technologically predetermined. Therefore, the following less explored hypotheses will be tested to show that the extent of positive employment effect is not always uniform and it would vary largely depending on the ecological conditions of the village, the socio-economic status of the adopter and the type of the agricultural operation being compared. The hypotheses to be tested are:

1) The increase in labour use is relatively more in the irrigated village than in the non-irrigated village while a shift occurs from TV to MV.
2) The small and the marginal farms use more labour per unit of land than do the large farms while shifting from TV to MV.
3) Most of the incremental labour use occurs in the three major operations of "Harvesting", "Weeding" and "Transplanting".

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[60] Andrew Pearse mentioned several other features of MV besides what we have mentioned in the text, which may further enhance the labour use per acre. They are, treatment of seeds with chemicals to ensure proper germination, the depth of the seed in the soil, the density of the plant on the ground and the timing of transplanting. According to him all these features require more than the accustomed work.

4) A greater portion of the incremental labour requirement is met from the hired labour in the case of large farmers vis a vis small farmers.

The data for testing these hypotheses were collected by using the same old questionnaire and procedure which was followed earlier in 1987-88 by the DIS researchers for collecting plot level detailed data on input use, labour use and output of different crops. The detailed structure of our new sample plots from where the input-output data was collected for the crop year 1992-93 is presented in the Table 6.4. [For details about the data gathering procedure please see section 3.4 of this thesis]

For the cropping season of 1992-93 we could collect data on 133 plots of which only 28 plots were cultivated with TV and the remaining 105 plots acres were used for cultivating MV. 81 plots out of the 105 MV plots belonged to the two irrigated villages of Darikamari and Patardia and the remaining 23 MV plots belonged to the three non-irrigated villages of B.pur, Sh.pasha and Mailmara. Unfortunately there was only one plot from the MV villages which has been cultivated with LV. The remaining 27 LV cultivated plots belonged to the non-irrigated villages. Thus region wise comparison of labour use for LV and MV was possible for only the non irrigated villages. The comparison for the irrigated villages presented in Table: 6.5 was made between the estimated labour use of only one TV plot belonging to a large farmer and 81 MV plots belonging to all categories of farmers. Since it is based on a single TV plot the findings has to be taken with caution.

In spite of the small size of the sample it was found that the estimated average labour uses were very near to that of many other pervious larger sample based studies.[61] From the Table 6.5 we find that per acre labour use for MV cultivation by the small, medium and large farmers are respectively 58, 66 and 52 mandays in the irrigated villages. The same in non irrigated villages is respectively 72, 74 and 67 mandays. Thus it is clear that the different classes of farmers from a irrigated zone would use on average a lower amount of labour in the cultivation of MV than their counterparts in the non irrigated zone. Thus the average labour use per acre for the MV cultivation was as a whole 14 percent lower in the irrigated zones than that in the non-irrigated zones. All these evidences disprove the first hypothesis forwarded before.

This can be easily explained by the crop composition of the plots selected from the different regions. For example in the non irrigated zone water is naturally scarce and irrigation was limited so whatever little water facility was there, it was used completely for cultivating mainly the secured dry season Boro MV crop. Thus the MV plots from the non irrigated zone as a whole were small in number but was overwhelmingly cultivated with Boro MV which requires relatively more labour than the other Amon MV variety. On the other hand in the Irrigated zone some plots were cultivated with Amon MV with the help of natural rain supplemented with a little irrigation. If this type of crop

[61] The "Costs and Returns Survey For Bangladesh", AER, GOB., reports that the per acre labour use for LV Amon and MV Boro was respectively 53.1 persondays and 109.7. According to another large scale IFDC survey they were respectively 53 and 88 persondays. Hossain, Jabbar et. al.(1990) estimated them as equal to 53.4 and 82.2. And if one now looks at the estimated labour uses based on the current survey covering all the regions (see the table 6.5) one finds that the labour use for the LV covering all regions varies between 47 to 50 persondays and that of MV varies between 55 to 68 persondays. These seem to be fairly close to the above findings if one further remembers that in the current sample some LV plots consist of Aus LVs which have pulled down the average labour use figure to some extent. Similarly Amon and Aus MV plots have also pulled down the av. MV labour use per acre in the sample plots.

bias in MV cultivation is found to be common in all irrigated zones, the above finding will be valid in general.

The above, if true , has important dynamic implications. Dynamically speaking, it is more likely that the marginal shift to MV land would occur in the Amon season in the already irrigated zones since boro season MV potentiality of those regions are most probably exhausted long ago. But in the non irrigated areas with slow expansion of irrigation the marginal shift to MV is more likely to occur during the Boro season. Thus in future the positive employment impact per acre due to shift to MV will be relatively larger in the non irrigated areas since in general Boro MV requires relatively more labour per unit of land than the Amon MV. Moreover in the newly irrigated areas the employment effect per acre of MV is likely to be magnified due to the cumulative effect of increase in both cropping intensity and labour intensity of operations. However, the aggregate expansion of Amon MV land in the irrigated villages is likely to be much larger than the small amount of Boro season MV land expansion in the non irrigated areas and hence the aggregate employment effect may still be larger in the irrigated areas.

From the Table 6.5 we also find that labour coefficient is in general higher for MVs than for LVs in both irrigated and non-irrigated areas and that is true within each area for all classes of farmers. But the more interesting observation is, whereas the use of labour per acre goes up by 46 and 57 percent respectively by the small farmers and middle farmers of the non irrigated zone, while they shift to MV, the same increases by only 41 percent in the case of the large farmers. This may be due to the higher opportunity cost of labour for the large farmers. Similar things may also be true for the irrigated zone but could not be tested because of lack of data on local variety cultivation by different classes of farmers for this zone. The above facts are the evidences in favour of our second proposition which actually implies a further strengthening of the inverse relationship between labour intensity and farmsize as there occurs a shift to MV cultivation.

Our third hypothesis was about the relative contribution of particular operations in the incremental labour use per acre as one switches from LV to MV. The relevant information for testing that proposition are presented in the Table 6.6. The Table shows that in terms of the contribution in the incremental labour the first three operations are respectively "Weeding" (64 percent), "Transplanting" (36 percent) and "Harvesting (34 percent).[62]

Thus these three operations together account for 134 percent of the employment gain through switching to MV from LV. Whereas the employment gain through the operations of "Land Preparation" is negative (-52%) and that through "Interculture" or threshing is negligible. This suggests that when a shift to MV occurs the farmer will have to increase his efforts for several operations. However most of the increased labour need is likely to be concentrated in the beginning (Sowing/transplanting and weeding) and at the end (Harvesting and Threshing) of the crop season. This again implies that the seasonal variation in labour demand may increase with the spread of MV.

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[62] Adding up of the percentages may be grater than hundred since some operations contributed negatively to the labour use. In this case it was found that absolute decrease of ploughing labour for MV was 6.97 persondays per acre which was 52 percent of the total incremental labour for all operations taken together.

If we look at the composition of the incremental labour use then we find that in general family labour is withdrawn while shifting to MV. However this withdrawal of family labour occurs from the operations of ploughing, sowing/transplanting, harvesting and threshing. But more family labour is put in the operations of weeding and interculture. On the other hand more hired labour is put in general for all operations. But here the highest increase occurs in harvesting first and then transplanting. This again shows that MV induced demand for hired labour will be concentrated in the two peak periods of operation: harvesting and transplanting. While the MV induced increase in the family labour use will be taking place mostly for weeding.

The preponderance of family labour use in ploughing, weeding and interculture has important economic causes behind them. Special prerequisites have to be fulfilled before hiring labour for these three operations. As to the job of ploughing there is a need of bullocks and the households supplying hired labour must possess them in order to hire out his ploughing services. On the other hand, the employer would hire such labour if he is in short supply of the animals. Since most of the MV cultivating farms have their own bullocks and most of the wage labour households are landless who can not afford to maintain bullocks, this job has to be done by family labour in most cases.
Interculture labour not only requires special skill but also a constant monitoring of the crop in the field which is naturally impossible for any casual labour hired on a daily basis. Permanently hired labour can do that if he possesses the necessary skill. But again that permanent worker will have to be faithful since there is no effective way of monitoring his labour by the employer. Because of these features, the "~~T~~transaction ~~C~~cost" of hiring labour (i.e. the cost of searching a skilled labour and also the cost of monitoring

him) for interculture becomes too high to be economic.[63] Thus automatically the scope of hiring interculture labour is almost nil in Bangladesh.

Weeding also requires utmost care and constant monitoring of the job which is very hard. Alternatively the cost of finding out a trustworthy worker who needs no monitoring, is also often very high. Thus, these extra transaction costs often discourage employment of purely hired labour for weeding. As our sample shows the farmers often engage both family labour and wage labour together to economize the transaction cost of this type of operations.

Conversely the labour of transplanting and harvesting can be monitored easily and whatever special skill they require is generally possessed by most of the agricultural labourers in Bangladesh. Thus the "Transaction Cost" of hiring labour for these two operations are relatively lower and the relative proportion of hired labour in the incremental labour use while shifting to MV is higher for these operations. [See Table 6.6] A further disaggregation of the increase in labour use for MV into hired and family labour according to different farmsize category was made and presented in Table: 6.6 which proves the truth of the last hypothesis. The Table shows that if we take both the irrigated and non-irrigated villages and all the classes together then shifting from LV to MV actually caused a 31 percent increase in the labour use per acre. However this 31 percent increase was actually the net result of 25 percent decline in the use of family labour plus 312 percent increase in the use of hired labour. The class level data also

( ) ~~reference~~ date?

[63] See Stiglitz, Hoff and Braverman For a detailed theoretical discussion on how high transaction cost causes some rural markets to shrink or even wither away completely.

shows that this tendency of reducing family labour use is relatively stronger among both the small (35%) and the large farmers (23%) as compared to the middle ones (14%). On the other hand the tendency to increase the use of hired labour was highest among the small farmer (466%), then comes the middle (227%) and finally the large farmers (136%). This high percentage increase of hired labour by the small farmers is mainly due to the low base. But even then it is contrary to the normal expectation and goes against the old standard belief that small farmers are generally not employers of hired labour.[64] One possible explanation is this that by shifting to MV the small were able to increase their income which again induced them to substitute family labour with hired labour. This is thus may be viewed as an old instance of the familiar "Backward-bending Supply Curve of Labour". Or in other words when labor productivity was low , farmers had to work beyond the full employment norm (more than 8 hours a day) to earn subsistence income; but when productivity increased they withdrew from the arduous agricultural work and get it done by hired labourers. Moreover at higher levels of agricultural productivity opportunities are generated in the non-farm sector due to agricultural growth linkage effects.(Mellor, 1973) These non agricultural work is of higher productivity, requires higher levels of capital and literacy and hence taken up by the family members of large farm households, leaving the agricultural labour to the landless.

Whatever may be the explanation the fact remains that shifting to MV would cause a rise in the demand for hired labour across the board. The Table 6.6 clearly shows that

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[64] Refutation of this old belief is further confirmed by the data presented in a later table 6.10 where it was shown that 66 percent of the employer HHs belonged to small farmer class.

shifting to MV is likely to cause an absolute reduction in the per acre family labour use which is again more than offset by the increase in the use of hired labour.

6.4 Labour Market: The Issue Of Indirect Demand

As argued before [See section 3.3] MV also stimulates various new activities in the rural areas through both forward and backward linkage effects. A complete general equilibrium model or input-output model is needed to capture all the indirect effects of MV on aggregate employment through these linkages. In the absence of such a model one can still infer about certain specific linkage effects by looking at the expenditure patterns of the different classes of farmers in the MV regions and then comparing them with that of the non MV regions. This exercise has already been done by Hossain [1988] for two such regions in Bangladesh to see the indirect linkage effects of both consumption and investment expenditure associated with increased adoption of MV.

In order to carry out this exercise we shall use detailed data on the expenditure behaviour of 81 HHs coming from different classes and different villages. Of these 81 HHs only 30 were from the MV villages (i. e. Patardia and Darikamari) and 51 were from the remaining three villages. Although these sample HHs were selected through using stratified random sampling technique yet they are too small to be the true representative of their respective regions. However as a tentative exercise we calculated the average HH level weekly consumption expenditure, yearly cloth expenditure, total investment expenditure and the composition of investment expenditure into agriculture and non-agriculture for the two groups of HHs from the two different regions. These particular items were selected because of their comparability with previous findings. The results are presented in the Table 6.8.

From these results it was found that all the different types of expenditures except agricultural investment were approximately thirty to sixty percent higher in the MV regions. Thus the per HH demand for all these items were at a higher level in the MV villages inducing higher level of economic activities in these fields. This is likely to generate indirectly new employment opportunities relatively more in these villages.
The lower per HH agricultural investment expenditure in the MV regions (also found in earlier studies), though strange yet can be explained easily. A few HHs in one of the non MV villages invested a huge money to buy irrigation equipment and hence pulled up the total average figure very high. Whereas most of the agricultural investment by the HHs in the MV regions consisted of small amount of variable investment for buying fertilizer. However as stated earlier a relatively larger occupational shift from agriculture to non agriculture in was observed in the MV regions, implying a larger non agricultural investment. This was reflected in the 66 percent higher amount of non agricultural investment in the MV regions than that of the non MV regions.

The above findings are partly different from what has been found by Hossain (1988) for a larger set of HHs selected from a larger number of villages. Hossain's finding was that the MV technology did not induce higher agricultural as well as non agricultural investment in the MV regions as compared to that in the non MV villages. Thus, according to him the lack of investment opportunity in the agriculture forced the non MV village people to invest higher in non agricultural sector even more than that by the average HH in the MV villages. And since irrigation the main avenue of agricultural investments are already taken care of in the MV regions so the average per HH agricultural investment is also lower in the MV regions. The first proposition regarding higher investment in the non agricultural sector in the non MV villages seems not to get support from our sample data whereas the second can be considered as a common finding of both the studies.

However actually the definition used by Hossain for measuring non agricultural investment was narrower than that of our study. Our study treated all investments that are not agricultural as non agricultural investment. But Hossain has put the yearly expenditure on housing, sanitation and consumer durable under another separate category of "other investments". In order to make his results comparable with that of us, the figure of this "other investments" need to be added with his "non agricultural investment" figure. After doing so for both regions Hossain's study also reveals that the total non agricultural investment (broadly defined) was 6 percent lower in the non MV regions compared to villages growing MVs. This comparable result is not qualitatively different from our findings. Our findings defer in terms of degree only showing just a higher degree of difference.

These findings imply that MV technology does actually create indirect employment within the village via increase in both major consumption and investment expenditure per HH. Moreover the effect will be relatively stronger if that increase takes place among the small farmers because their pattern of both consumption and investment is more biased towards labour intensive and local goods.

6.5 Labour Market: The Issue Of Diversity

In Table 6.1 it was pointed out that atleast there exists four different kinds of agricultural labour transactions in Bangladesh, e.g, casual labour, permanent labour, exchange labour and contract labour. Besides these common forms of agricultural labour transactions there also exists two other less common forms: migrant labour and interlocked labour. There are several plausible hypotheses regarding the influence of MV on these different forms of labour transactions. Some of those hypotheses are amenable to empirical test with the available data. Those hypotheses along with their original source references are listed below. However before forwarding any specific hypothesis one must in the beginning establish the general premise that in the MV villages many employer farmers will be facing a relatively tighter labour market situation especially during the peak season. [Byers, , Otsuka, , Lipton, , and many others.] The validity of the above premise was also made clear previously in our analysis of the operation wise incremental labour use due to shift to MV from LV. Given the validity of this general premise, the following specific hypotheses about the impact of MV technology upon the diversity of forms of rural labour transactions can be forwarded for test.

A) As MV progresses labour shortage may occur in the peak season. Also the number of labour hours per day to be provided by a worker may increase because of higher working intensity. To solve these problems the large farmers may hire permanent labour more for the whole year. Thus in the MV regions there may be observed a higher incidence of permanent labour. [Bardhan, 1982]

B) In the MV villages a higher incidence of hiring non local casual labour and/or migrant labour may happen because local casual labour will be unable to meet the aggregate demand of the employer HHs. [David and Otsuka, 1994]

C) Since the problem of labour management is largely a function of the size of labour employed and that again is likely to be larger in the MV villages so for evading that problem the incidence of contract labour and/or piece rate based hiring may be higher in the MV villages.[Rudra, 1978 and Binswanger, 1986]

D) For certain agricultural operations, (e.g. harvesting, transplanting and ploughing) the quality of work does not differ much from labour to labour and the measurement of the effort put by the worker is possible by simply inspecting the result at the end of the work. In these cases piece rate is feasible and it would become more preferable to time rate too, if the intensity of effort also varies much for that type of work in the absence of continuous monitoring. These features are present particularly for the above mentioned types of works, hence generally contractual work arrangement would be more prevalent for them across the board [Roumesset, 1984]

E) In the face of a tight labour market in the MV villages, the large landowners may try to increase their bargaining power over labour by going more for interlocked transactions of labour.Thus in the MV regions the incidence of interlocked transactions should be relatively more.[65] [R. Pierce, 1983]

[65] This last hypothesis refers to a voluminous literature [see Stiglitz, Hoff, et.al. 1990] and qualifies to be treated more extensively under a separate section and we also did so. [See section 6.6]

During the course of our survey we collected information about the last week's employment as well as about the nature of the week (i.e. whether facing any shortage of casual labour supply or not?) for all the 850 respondents from all the five villages. Besides detail information ~~were~~ was collected on the employment of permanent labour, migrant labour, contractual labour and also about those labour who were involved in interlocked transaction in the last year. ~~These~~ This information can be used to test the above hypotheses. But before undertaking that test it is useful to investigate into the profile of the employer HHs found in our survey.

In all, there was found 182 employer households in our survey , who were employing one or another kind of labour during the week before the interview or during the last year. The distribution of these employer households according to their villages and landholding groups is presented in Table 6.9. From that Table it can be seen that about 38 percent of farmers from the two irrigated villages employed labour. As expected, the percentage of employers ~~is~~ are a little bit lower i.e. 35 percent in the three non irrigated villages. The average proportion in the non irrigated villages would become still lower (only 24 percent) if we had excluded the semi-irrigated village of B.Pur from the sample of non irrigated villages. B.Pur was a special type of village in the sense that it's land distribution was highly inegalitarian which is why the incidence of labour employment was found to be the highest there among all the five villages, in spite of it's not very high level of irrigation.[66] It can also be seen from the Table 6.9 that of the 48 employer HHs in B.Pur almost 50% had come from the middle and large farms. But in

[66] The inegalitarian distribution of land in a village actually causes a lowering of the wage rate and that induces more farmers to become employer of labour.

the case of the other two non irrigated villages 66 to 78 percent of the employer HHs did actually belong to the small farmer group. For the irrigated villages also 75 to 90 percent of the employer HHs belonged to the small farmer group.

Thus, the socio-economic profile of the employer HHs from our sample villages suggest that at present the traditional idea about the non-employer status of the small farmers no longer holds good in Bangladesh. And this traditional notion breaks down more quickly when we study the case of the irrigated MV villages, specially in those villages which have a less unequal distribution of land. Presumably, the MV technology necessitates concentrated use of labour during a short time span which can't be met with one's own family labour alone even by the labour surplus small farm HHs. Hence they may have to employ mutually each other's labour at least in particular seasons. Moreover if a some small farmer of a MV village shifts to non agricultural occupation then the higher opportunity cost of his labour may induce him to substitute family farm labour with the hired labour of those who specializes in agricultural labour.

In Table 6.10 these employer households have been cross-classified according to their villages and the type of labour they hired and the village wise composition of the total employed labour in terms of the various types of labour has also been estimated and presented at the bottom five rows. These classifications and estimates presented in the Table 6.10 furnish the necessary evidences for testing the hypothesis A, B and C presented at the beginning of this section.

Another Table 6.11 divides the contractual worker employer households according to their residence and the nature of the contract work. These information can be used to test the hypothesis D.

Table 6.12a and 6.12b provides information about the village wise incidence of interlocked labour transactions and the various types of those transactions. These Tables tests the validity of hypothesis E.

HYPOTHESES A

The first two rows of Table 6.10 show that the relative incidence of Permanent labour measured in terms of both percentage of HHs reporting employment of permanent labour and the number of permanent labour per thousand HHs, was actually distinctly high in the two non MV villages: B.Pur and Milemara. Thus prima-facie evidences do not support hypothesis A. Similar type of findings were also reported in the two previous studies carried out by Hossain (1989) and Muqtada et.al. (1974) Following their logic as well as our pattern of data we may repeat here that in Bangladesh permanent labour is mostly engaged by the large farmers (see Table 6.10) in the northern districts of Bangladesh which have an old feudal tradition and where the structure of landownership is still very unequal ~~inegalitarian~~. In our sample B.pur represents this type of village and Table 6.10 actually shows that out of 59 permanent labour employing HHs in our sample 21 (36%) HHs are from B.Pur and 76 percent of them belonged to either middle or large landholding classes. Another non MV village where there was found a quite high incidence of permanent labour is Milemara, a saline prone village in our sample. Actually this village is an exceptional one and employs permanent labour mostly for managing shrimp culture. Out of the 59 employers of permanent labour in our sample 27 hailed from this saline prone village and 59 percent of these employers came from middle and large landholding classes. However in the last non MV village Shankarpasha the incidence of permanent labour was only one.

Thus in total the non MV villages accounted for 83 percent of the permanent labour employer HHs. In the case of the two MV villages the number of permanent labour employing HHs were only 10 (17%) and 50 percent of them hailed from either middle or large landholding classes. Finally the proportion of large landholders among all this 59 permanent labour employers is found to be 64 percent. And if we look at the bottom of the Table 6.10 we find that in two of the non MV villages, B.Pur and Milemara, the proportion of permanent labour in the total labour use were more than 50 percent. But the same in the two MV villages was even less than 35 percent.

These findings definitely reject the hypothesis "A" which says that MV technology induces permanent labour employment. It rather shows that it may prevail in a large scale in particularly those non MV regions which either have an inegalitarian land distribution or are oriented towards such non agricultural activities which require long term employment of specially skilled labour. When the labour market is small and risky , labour households may prefer permanent labour contract. But as MV expands the labour market expands and jobs become available throughout the year and the permanent labour contract is no longer preferred due to it's lower social status. Thus from a dynamic point of view it is expected that Permanent Labour contracts would increasingly give way to other forms of labour contracts as MV spreads more.

HYPOTHESIS B

Table 6.10 shows that casual labour is the dominant source of hired labour in the two MV villages and one non MV village. But the percentage of outside casual labour in the total casual labour use was however quite low everywhere. Moreover it did not vary much (from 16 to 25 percent only) from village to village. Thus, it seems that both MV and non MV villages have almost a similar incidence of low non local casual labour or conversely their farmers have a preference for the local labour in the case of temporary hiring for two to four days.

The above evidences partly goes against our second hypothesis. It is partly because, without examining the incidence of migrant labour of both types, coming into and going out of the village, one can not become sure of the aggregate trend.

HYPOTHESES C

Data presented in Table 6.11A shows that the relative incidence of both the number of employers of contractual workers and the persondays supplied by them do actually vary significantly between the MV villages and the non MV villages but in the opposite direction to what has been suggested by the hypothesis C. It is found that the percentage of employers providing piece-rated contract among the cultivators in the non MV villages (excluding the special saline-prone village) range between 24 to 27 percent. The same ranges between 4 to 14 percent only in the MV regions. Although the relative incidence of contractual person-days employed is only 9 percent of the total labour use in these non MV villages, but yet it is significantly higher

HYPOTHESIS D

Table 6.11B shows that in total 2075 persondays of work was performed by the contractual workers in the 5 sample villages and 97 percent of these workdays were performed for transplanting, harvesting and ploughing. This completely confirms our hypothesis "D" which says that contractual hiring is likely to be biased toward those agricultural jobs where continuous monitoring is not important because, the amount of work done is easy to measure after the completion of the work and results itself can speak for the quality or/and effort of the labour. Seasonality of labour demand is also high for these operations and the piece-rated contract may ensure more work done by a given number of workers compared to daily wage contract.

HYPOTHESES "E"

Table 6.12A shows that there was not a single incidence of interlocked labour transaction among the interviewed agricultural wage labourers from the MV villages. On the other hand it was found in each of the three non MV villages. However it was most prominent in B.Pur which was a semi-irrigated draught-prone village with a highly inegalitarian structure of land ownership and a remnant of feudal traditions. Out of 55 agricultural wage labour HHs, 21 HHs (38%) reported that they actually have stipulation of transactions in the credit and/or land markets with their employers. Among these 21 HHs 16 HHs(76%) reported that because of interlinkage the landlords were able to able to give them a lower than the normal wage. Only eight HHs reported that they received normal wages. And the remaining six were too afraid to say anything about wage. In the flood-prone Sh.Pasha 10 HHs out of 83 i.e. 12 percent reported about their involvement with interlinked transaction. In Mailmara the incidence of interlinked transaction was still lower; only 2 out of 32 agricultural wage labour i.e. 6 percent reported so. However in Sh.Pasha and Mailmara the wage labour HHs were less afraid of their employers and almost all the involved labourers complained that they were paid a below normal wage. Table 6.12B presents the break down of the interlinked transactions for each village according to their types. The first type is a simple two market interlinked transaction where a labourer has also some leased in land from his employer. Here, in the land scarce Bangladesh, the wage labour HH is obliged to work for the landlord at a below normal wage rate in order to protect his leasing contract. Sometimes the labourer lessee also receives credit either to be used for buying inputs used in the leased in land or simply for meeting his own consumption deficits. This is a three market interlinkage and has been found to be more common than the first type. In our sample of forty two labourers who were involved in interlinked transactions only eight were involved in the first type of transaction, while the number of labourers involved in three market interlinked transactions was thirteen. However the most common type of interlinked transaction in the rural labour market of Bangladesh is the interlinkage between credit and employment. In this case the labourer receives some cash money in the lean season as a credit and repay it in the peak season by working at the creditor's fields at a below normal wage rate. This type of interlinkage has often been called "Forward Selling of Labour" and is a relatively common phenomenon in the rural labour market of Bangladesh. In our sample we also found it to be the dominant type of interlinked labour transaction. Actually twenty one (50%) labourer HHs out of forty two were involved in such transactions.

by whom? please refer some.

In general we can conclude the last two sections (6.5 and 6.6) by pointing out that diversity of labour transactions do exist in the villages of Bangladesh. However in most of the MV and non MV villages the dominant form of labour transaction is the casual labour. But in a few non MV villages especially in the highly inegalitarian ones with a feudal tradition the permanent labour still remains dominant. And in the case of contractual worker employment the employers generally prefer to employ them for particular types of agricultural operations such as, transplanting, harvesting and ploughing and they prevail more or less in both MV and non MV village. However their extent is very small in the over all set of labour transactions. Interlinked transactions are generally found in the non MV villages and the most common type of interlinked transaction is the interlinkage between credit and employment another name of which is "Forward Selling of Labour".

Thus in general switching to MV technology is likely to reduce the incidence of permanent workers and interlinked transactions while increasing the incidence of contractual workers and casual workers in the rural labour markets of Bangladesh. As a further consequence of increase of the incidence of seasonally employed contractual labour, migration of workers from less prosperous areas to more prosperous areas may also increase. As a whole these changes will have positive impact on the income of the rural wage labourers. The absolute level of employment would improve, labourers would become relatively freer, their bargaining power would increase and they will be able to optimize their labour use better than before. And finally if migration from less prosperous areas to MV areas takes place then a spill-over effect of these benefits would also reach the non MV areas!

6.6 Labour Market: The Issue Of Migrant Labour

MV areas have a higher demand for agricultural labour than non MV areas. And especially in the peak season the available stock of free labour may not be sufficient to fill all the demand. In that case it is expected that the free labour from the non MV regains may migrate into the MV areas to avail the work opportunity. However, such a migration of labour will take place only if there is no work available in the non MV regions or if the wage rate in the MV region is at least higher than that in the non MV area.[67]

It is also suggested that through migration the wage gap between the high MV and Low MV or Non-MV areas may be reduced through a reduction of the ~~av.~~ average wage in the MV areas and an increase of the same in the low/non MV areas [David and Otsuka, 1994]. This kind of logic has been used to draw major policy implications for the future direction of agricultural research. The proponents of this view suggest that research on improvement of MV should be concentrated upon favourable irrigated zones where the adoption rate is already high because the research benefits will be occurring there quickly and will automatically trickle down to the non adopting areas through various kinds of adjustments in the inter regional factor markets. and they specifically cite the above mentioned process of labour migration as a positive evidence of such adjustments.[Otsuka and David, 1994]

[67] The wage rate in the MV region must at least cover the extra cost of migration in addition to the non MV wage rate.

Although MV may act as an inducement for seasonal use of migrant labour but it is only one factor in that process. There are several other intervening factors that affect the migration process either positively or negatively. The net effect will depend on the relative weight of all those factors taken together. Therefore depending upon the ultimate configuration of actually effective forces the ultimate outcome may become quite different from what has been envisaged by K. Otsuka and C.C. David in their simple inter-regional labour market adjustment model. Following are the few reasons for which mobility of labour from low/non MV area to high MV area may be imperfect:

1) Asymmetry of information: In agriculture it is often quite hard to monitor and enforce labour effort. Thus the employer usually prefers a known and trustworthy labour. For migrant labours there exists a lack of information on the part of the employers about their trust-worthiness and they may not be willing to take the risk of employing the relatively less known migrants.[68] In that case wages of the migrant labour may become lesser than that of the local labour or simply migration may not take place as expected. Similarly lack of information regarding the job opportunity in the destination district may discourage labourers to migrate.

2) Poor infrastructure or transport system may prevent migration by making the process costly/difficult
co~~st/difficulty o~~f migration ~~too much~~.

3) For the free and idle workers of non/low MV areas there may exist more attractive local non agricultural employment opportunities as alternative to

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[68] Breman observed that these impediments against migration can be partly solved through the emergence of a middleman or broker in between the employer and the migrant labourer. This broker not only solves the problem of asymmetrical information but also sometimes provides temporary credit to cover the initial transport cost of migration. [Breman,1984, Binswanger and Rosenzweig,1984]
But another study from Bangladesh found that even if a migrant labour could solve these problems and get employment, he does not get a higher wage rate than the local labour for his lesser bargaining power and also because the employers prefer local labour.[Asaduzzaman, 1988]

outside agricultural employment and that may prevent them from outmigration to high MV areas.

4) The assumption of tight labour market situation may not hold good in all MV areas. In that case MV induced employment expansion would absorb only the surplus or the redundant labour within the same locality and there would be no rise of agricultural wage to attract migrant labour.

5) Migration out not only depends on the "pull" force of high earning opportunity or conversely the "push" force of low income, but also on the characteristics of the migrant himself. Ceteris-paribus a more young (between 15 to 30 years), a male and an educated person without any binding to land and also with some minimum capital to finance migration (in other words not belonging to the extreme poor group) will have the capacity to migrate more easily. [Lipton, 1989]

The Table 6.13 depicts the flow of migrant labour from the different districts of Bangladesh to the sample villages. Tables 6.13A and 6.13B provides information about the extent of permanent and temporary net migration (i.e. total no. of permanent and temporary outmigration- total no. of permanent and temporary in-migration in each village). Both the Tables present the relevant information according to the village which can also be used as a proxy for different production environments. The first Table refers to the number of households migrating in or migrating out of the village permanently during pre 1992-93 period. The "Going Out" figure is therefore obviously under estimated since some of the "Going Out Households" have not left any of their relatives behind to report about their outmigration at the time of our survey.

The second Table refers to the net migrant labour use for the different villages during the last year. It measures "Migrant In Persondays" of a village in terms of the total amount of "Person Days" supplied by the non local seasonal migrant labour and the non local casual labour. The " Migrant Out Persondays" of a village is measured in terms of the total amount of labour days supplied to the employers residing outside the orbit of three miles around the concerned village by the local households during the last year. These information can be used to check which of the above two views regarding the direction of flow of migrant labour is more realistic.

Firstly, if we look at Table 6.13 we find that 59 percent of the total migrant in labour days were employed in the two MV villages. However, apparently it is also noted that 36 percent of the migrant in labour days were employed in one of the non MV village B.pur. But in true sense most of the migrant labour days of B.Pur were not supplied by real seasonal migrant labour because the same Table also shows that 58 percent of the migrant persondays of B.Pur were really supplied by labourers residing within the district of Thakurgaon, the same to which B.Pur also belongs. Hence, these labourers were although living outside the three miles orbit of the village B.Pur but that was still not as far as to be a different district. It is therefore not a true case of long distance seasonal migration. Table 6.13 also shows that 70 percent of the migrant in labour days were coming from the three districts of Rangpur, Kurigram and Thakurgaon. And all these three districts have a very low intensity of MV cultivation. Thus altogether these evidences suggest that there may actually be some seasonal migration of labour in Bangladesh from MV areas to non MV areas.

Table 6.13A shows that 13 percent of the HHs residing in D.Mari, a high MV village in our sample, were migrant in HHs. But in the three other non MV villages the incidence of in-migrant HHs varied from only two to six percent. It is also observed from the same Table that 17 percent of the farm HHs of D.Mari had employed migrant workers during the last year and all of them came from other far away districts(see Table 6.13). And also no HHs from this village went outside(i.e.more than 3 miles away) to sell labour. But among the non MV villages the maximum incidence of outside employment took place in B.Pur. There it was found that 21 percent of the farm HHs employed migrant labour, but at the same time 10 percent of it's HHs reported that they were also selling their labour outside the village at one time or another during the last year. Thus these evidences also lend support to the proposition that migrant labour and/or migrant HHs were flowing to more prosperous areas from less prosperous areas.

The last but not the least proof of the above position is clearly manifested in the figures of Table 6.13B. It shows that in both of the MV villages net migrant in person days were positive whereas the same was negative in two of the three other non MV villages. The third exception was B.PUR and the explanation of that has already been presented before.

6.7 Labour Market: The Issue Of Labour Supply

The economists have used the micro economics of labour-leisure choice to explain the labour supply behaviour of the rural households in the context of Green Revolution. According to them if MV is adopted and it really contributes significantly to a rise in the income of the adopters then their leisure preference would increase. On the other hand if MV induced demand for labour raises the wage rate then the relative price of leisure (it's opportunity cost) would increase, inducing people to substitute work for leisure. In terms of micro economics of labour supply it is thus assumed that MV technology should generally have two mutually opposite effects on the labour supply decision of the household. A positive income effect would induce a higher preference for leisure but also at the same time a negative substitution effect would induce to substitute leisure with labour because of the increased opportunity cost of leisure. It is then further argued that for very poor households the income effect would be weaker than the substitution effect and hence the net effect of MV upon their leisure is expected to be negative i.e. their labour supply is expected to increase. On the other hand for the rich households the income effect will dominate over the substitution effect and hence the net effect of MV upon their leisure is expected to be positive i.e. their labour supply is expected to decrease.

The Tables 6.14A, 6.14B, 6.14C and 6.14D presents some relevant information for testing indirectly these hypotheses. In Table 6.14A the occupation wise distribution of family members of an average family in terms of average number of students per family, average number of housewives per family, average number of inactive members per family (i.e. disabled and children) average number of unemployed per family (i.e. able bodied family members without any productive job) and average number of workers per family (i.e. able bodied family members engaged in any productive work in either agriculture or non agriculture on either a self employed basis or on a wage/salary employment basis.) is being presented, cross classified according to their adoption status as well as village type. The last row of the Table shows the average family size under each cross-classification.

From this Table the most striking finding is that on average an adopter HH has a higher family size, higher number of students, higher number of inactive members, lower number of unemployed members and a higher number of workers than those of a non adopter HH in both MV villages (Patardia and D.Mari) and non MV villages (B.Pur, Mailmara and Sh.Pasha). But the higher absolute figures for the adopter HHs may simply be a reflection of the higher absolute size of their family! To check for this we had to calculate the proportion of students, housewives, inactives, unemployed and workers in each type of HH for all villages. From this calculation it was found that the relative proportions of both student members and workers were higher among the adopter HHs. It implies that the rate of participation in productive works, on average was relatively higher for the adopter HHs. This may be so because adopter HHs in general have a higher work opportunity and since most of them hail from lower landholding classes they may often try to engage productively whatever family workforce they have in their disposal to meet their higher necessity of labour arising from a higher necessity of income. Consequently the relative rate of unemployed was also lower for the adopter HHs. In general therefore at the household level number of workers per HH was found to be increasing with a technological switching from non MV to MV in both types of villages. Moreover a higher relative rate of students were also observed among the adopter HHs as compared to the non adopters HHs which might imply that through a shift to MV from non MV education of the future generation is also likely to improve more in both MV and non MV villages. Perhaps otherwise those children would have to remain uneducated and underemployed due to lack of HYV induced rise in both income and work-opportunity.

Hossain's study (1988) found the proportion of workers as well as students in the MV villages as a whole to be 26.5% and 36% while those in the non MV villages were 35.7% and 23.1% respectively. Our HH level finding divided into adopter and non adopter groups is not directly comparable with Hossain's inter-village findings. However from the Table 6.16a aggregate village level estimates can also be derived for comparing them with the findings of Hossain.

The derived calculations show that in both MV and non MV villages, the proportion of workers in an average HH were respectively 28 and 29 percent while that for the students was 24 and 25 percent respectively. Thus in our study, across village types the differences in the proportions were actually negligible for both workers and students. And the direction of difference did tally with the findings of Hossain only in the case of workers. However, as mentioned before, with respect to adoption there were differences in favour of the adopter HHs in both types of villages with respect to both proportions, indirect implication of which is similar to Hossain's findings on students but not with that on worker.

Table 6.14B repeats occupation wise distribution of family members but this time according to their landholding status. If one compares the family size of both adopter and non adopter HHs separately across their different landholding classes; one finds that there is a more or less direct relation between the class status and the average size of the family. The marginal class (completely landless+functional landless) has an average family size of 4.22 which increases slowly but more or less continuously as we move up along the ladder of landholding status to become 5.63 for the large (rich+landlord). However the number of workers per family has no such unambiguous trend. It increases more or less continuously from 1.13 for the landless class to become 1.48 for the small farmers and then starts declining till it becomes only 1.36 for the rich and then suddenly jumps to a level of 1.99 for the next landlord class. However if we take the average relative proportion of workers at HH level and plot it against their respective landholding status we find a slightly "U-SHAPED" curve implying higher rate of workers participation at both ends of the landholding scale. This is not similar to the findings of Hossain(1988) who found a clear cut inverse relation between these two variables. One intuitive explanation for the slightly "U-SHAPED" relation is that at the lower end the greater percentage of family members opt to work productively because of sheer pressure of poverty, while perhaps greater opportunity for earning a high level of income from diverse sources induces a higher rate of worker participation at the upper end. This explanation will hold good only if we assume that there is a threshold of poverty associated with a threshold of landholding (here it is at least 50 decimals) below which poverty becomes unbearable and HHs begin preferring work to leisure; conversely there must also be an upper limit of landholding going beyond which opens numerous high income job opportunities before a HH and lure them to sacrifice leisure for very large incremental income. Thus the push effect of extreme poverty induces a higher work participation rate among the poor while in case of the rich the pull effect of attractive income induces the same.

But another more important point is that the total productive labour contribution by a HH. not only depends on the number of workers engaged in productive works but also on the average daily work hours of those workers. The Table 6.14C looks into this and presents the average productive workhours per male worker across the different landholding classes divided into two groups: adopter and non adopter. It also presents the breakdown of that total workhours into four possible components such as agricultural self-employed labour, agricultural wage employed labour, non agricultural self-employed labour and non agricultural wage employed labour. From the information presented in this Table several novel conclusions can be drawn:

a) In general the average productive labour hours per day per male worker increases as one moves up along the landholding status ladder up to the rank of small farmer level and that is true for both adopters and non adopters. But the average productive labour hours sharply declines as one moves further upward from the small farmer level along the same landholding status ladder, for the adopter as well as the non adopter HHs. The above finding implies that at a very low level of land holding the labour effort of the HH increases as they obtain small incremental land. However after a certain level of increase in landholding the HH is induced to reduce their work effort.

b) In the case of all villages, the male members of adopter HHs from all classes supply on average 5.59 hours of productive labour per day. On the other hand the non adopter HHs supply 5.85 hours which is slightly higher. However this difference becomes more prominent if we look at the non MV villages separately. But conversely, in MV villages adoption actually encouraged a male worker to supply more average productive labour supply. A closer examination reveals that in case of all village data the proportion of landless and functionally landless was relatively high among the non-adopters and they were actually responsible for pulling up the non-adopters' average work hours to a high level. And since this was more true for the non MV villages so the non adopter's average work hours became relatively more higher in non MV villages.

d) In the case of all villages the adopter's productive labour was mostly engaged in the agricultural sector (65%) while the non adopters engaged themselves mostly in the non agricultural sector(64%). But in the case of the lowest two classes (ranking up to functional landless) not only the non adopter but also the adopter HH male members on average spent relatively more workhours in the non agricultural sector. This implies that the adoption of MV by an increasing number of HHs results in a change in the aggregate labour mix of a village in favour of agriculture. However this general change in labour mix at the village level may not be reflected in the labour mix of a particular segment of that village e.g.: the completely landless and functionally landless HH workers. Because they are not generally bind to any significant piece of agricultural land where they can adopt and be influenced by it's higher agricultural labour requirement.

e) In the case of all villages for both adopters and non adopters the prevailing main mode of work was self-employment in both agricultural and non agricultural sectors. However the ratio was more favourable towards self employment for the non agricultural sector. For example, the ratio between self employment based work-hours and wage employment based work hours in the agricultural sector for all types of HHs as a whole was 2.84 to 1, while that in the non agricultural sector was 7.78 to 1. It is not unexpected since the non agricultural sector in the rural areas of Bangladesh is not a large scale modern sector with capitalist production relation. It is well established that small scale self-employment based activities are still predominant in the rural non agricultural sector of Bangladesh [Hossain, Rahman, and Bayes, 1995].

f) For the three lowest ranking classes: landless, functionally landless and marginal farmers the ratio between wage labour hours and self labour hours in agricultural sector was much higher than those for the remaining upper classes. For example in the agriculture sector the overall ratio between self labour hours and wage labour hours for the lower ranking three classes as a whole was 1.85 to 1. The same for them in the non-agricultural sector was 6.95 to 1. But this ratio between self labour and wage labour among the two highest ranking classes of rich and landlord was 5.72 to 1 for the agricultural sector and 4.13 to 1 for the non agricultural sector. This implies that labour selling in the agricultural sector will be mainly done by the lower ranked HHs. But labour selling in the non agricultural sector will not be an exclusive business of the lower ranked classes only. Rather the recent proliferation of micro credit based non-agricultural self-employed petty activities have been preventing the process of complete proletarianisation of the rural poor.

g) As argued above, the ratio between self employment hours and wage employment hours is highly dependent on the worker's landholding status. This fact is revealed more clearly in the Table 6.14d which also has important implications about specialization (or differentiation) among the rural labour suppliers. From that Table we find that among the total 881 male workers surveyed, only 120(14%) were professional wage labour. The Table also shows that most of these one hundred and twenty professional agricultural wage labour(72%) belongs to either the landless or the functionally landless group. Moreover the average wage employment hours for all these professional agricultural labour was 5.52 hours per day whereas the same for the whole population of rural labour suppliers (i.e. 881 male workers including the professional agricultural wage labourers) was only .75 hours. A simple calculation also shows that about 99 percent of the aggregate agricultural wage labour hours in the sample villages were contributed by only 13 percent of our male worker population, who were actually agricultural labour by their profession. Thus in general we can say that "Proletarianisation of Agricultural Wage Labour" has already come into existence in the rural areas of Bangladesh however small it may be.[69]

The above discussions on both demand and supply sides of the rural labour market can now be brought together to form a coherent picture of the current rural economy of Bangladesh. Firstly, many of the members from the upper and lower classes in the rural areas are moving out from agriculture. But at the same time the expansion of MV is creating a higher requirement of labour in certain rural areas. This increased requirement of agricultural labour in those areas has been mostly met by either increasing personal work effort or wage labour hiring. In the case of middle class adopter farmers the main

[69] In our present context the notion of "Proletarianisation of Agricultural Wage Labour" has a wider connotation than just "fewer labourer supplying more agricultural labour", it also implies the emergence of a distinct group of male workers who now sell a high enough amount of labour hours per day into the agricultural sector and can live exclusively on that income. Thus rural workers who not only lives on the sale of their labour power but also sells it exclusively in the field of agricultural activities can actually be called "agricultural labour" in the proper sense.

method was to increase their own work effort, but the large farmers as well as many small farmers whose opportunity cost of labour is relatively higher due to their non agricultural involvement, usually meet it by hiring landless agricultural wage labour. As a result there is emerging a distinct class of professional agricultural wage labour HHs who are now able to get a full time employment in agriculture alone either in their own locality or in other MV areas where they can easily migrate at the time of real need. The members of this class is mainly coming from the landless and functionally landless HHs. Thus HYV is acting as a vehicle of rural capitalism while micro-credit based petty non agricultural activities are putting obstacles against the differentiation process among the rural poor and thereby slackening the speed of such capitalist development.

6.8 Labour Supply: A Multivariable Regression Equation

To catch the impact of MV technology on the labour supply of a farm household isolatedly, a multivariable regression model is used with the average agricultural productive labour hours per male per day (AGMLHRS) of a household as the dependent variable. The average figure is derived from the time use data of the male workers over one week period. Two dummy variables are used to capture the effect of village level differences in production environmental conditions which also indirectly represents the degree of MV adoption across villages. These dummy variables are FLOOD and DRAUGHT. Each of these dummy variables assumed a value of 1 if the residence village of the respondent is a flood prone or draught prone village otherwise the value is put equal to 0. The two most important relevant independent variables for our model are the percentage of irrigated land in the village (PCIRN) which actually represents a proxy for the degree of MV adoption in the residence village of the respondents and also the grand total amount of land cultivated with modern variety by the respondent's household (TMVG).

Other important independent variables that are expected to have influence on the amount of agricultural labour supply by the male workers of a household and therefore included in the model are the size of the farm of the respondent household (FSZ), the subsistence pressure on the household measured inversely i.e. as the amount of operational land per member of the household(SUBP), the personal education level of the worker (WED) and the distance of the nearest bus station from the village of the worker (BUS) as a proxy variable for the availability of other work opportunity outside the village.

The symbolic form of the multivariable linear regression function used is:

AGMLHRS = F(FLOOD, DRAUGHT, PCIRN, TMVG, FSZ, SUBP, BUS, WED)

Where:

AGMLHRS =	is the average daily agricultural labour hours supplied by the adult male workers of a household.
FLOOD =	A Dummy variable taking value 1 for the flood prone village of Shankarpasha else 0 for all other villages.
DRAUGHT=	A Dummy variable taking value 1 for the draught prone village of Baikunthapur else 0.
PCIRN=	The percentage of irrigated land in the village of the respondent.
TMVG =	Total amount of land under MV cultivation.
FSZ =	Total cultivated land.

SUBP = An inverse indicator of subsistence pressure defined as per capita operated land available for the household.

BUS = The distance of the nearest bus station from the worker's village.

WED = The education level of the worker measured by the number of years of formal schooling.

The value of R^2 of the model is low but the F value is significant and the values of most of the coefficients are also statistically significant. The estimated values of the coefficients and their level of significance as well as the overall significance of this multiple regression equation are presented in the Table 6.15.

The Table reveals the following findings:

1) The intercept of the equation is negative and statistically significant.
2) Agricultural Productive Labour Supply is positively and significantly related with the variables: FLOOD, PCIRLN, BUS and TMVG and FSZ. The coefficient of another variable SUBP is also positive but it is statistically insignificant.
3) Only two variables have statistically significant negative relationship with the agricultural labour supply. They are DRAUGHT and WED.

What possible explanations can be given for these findings? Firstly, there is a significant number of male workers in the sample belonging to the very poor and very rich households who do not supply any productive labour in the agricultural sector. Hence we have the unusual significant negative value for the intercept.

Secondly in the villages where the percentage of irrigation is high that means the villages of Patardia, Darikamari and Shankarpasha the average male workers on average supplies more labour in the agricultural sector. This implies that if in a village extensive agricultural work is available due to irrigation then supply responds automatically. Conversely, the statistically significant negative coefficient attached to the variable "DRAUGHT" shows that in a draught prone village where agricultural work is not much available, the average agricultural labour supply for the male workers are also in general low.

In our sample the villages which are relatively highly irrigated villages are also the villages with better communication facility with urban areas through buses. Thus "villages with bus facility" also show higher agricultural labour supply propensity for their male workers. At household level the male workers belonging to the households with higher subsistence pressure measured in terms of per capita operational land availability shows that if that availability decreases (i.e. if subsistence pressure increases) then his agricultural labour supply also decreases. It is consistent with our previous findings where it is shown that a larger portion of the land-poor households are giving up agricultural work and going out to work in the non agricultural sector. Since in our sample the number of the professional landless agricultural labour is very small so the regression coefficient shows that on the whole the land-poor households are supplying relatively lesser agricultural labour. However the coefficient value in this case is not statistically significant.

Finally the statistically significant and negative value of the coefficient attached to WED only shows that if the male worker is highly educated then he dislikes agricultural job and thus his agricultural labour supply declines significantly. Actually these findings are mostly consistent with our previous findings presented in ~~the~~ Table 6.14 and also partly with that of ~~Mahabub~~ Hossain's previous research findings. which ones? — please refer item As mentioned before the higher subsistence pressure implies lower amount of per capita operational land and therefore these households could not supply more productive agricultural labour simply because of lack of land under their operational control. On the other hand the rich farmers or landlords with higher per-capita land ownership also did not supply higher productive agricultural labour mainly because of the negative effect on agricultural labour supply induced by the increase in social status, education and income. In our model this effect is mainly captured by the variable of WED. Only the tenants who are able to rent in land and overcome the non-availability of agricultural work constraint or the middle farmers who are more devoted to family farming of a medium farm generally supply relatively higher amount of productive agricultural labour. There is of course a small but significant group of professional landless agricultural wage labour who also supply relatively higher amount of agricultural labour. But they generally live in especially those villages where the agricultural labour demand is sufficiently high to offer employment to them throughout the whole year. If work is not available in their own locality, they often work in other villages as the migrant agricultural worker. The story behind the lower supply of productive agricultural labour in the draught prone village is also easy to explain. In those environmentally poor villages the workers in general lacks agricultural work opportunity. The negative effects on the supply of agricultural labour mainly sets in if the worker gets a high level of education which may open before him more pleasant and higher income opportunities. The MV induced income increase and it's positive effect on leisure preference may be present but it must have been offset by the higher opportunity cost of leisure.

6.9 Labour Market: The Wage Issue

Our previous analysis shows that MV has in general an increasing effect on the supply of agricultural labour among the adopter farm households. But at the same time due to increased income via MV adoption some of them particularly the larger(above the marginal farmers) farms whose income increasing effect of adoption is relatively large, are likely to reduce their own family labour supply. Thus the additional labour use and the gap created by the reduction of family labour together constitute the incremental demand for hired agricultural labour in the larger farms. And since farmers possessing more than 150 decimals of cultivated land (which is the limit of marginal farmsize in our context) are the main buyers of labour power in our sample so their demand increase should also increase the agricultural wage significantly unless there occurs any offsetting increase in the supply of agricultural wage labour. However this is less likely, because with the penetration of MV into a village, the number of occasional labour sellers in the field of agriculture decreases and a fewer professional agricultural wage labourer takes up the new higher workload by increasing their average individual work effort. Thus the agricultural real wage rate may go up in the MV regions due to the increased competition among the employers to hire a fewer number of workers and also due to the necessity of paying higher amount to induce higher effort from the labourer.

However the story remains incomplete since many other factors can counteract or supplement the simple process of technology induced rising real agricultural wage. One such general factor is the process of "induced mechanization" in the wake of MV and that has been extensively reviewed in the chapter 2 (~~Review of literature~~). But that factor was also critically examined in chapter five and was found to be irrelevant for Bangladesh. However in the context of Bangladesh a few other intervening factors are specially relevant and must be taken into account before measuring the possible positive impact of HYV on the agricultural wage rate in a particular locality. These factors influence the local wage rate directly or indirectly by their effects on the supply and/or demand of wage labour in that area. They are:

a) The structure of landownership.

b) Existence of high unemployment and/or under-employment.

c) The seasonal nature of unemployment/under-employment in the rural areas.

d) Existence of positive or negative net in-migration.

e) An uneven development of the non farm sector implying uneven non farm work opportunity across different regions.

f) Uneven availability of credit for the poor across different regions implying uneven opportunity of non agricultural self-employment across different regions.

g) Diverse forms of labour transaction implying a segmented labour market and the coexistence of institutionally determined different wage rates for different types of labour.

h) The trend of the cost of living index of the rural wage labour or alternatively the movement of the price of their staple consumption item rice.

It is also a table. Why don't you call it a table and number all Tables consecutively

Exhibit 6.16 describes the nature and direction of the effects of these factors on the real agricultural wage . Given the influence of these variety of factors on the agricultural wage , it is very difficult to isolate the pure effect of MV on real agricultural wage. One approach to solve this problem is to estimate a reduced form model of wage determination where wage is a joint function of all the various variables/factors that influence the supply and the demand of labour. But this will require a large set of diverse regional wage rates along with the information about all the relevant factors pertaining to each of the regions. Since such data was available for only five regions or villages so such an empirical exercise could not be undertaken in this study.

Given the nature of the available data, the wage issue can still be analyzed by examining the relevant characteristics of each village and then correlating them as far as possible with the observed wage differences among them by using a less rigorous method of descriptive qualitative analysis.

Table 6.17 presents the village wise estimation of a few relevant factors that are expected to influence the average real agricultural wage level of that village. Side by side the village wise actually paid weighted average wages for all kinds of hired agricultural labour have also been estimated in real terms (Paddy Wage) and presented in the same Table for an easy inter-village comparison.

The Table shows that the highest real agricultural wage is being paid in the village of Mailmara: 9 seers where the HYV is least developed! Mailmara is actually a saline prone zone and employs only one type of labour i. e. "permanent workers". Since permanent workers are mostly kept here by the large HHs and being used mostly for export oriented agricultural jobs (Shrimp Culture) so this wage rate is not really representing the agricultural wage for farm activities and therefore can't be compared with other saline free villages.

Among the comparable four other villages as is usually expected the highest real agricultural wage is being paid in the village of D.Mari, the topmost MV village in our sample. The Table also shows that in D.Mari the proportion of landless HHs is 71 percent while that of the rich and landlord is only 3 percent. This very unequal land ownership structure "ceteris-paribus", should have pulled down the wage, if there were not the two other countervailing forces e.g., a significant size of non agricultural employment opportunity (81 percent of the landless with non agricultural occupation) and also an extremely high level of adoption of HYV (99 percent of the rice land was devoted to MV). Because of these two forces we find in D.Mari labour scarcity instead of labour abundance. And as noted earlier (see Table 6.13), in D.Mari the excess demand for labour has been met by the supply of relatively high wage earning migrant workers. And that actually pulled up the average weighted agricultural wage rate of D.Mari quite high.

Although the nominal wage in another MV village (Patardia) seems to be the lowest yet when we take into account of the differential paddy price across villages and translate the nominal wage into real wage by using local rice price, the difference gets minimized. Then it becomes almost equal to that in B.Pur. Even though the extent of MV rice is 64 percent lower in B.Pur than Patardia. This equality of real wage across these two villages in spite of their high adoption differential of MV, can be easily explained if we remember that B.Pur is a village with the highest amount of cultivated land in the sample and a relatively lower density of population as well as it had a significantly larger proportion of rich and landlord HHs among the villagers. Hence it has a much higher need of aggregate labour. Moreover the incidence of migrant labour use was also relatively low. The higher incidence of permanent labour in this village did not pull down the average weighted wage rate in B.Pur since they were also earning almost the same wage as the casual labour there (see Table 6.18C). This example of B-Pur amply proves the logic of our contention that the simple variation in the adoption level of MV can no more explain the variation in the regional wage rates in the rural area.

The wage rate of Sh.Pasha is also found to be higher than that in Patardia even though the MV intensity of rice cultivation is 15 percent lower there. This puzzle becomes more acute when one further observes that the percentage of landless is significantly higher(62%) in Sh.Pasha as compared to that of Patardia (37%). The proportion of the rich and landlord are also almost similar in both the villages. However the puzzle becomes solved if one remembers two things: Firstly Sh.pasha is a flood prone village and all it's MV rice land are cultivated exclusively in the boro(dry) season when average agricultural wage throughout B.Desh goes a little bit up. Secondly, most of the landless HHs of Sh.pasha were engaged in the non agricultural occupation ; hence they were not competing with the separate segment of proletarianised agricultural wage labour during the Boro season to pull the agricultural wage down.

The above comparative study focuses broadly on three main factors to explain the observed differences among the average village level real agricultural wage rates across sample villages.

They are:

1) The structure of landownership,

2) The extent of MV and

3) The extent of non-agricultural involvement of the poor classes or the degree of specialisation among the rural poor.

what refs?

The importance of the first two factors are well established [~~see~~ Ahmed, Iqbal,] and the third factor is acquiring importance perhaps only recently. It's importance can be better appreciated if one further looks at the village wise occupational profile of the landless. This is presented in the Table 6.17a. The Table clearly shows that in two of the sample villages D.Mari and Sh.Pasha (where the real agricultural wages are also relatively higher, in fact the highest and the second highest) the landless group were considerably high in absolute number and they were mainly divided into two bi-polar groups. One group is completely engaged in non agricultural occupations and that is the major group (from 81 to 63 percent!) and another group has become professional agricultural wage labour (9 to 31 percent). Only 6 to 10 percent of the landless HHs in these two villages were bound to their tiny plots and had the main occupation of cultivation supplemented by casual wage labour. This proves our contention that in villages with higher MV (at least in one season) if there also occur a higher degree of division of labour and there exists a professional group of agricultural wage labour then that may help to raise the average wage rate of those few professional agricultural wage labour. On the other hand in the two other saline free villages we find the proportion of the cultivator cum wage labour type of HHs were quite high (32 and 45 percent). And the proportion of professional agricultural labour was also similarly high (20 and 38 percent). This type of occupational structure among the landless obviously leads to a higher competition for job among them and ultimately bids the wage rate down. Another possible explanation for the relatively higher wage of a whole-time agricultural labourer as compared to that of a part-time agricultural labourer is as follows: For cultivator-cum-labour households wage earning is just one more source of income (cf garment workers) to supplement the main income from farming, so they are willing to accept whatever is given. For full time agricultural labour households hiring out of labour is the main means of subsistence, hence they will demand atleast a subsistence wage, otherwise they will not be able to reproduce their labour.

6.10 Diverse Wage Rates For Diverse Labour Transaction

The Tables 6.18A to 6.18F captures the effect of diversity in the form of labour transaction upon the offered wage rate as observed in each of the five sample villages and finally compile them for all the villages taken as a whole. From these Tables we find that in three of the villages (D.Mari, B.pur and Sh.pasha) the migrant labour and contractual labour received higher wages than the casual or permanent workers. In one of the other two villages (M.mara) there did not exist any migrant labour or contractual labour. And in the last other village (Patardia) the permanent labour did receive a wage higher than that of the migrant labour but lesser than that of the contractual labour. But this high level of permanent worker's wage is based on a single case and thus liable to large sampling error (see Table 6.19C). The point mentioned above is further corroborated when we look at the Table 6.18F where the average of all the five villages are presented. It shows that the highest wage is received by the migrant labour(41.22 tk) which is 47 percent higher than the general average wage rate . For the contractual workers the wage was also quite high but it depends on the nature of the job. It was found that only for harvesting the wage rate for piece-rated contracts was 35 percent higher than average wage for daily wage contracts.

The high level of wages for the migrant labour can be explained in terms of their seasonal nature and the extra cost involved in migration. It also indirectly shows that migration of labour from one locality to another locality in our sample was more a reflection of the so called pull effect of prosperity than the push effect of poverty.
The contractual workers also enjoys a higher than average wage perhaps because of the seasonal nature as well as the higher intensity of their work. They are usually hired for the job of harvest and paid whenever they could finish their harvesting of the fixed area. They naturally try to finish their job within a shortest possible time by sometimes even working day and night with utmost intensity so that they may avail the next job as early as possible. That is why our eight hourly definition of day is not valid for them. And the daily wage in their case may actually represent more than a day's work of other types of labour. Since the accounting of work-hours for the contract workers might have been under estimated in some cases so the higher average wage for them may be partially an illusion.

The only unusual pattern that we observe in these Tables is the higher level of wages of the permanent workers than that of the casual labourers in all the four villages where both of them coexist. This implies that the old idea of an young apprentice servant working as a permanent worker just for a dwelling opportunity and food for three times a day no longer fits the image of the permanent workers now a days. Even in the village of B.Pur (Representing a highly inegalitarian village with a feudal tradition) the permanent workers receive about 40 percent of their total earnings in a cash form the daily equivalent of which is about tk 10 [see Table 6.18C]. This also shows that with the diffusion of MV technology the content of permanent labour itself may change. It no longer remains a homogeneous category ! There may actually be two different types of permanent labour e.g. one is the supply induced traditional attached labour who has taken up the work under the pressure of poverty and there is another type of demand induced attached labour employed for the better supervision of the farm. The composition of these two types of attached workers may change with the diffusion of MVs.

~~The~~ Tables 6.19A to 6.19G examine the differences in the real agricultural wage for each of the labour types across the sample villages. It also supplements previous findings (Table 6.10) on the relative amount of the particular type of labour across the different villages as well as throws light upon the composition of wages in terms of cash and kind. The break down of the contractual worker's wage into cash and kind were not available for all the four types of jobs. For the first, second and the third type of jobs (ploughing transplanting and weeding) such break down was not available because actually the contracts for those jobs allowed only cash payment or in some rare cases payment through return services commonly known as "Badli" (Exchange Labour). Only in the case of harvest labour sometimes a part of the payment was being made in terms of a part of the harvest. But that particular type of data was not available instead we had only the totai value of the receipt of the labour after fulfilling the contract. So the analysis of the composition of wages has to be restricted among only the casual, migrant and the permanent workers.

From the comparison of Tables 6.19A, 6.19B and 6.19C it appears that the wage of the permanent workers is the least monetized wage and this holds good in all the villages where they coexist with other types of labour. All villages taken together the proportion of kind wage in the total wage of an average permanent worker comes around 57 percent. The proportion is even higher in B.PUR and Patardia.

On the other hand the most monetized wage is the wage for the casual labour. The proportion of kind wage in the total wage for an average casual worker (all the sample villages taken together) comes to be about 73 percent. The intermediate position regarding the composition of wages is held by the migrant wage. These findings are not unexpected since a migrant labour comes from outside and should prefer to have lunch from the employers while the casual labour is usually a local resident and can take his meal at his own home in between his work.

6.11 Real Agricultural Wage: Macro Trends And Regional Patterns

There may be several pitfalls in calculating the real agricultural wage over time. Some of them are:

a) To choose the specific form of labour transaction among the existing diversity. Usually people concentrates upon the wage of casual labour, the common most form in Bangladesh.

b) The choice of the level of aggregation. Usually Agricultural Directorate supply information on agricultural nominal wages covering different months or seasons, different agricultural operations and different places of Bangladesh. A simple national average can be calculated from them to find a single figure of national nominal agricultural wage. Or alternatively a district level agricultural wage can be determined by averaging the intra district data.

c) The choice of a proper cost of living index for the agricultural labour. There can be constructed special index for the class of agricultural labour on the basis of their budget studies or alternatively one can use the rice price index as a proxy.

A.R. Khan [1989] used the national level nominal wage data of agricultural casual labour supplied by the agricultural directorate and turned it into real wage data by using a rural consumer price index. He constructed a longrun series of real agricultural wage for Bangladesh from 1965 to 1985. Then he regressed that real wage on agricultural productivity (a weighted average of rice and jute) and the ratio of the price of agricultural commodities to manufactured goods and found those explanatory variables quite significant and positive.

From the time series of agricultural real wage prepared by Khan, it is clear that there were two distinct periods of rising real agricultural wage during the long period of 1965 to 1982. Firstly in the late 60's and then in the early 80's. If we correlate this with the agricultural growth of Bangladesh we find that these were also the periods when Bangladesh agriculture experienced bursts of growth mainly based on dry season expansion of MV rice cultivation. In the late 60's the MV began to spread widely and agricultural growth remained at a high level in or around till 1969. From then on there was a slow pace of growth in MV as well as Agriculture up to 1980. And the real agricultural wage also showed a more or less secular declining trend. However from 1980 there was again a sharp rise in both agricultural growth and MV. And the two years data on agricultural real wage for the year 1982-84 also showed a concurrent positive growth. But Khan did not comment anything about that rising trend. Rather like the earlier one he was again highly sceptic about the sustainability of this rise. In general Khan's findings suggest that MV based agricultural growth as a whole contributed positively to the rise of real agricultural wage although it was not sustainable in the long run.[70] Unfortunately only the second part of Khan's message were widely publicised and people almost forgot about the temporary positive effect of the agricultural growth on the real agricultural wages.

(')

Another study was carried out by ~~Palmer~~ Jones in 1993 on the basis of the same data covering a greater period of time from 1965 to 1990. He unlike Khan used the coarse rice price index to translate the nominal wage into real wage. His time series looks different from that of Khan and Lee's study (1984) because of the use of this

ref ?

[70] In 1989-90 Khan and Hossain reanalysed the trend of real agricultural wage. In that study they presented two different estimations of real agricultural wage, one measured in terms of rice kgm equivalent and another estimated at 1973-74 constant prices. However in their actual analysis they used only the second series of estimates, which was also used before by Khan and Lee (1984) covering the period 1949 to 1980. One justification for ignoring the "rice equivalent wage" given by the authors was, "the two indices generally move in step; but in periods of pronounced change the second index moves more sharply because rice prices generally are more volatile than average during such periods."

different index for the adjustment of the nominal wage data.[71] But his general finding on the basis of the newly defined series of real wages was even stronger than that of Khan regarding the positive relationship between the MV based agricultural growth and real agricultural wage. Palmer found the early 80's rising trend of real agricultural wage to continue even up to late 80's with the exception of 1986 and 1987. One finds the same trend to continue after 1987 with year to year fluctuation around the trend. In general it is found that the real agricultural wage shows a sustained rising trend beginning from early 80's.

Jones
~~Palmer~~ tried to explain the beginning of this rising trend in agricultural wage by referring to the starting of a new burst of MV based agricultural growth in the late 80's mainly due to the favourable prices of both outputs and the irrigation equipments. To this must be added three other positive developments of the late 80's and early 90's such as, increased activities of the various poverty alleviating NGO's, the Grameen Bank's tremendous expansion of micro ~~petty~~ credits for self employment, an absolute decline in the employed labour force in agriculture and finally the process of professionalization of the agricultural wage labour. All these factors along with MV contributed to the recent rise in the real agricultural wages in Bangladesh.

The

[71] The difference between the two different indices of real wage arises because Khan's cost of living index captures the high rate of inflation in the manufacturing sector in the 70's and thus pushes the real wage considerably lower than the one arrived at by using only the rice price deflator. The argument offered by Palmer in favour of pure rice price index was "~~P~~roblem with Khan's approach to the real wage is that it works with a constant basket of goods which does not take account of the adjustments that can be made by consumers to changing relative prices. If the price of cheap sources of basic commodities consumed by the poor has fallen relative to more expensive sources and 'luxury' commodities, then the use of a fixed commodity bundle will over estimate the effect of a price change on the real wage.

James

Palmers also looked at the inter regional variation in the real agricultural wage. He found that in general wage in the district of chittagong was the highest for every year since 1975. Similarly the wage in the district of Dinajpur was consistently the lowest in every year since 1975. This is explained by him as due to not only higher extent of MV in Chittagong but also due to relatively low percentage of landless labour there. This is an extreme example, but in general the inter district variation in the wage also shows that where the supply of labour is high due to more inegalitarian structure of land ownership and also demand for agricultural labour is low due to low level of MV, the wage generally becomes very low.

The last and the recent most study on real agricultural wage was carried out by R. Thamarajakshi and Martin Ravallion (1988). After examining the overtime trend of the real agricultural wage from 1949 to 1988, what about Ravallion? Thamarajakshi concluded " The long period 1960/61 to 1986/87 consists of two subperiods; 1960 - 1972/73, a period of decline in real wages and the food wage rate; and 1973/74- 1986/87, a period of improvement. Even so, the average level of real wages, in constant 1973-74 prices, was lower in the latter period than in the former period".

However if one completes the wage and food price Table of Thamarajakshi and Ravallion by adding comparable recent infirmations up to 1991 then one finds that in spite of some oscillation the rice wage reached an almost all time peak of 3.51 kgms in 1990. In 1991 it was also as high as 3.44kgms. The big question ~~is how far is~~ it sustain~~able?~~ relates to sustainability

One last point in favour of the positive impact of MV on agricultural wage relates to the method of calculation of the average agricultural wage. Till now all the studies on real wages take only wage under daily contracts. If the use of the piece rated contracts increases with the diffusion of MVs the average wage will go up since the piece rated wage is higher than the wage rate under daily wage contract.

Thus we find a clear positive relationship between the real agricultural wage and agricultural growth from all the three previous analyses of the factors explaining the macro trend of the real agricultural wage. Since the MV based growth of rice was the main driving force of the agricultural growth in Bangladesh , so naturally it can be inferred, ceteris paribus, MV expansion should have a positive effect on the real agricultural wage rate via it's positive effect on agricultural growth. And if in practice it is not found to be consistently so then that failure should not be attributed to MV, rather one should search out the other offsetting factors such as higher degree of landlessness, existence of surplus labour, inter regional mobility of labour and various institutional constraints that create segmentation in the labour market in favour of the powerful large employers of labour, lack of non farm work opportunity, etc. It ~~seems that~~ is clear that
MV does not contribute to However, its positive
the rural poverty and low wage ~~is not a contribution of MV~~, ~~at the worst it is a sign of~~
contribution is often not strong enough
it's ~~weakness to gather an adequate level of momentum~~ to counteract other independent structural forces behind these two phenomena.

6.12 Rice Price and Nominal Wage

The relevant argument that we spelt out before is as follows: As MV expands the rice price will either remain stable or even may fall due to MV induced growth in the supply of Rice. Even if it does not behave so then it does not mean that MV had zero effect on the movement of rice price. Actually it only means that rice price increased in spite of the supply effect of the MV because demand increasing factors e.g. population growth and high income elasticity of demand for rice were stronger. In other words if MV had not expanded and therefore the incremental supply were not there then rice price would have increased more! Now if one further adds another assumption about the stickiness of the nominal agricultural wage rate(or more accurately less than unit elasticity of nominal wage rate with respect to rice price) then one can easily argue that MV induced fall/less increase in the rice price will result in a positive increase/lesser fall in the real rice income of the agricultural wage labour class.

Those who opposes this view may argue that money wage is highly tuned to the rice price and will adjust in such a way that the gain of falling rice price would be wiped away and the loss of a rising rice price will also be minimized considerably. The issue is such that it can be handled empirically. To consider the responsiveness of ~~nominal~~ agricultural wage to changes in retail price of coarse rice, Ravallion and (?) Thamarajshki ran a regression model where the log of nominal agricultural wage was regressed upon the log of current rice price, log of one period lagged rice price, log of one period lagged nominal agricultural wage and log of time.The function in double log form was fitted to the relevant data for 1960-1986/87(see Table 6.21).The estimated model was as follows:

$\log WM_t = 0.325 + 0.781 WM_{t-1} + 0.348 \log RP_t - .083 \log RP_{t-1}$

(7.99)*** (4.42)* (.82)

$-.034 \log t$;

(.65) R square=0.99, adj. R square=.99,

I don't think you need to report their results in such detail. Just report the essence.

The numbers in parentheses are t values for the coefficients and an asterisk indicates significance at 1 percent level of significance. The equation shows that the elasticity of nominal wage rate with respect to the retail price of coarse rice is positive but less than one (only .35).

Thus, the above study supports the claim of those who suggest a favourable income effect upon the agricultural wage labourers due to MV induced fall/lesser increase of the rice price. However using a slightly different specification of the model by including two other demand side variables (the proportion of MV area and the weighted average productivity of rice and jute per acre) Thamarajskhi found that the elasticity is increased to a level of 0.6 i.e. still lesser than one. Thus she concluded that in general rice price movements are not completely neutralised by the movement of the agricultural money wage rate. Another important finding of thamarajskhi was that the elasticity of wage became lowest, only .3 during the famine period.

Thus for Bangladesh it seems to be generally true that wage increase is likely to lag far behind rice price increase and conversely employers are unlikely to pay lower if the rice price falls. In this situation MV technology has an added income benefit for the poor through the combined interaction of product and factor markets.

6.13 Synthesis of Findings on the Labour Market

In general MV technology favours the agricultural labour suppliers and since they come from the bottom sections of the rural community so MV indirectly benefits the poorest of the poor too. It increases the productivity of agricultural labourers. It also increases the demand for labour directly in the agricultural operations. It also has positive forward and backward linkage effect on employment creation. This increased demand is mainly met by casual labour. A significant part of the increased demand in the more prosperous areas is met by professional agricultural labour from the locality and also by migrant labour supply. The incidence of contractual labour and piece rate also increases in the more prosperous MV areas. In general these changes tighten the labour market for the employers and increases the bargaining strength of the labour power sellers. There have been no discernible institutional changes like switching to permanent labour or interlocked labour transaction on the part of the employers in response to the tighter situation in the labour market ~~is~~ not ~~found to be a common practice in Bangla~~desh. However migrant labour inflows from more backward areas to more developed areas somehow slacken~~s~~ the tightness of the labour market and help~~s~~ the employers to limit the increase of the wage rate. But from another point of view ~~it implies~~ they imply a positive spillover effect of MV technology for the labourers of the non MV areas.

TABLE: 6.1

TYPES OF LABOUR TRANSACTIONS IN THE RURAL LABOUR MARKET

TYPES	DURATION	MODE OF PAYMENT	MEDIUM OF PAYMENT
CASUAL LABOUR	On a daily basis.	Time Rate, wage payment at the end of the day's work.	A mixture of cash and kind or pure cash.
PERMANENT LABOUR	Yearly or for one crop season.	Time rate, a fixed salary after a month's work .	A mixture of cash and kind.
CONTRACT LABOUR	According to the desire and ability of the worker or group.	Piece rate.	In kind (e.g. a share of the harvest) or a mixture of cash and kind.
EXCHANGE LABOUR	According to mutual consent.	N.A.	Labour service.

Number the tables consecutively.
The tables which have not been used as any input to arguments in the text should be deleted.

TABLE: 6.2

RURAL LABOUR MARKET IN BANGLADESH: MACRO TREND

(in millions)

VARIABLES	1973-74	1983-84	1991-92
NO. OF RURAL HOUSEHOLDS (% of all HHs)	11.61 (91.63%)	12.87 (85.37%)[1]	15.60 (80.45%)
PERCENTAGE OF RURAL LANDLESS HOUSEHOLDS[2]	48.7	46.3	N.A.
PERCENTAGE OF SMALL FARM HOUSEHOLDS[3]	32.5	33	N.A.
AGG. EMPLOYED CIVILIAN LABOUR[4]	21.40	28.50	50.14[5]
LABOUR EMPLOYED IN AGRICULTURE[4]	16.80 (78.50%)	16.70 (58.59)	37 (73.79)[5]
PERCENTAGE OF FAMILY LABOUR IN AGRICULTURE[6]	75.16	60.40	44.7[5]
PERCENTAGE OF HIRED LABOUR IN AGRICULTURE[5]	24.84	39.6	55.3[5]
PERCENTAGE OF PERMANENT LABOUR IN HIRED AGR. lABOUR.	N.A.	4.48	N.A.

NOTE: 1) This figure is from 1981 population census(quoted in SYBD 1986). The two other figures of rural HHs are taken from the population census of the years refered in the column headings.

2) Landless households refer to those who own less than .05 acres of land and the figure refers to year 1978 instead of1974.1983-84 data is from the agri. census. The latter document attributes to the large decline in the number of households with no land between 1978 and 1983 to the sampling error of the L.O.S. Others have tried to attribute it to the migration of landless HHs out of the rural areas.

3) Small farmers refer to those who own more than .49 but less than 2.50 acres of land and the figures are from L.O.S. of 1978 and 1983-84 census.

4) 1973-74 figures are taken from the population census and 1983-84 figure is derived by an upward adjustment of the figures of 1983-84 L.F.S.(See Khan and Hossain, 1990)

5) Both the figures refer to 1989 and incomparable with the previous ones due to changes made by the BBS authority in definitions.Actually 16.1 million new female entrants were enumerated as agriculturally employed who according to previous definition would not have come under that category of employment.

6) Labour employed in agriculture are of three types: selfemployed,unpaid family worker and hired labour. The first two are together treated as a family labour and the last as hired agr.labour(BSYB,1986 and AGR.CENSUS)

TABLE: 6.3A

RURAL LABOUR MARKET IN BANGLADESH: MICRO TREND: 1987-93

VARIABLES	1986-87	1992-93	GROWTH RATE (%)
TOTAL POPULATION	432	411	(-)4.86
TOTAL NO. OF HHs	76	76	0
NO. OF LANDLESS HOUSEHOLDS	29	28	(-)3
NO. OF SMALL FARM HOUSEHOLDS	33	32	(-)3
NO. OF NON FARM HOUSEHOLDS	14	30	114
NO. OF NON FARM HHs COMING FROM SMALL FARMERS	4	11	175
NO. OF NON FARM HHs COMING FROM LANDLESS HHs	10	16	60
NO. OF AGRICULTURAL WAGE LABOUR HHs	14	9	(-)44
No. OF AGRICULTURAL WAGE LABOUR HHs COMING FROM LANDLESS GROUP	13	8	(-)38
NO. OF AGRICULTURAL WAGE LABOUR HHs COMING FROM SMALL FARMER GROUP	1	0	

NOTE: 1) A Household is non-farm if it's major source of income is non agricultural. Similarly an agricultural wage labour household earns more than 50% of it's total income through wage labour in the agricultural sector.

2) The definitions of small and landless HH are same as before.

TABLE: 6.3B

RURAL LABOUR MARKET IN BANGLADESH: MICRO TREND: 1987-93

VARIABLES	1986-87		1992-93	
	DYNAMIC	STATIC	DYNAMIC	STATIC
TOTAL POPULATION	174	258	175	236
TOTAL NO. OF HHs	33	43	33	43
NO. OF LANDLESS HOUSEHOLDS	18	11	18	10
NO. OF SMALL FARM HOUSEHOLDS	12	21	12	20
NO. OF NON AGRICULTURAL HOUSEHOLDS	12	2	26	4
NO. OF NON FARM HHs COMING FROM SMALL FARM HHS	3	1	9	2
NO. OF NON FARM HHs COMING FROM LANDLESS HHs	9	1	16	0
NO. OF AGRICULTURAL WAGE LABOUR HHs	6	8	2	7
NO. OF AGRICULTURAL WAGE LABOUR COMING FROM LANDLESS	5	8	2	6
NO. OF AGRICULTURAL WAGE LABOUR COMING FROM SMALL FARMER	1	0	0	0

NOTE: 1) Patardia, Baikunthapur and Mailmara are considered as the static villages and the remaining two other villages are considered as dynamic over the period between 1987-1992 (For detail explanation see section 3.5)

TABLE: 6.4

THE STRUCTURE OF SAMPLE PLOTS

FARM SIZE	IRRIGATED ZONE		NON IRRIGATED ZONE	
	NO. OF PLOTS	AGGREGATE SIZE	NO. OF PLOTS	AGGREGATE SIZE
SMALL	38	935	25	1186
MEDIUM	26	690	17	548
LARGE	18	520	8	312
ALL	82	2145	50	2046

TABLE: 6.5

LABOUR USE PER ACRE FOR MV AND LV ACCORDING TO REGION AND FARMSIZE.

FARM SIZE	IRRIGATED ZONE		NON IRRIGATED ZONE		ALL REGIONS	
	LABOUR USE PER ACRE UNDER LV	LABOUR USE PER ACRE UNDER MV	LABOUR USE PER ACRE UNDER LV	LABOUR USE PER ACRE UNDER MV	LABOUR USE PER ACRE UNDER LV	LABOUR USE PER ACRE UNDER MV
SMALL	N.A.	57.94	49.20	71.67	49.20	63
MEDIUM	N.A.	65.71	46.90	73.56	46.90	68
LARGE	62	52.23	47.38	67.15	50	55
ALL	62	59.22	48.26	68.65	49	62

TABLE: 6.6

USE OF FAMILY LABOUR AND HIRED LABOUR PER ACRE ACCORDING TO FARMSIZE AND PRODUCTION ENVIRONMENT

FARM SIZE	LABOUR USE PER ACRE	IRRIGATED ZONE		NON IRRIGATED ZONE		ALL REGIONS	
		LV	MV	LV	MV	LV	MV
SMALL	TOTAL	x	58	49	72	49	62
	FAMILY LABOUR	x	32	43	25	43	28
	HIRED LABOUR	x	26	6	47	6	34
MEDIUM	TOTAL	x	66	47	74	47	67
	FAMILY LABOUR	x	30	36	35	36	31
	HIRED LABOUR	x	36	11	39	11	36
LARGE	TOTAL	62	52	47	67	50	56
	FAMILY LABOUR	24	28	42	39	39	30
	HIRED LABOUR	38	24	5	28	11	26
ALL CLASSES	TOTAL	62	59	48	71	48	63
	FAMILY LABOUR	24	30	41	29	40	30
	HIRED LABOUR	38	29	7	42	8	33

TABLE: 6.7

RELATIVE CONTRIBUTION TO THE INCREMENTAL LABOUR REQUIREMENT PER ACRE FOR DIFFERENT OPERATIONS DUE TO SHIFT FROM LV TO MV

OPERATION TYPE	PER ACRE AV. USE OF HL		CHANGE (%)	PER ACRE AV. USE OF FL		CHANGE (%)	PER ACRE AV. USE OF TL.		CHANGE (%)
	LV	MV		LV	MV		LV	MV	
LAND PREPARATION	2.27	6.40	181	26.69	15.59	(-) 42	28.96	21.99	(-) 25
SOWING/TR. PLANTING	1.72	7.59	341	3.67	2.69	(-) 27	5.39	10.28	91
WEEDING	.27	5.40	1900	1.36	4.84	255	1.63	10.24	528
INTERCULTURE	.09	.92	900	.16	1.19	643	.25	2.11	744
HARVESTING	3.20	9.09	184	3.53	2.17	(-) 39	6.73	11.26	67
THRESHING	1.27	3.63	185	4.61	2.79	(-) 40	5.88	6.42	9
ALL	8.82	33.03	234	40.02	29.27	(-) 37	48.84	62.30	27.55

TABLE:6.8

EXPENDITURE ON SELECTED ITEMS BY SELECTED HHs FROM MODERN VARIETY VILLAGES AND NON MODERN VARIETY VILLAGES

EXPENDITURE ITEM	REFERENCE PERIOD	AV. EXPENDITURE PER HH.		DIFFERENCE OF MV VILLAGES OVER NON MV VILLAGES (%)
		MV VILLAGES (30)[1]	NON MV VILLAGES (51)[1]	
FOOD CONSUMPTION	WEEKLY	542	405	(+) 33
CLOTH	YEARLY	2413	1811	(+) 33
TOTAL INVESTMENT	YEARLY	3032	2184	(+) 39
A) AGR. INV.	YEARLY	195	484	(-) 60
B) NON AGR. INV.	YEARLY	2836.67	1700	(+) 66
PURCHASED LAND (DEC)	YEARLY	2.93	2.03	(+) 44
VALUE OF PURCHASED LAND	YEARLY	2826	1068	(+) 164

NOTE: 1) The sample of the selcted HHs from the two MV villages consists of 30 HHs. 15 from each village covering all the seven categories of land based classes in accordance with the weight of the strata. Similarly 51 HHs were selected from the other three non MV villages.

TABLE: 6.9

EMPLOYER HOUSEHOLDS ACCORDING TO VILLAGE AND LAND-HOLDING

LAND HOLDING	NO. OF EMPLOYER HOUSEHOLDS (%)					
	PATARDIA (%)	D.MARI	B.PUR	MAILMARA	SH.PASHA	ALL
SMALL	27 (90)	30 (75)	24 (50)	11 (41)	29 (78)	121 (66)
MEDIUM	2 (7)	8 (20)	18 (37)	11 (41)	6 (16)	45 (25)
LARGE	1 (3)	2 (5)	6 (13)	5 (18)	2 (6)	16 (9)
TOTAL	30 (100)	40 (100)	48 (100)	27 (100)	37 (100)	182 (100)

NOTE: 1) The small farmers constitute those farm HHs who own less than 2.50 acres of land. The medium farmers own from 2.51 acres to less than 7.50 acres of land and the large owns more than 7.50 acres.

TABLE: 6.10

RELATIVE IMPORTANCE OF DIFFERENT LABOUR HIRING ARRANGEMENTS IN THE SAMPLE VILLAGES

VILLAGE	PATARDIA	D.MARI	B.PUR	MAILMARA	SH.PASHA
HHS REPORTING PL (%)	2	4	18	18	.03
AV. NO. OF PL. PER 1OOO HHS	20	40	180	180	3
CULTIVATORS HIRING CASUAL LABOUR IN A WEEK (%)	25	7	13	0	12
P.DAYS FROM OUTSIDE (%)	16	17	0	0	25
P.DAYS FROM INSIDE (%)	84	83	100	0	75
CULTIVATORS REPORTING USE OF MIGRANT LABOUR(%)	4	35	27	0	31
HHS REPORTING USE OF CONTRACT LABOUR (%)	4	14	27	0	24
SHARE OF TOTAL LABOUR EMPLOYED	161 (100)	90 (100)	246 (100)	203 (100)	148 (100)
P.L. (%)	21 (13)	28 (31)	147 (60)	203 (100)	7 (5)
C.L. (%)	137 (85)	32 (35)	73 (30)	0	129 (87)
MIG. L. (%)	2 (1.2)	27 (30)	17 (7)	0	3 (2)
CON.L. (%)	1 (.08)	3 (4)	9 (3)	0	9 (6)

NOTE: 1) In order to find out the average composition of labour use by the employers of each village, all forms of labour use were standardized into persondays employed per week, hence the total labour is here the av. persondays being employed per week by the employers of each village

TABLE: 6.11A

EMPLOYER HOUSEHOLDS ACCORDING TO VILLAGE AND MODE OF PAYMENT

MODE OF PAYMENT	NO. OF EMPLOYER HOUSEHOLDS (%)					
	PATARDIA	D.MARI	B.PUR	MAILMARA	SH.PASHA	ALL
TIME RATE	26 (6)	28 (3)	27 (12)	27 (7)	9 (15)	117 (8)
PIECE RATE	4 (.25)	12 (.25)	21 (.42)	0 (0)	28 (.32)	65 (.34)
TOTAL	30 (5)	40 (2)	48 (7)	27 (7)	37 (4)	182 (5)

NOTE: 1) The bracketed figures stand for the average number of persondays employed by the respective set of employers of each village during one average week under each of the specified mode of payment.

TABLE: 6.11B

ACTIVITY AND VILLAGE WISE BREAK DOWN OF THE PERSONDAYS OF CONTRACT WORKERS

VILLAGE	TOTAL PERSONDAYS OF CONTRACT WORKERS (%)				ALL ACTIVITIES
	NATURE OF ACTIVITY				
	PLOUGHING	TRANSPLANTING	WEEDING	HARVESTING	
PATARDIA	4	11.84	X	40.09	55.93
D.MARI	X	29.86	8.12	146.08	184.06
B.PUR	83.7	584.72	45	380.29	1093.71
MAILMARA	X	X	X	X	X
SH.PASHA	354.56	261.46	X	124.80	740.82
ALL VILLAGES	442.26	887.88	53.12	691.26	2074.52

TABLE: 6.12A

VILLAGE WISE INCIDENCE OF INTERLINKED TRANSACTIONS

Village	No. of interviewed Agr. Wage Labour**	No. of Interlinked Trasaction* With Primary Employer	No. of Interlinked Trasaction With Second Employer	Total No. of Inter-linked Transa-ctions	No. of Interlinked Labourer Reporting***		
					Low Wage	Normal Wage	?
Patardia	33	0	0	0	0	0	0
D.Mari	18	0	0	0	0	0	0
B.Pur	55	21	9	30	16	8	6
Sh.Pasha	83	7	3	10	9	0	1
M.Mara	32	2	0	2	2	0	0

Note: [*] Interlinked Transaction is defined here as simply the transaction of those labourers who have been involved in labour transaction and also at least one other transaction in the credit and/or land leasing market with his employer.

[**] 'Agricultural Wage Labour is a person who earns his livelihood mainly by selling labour.

[***] Some of the labourer involved in interlinked transaction did not want to report about their wages received from their employers and their responses were marked "?".

TABLE: 6.12B

VILLAGE WISE TYPES OF INTERLINKED TRANSACTIONS

VILLAGE	TOTAL NO. OF INTERLINKED EMPLOYEES	TYPES OF INTERLINKAGE*		
		LABOUR+LAND	LABOUR+CREDIT	LABOUR+LAND +CREDIT
P.DIA	0	0	0	0
D.MARI	0	0	0	0
B.PUR	30	4	15	11
S.PASHA	10	4	5	1
M.MARA	2	0	1	1
TOTAL	42	8	21	13

NOTE: Types of interlinkage refers to the types of markets being interlinked.

TABLE: 6.13

FLOW OF MIGRANT LABOUR FROM DIFFERENT DISTRICTS OF BANGLADESH TO THE SAMPLE VILLAGES

MIGRATED FROM	PERSONDAYS OF MIGRANT LABOUR FLOWING INTO					
	PATARDIA	D. MARI	B.PUR	M.MARA	SH.PASHA	ALL
COX-BAZAR	0	0	150	0	0	150 (6%)
COMILLA	1	23	40	0	0	64 (2%)
FARIDPUR	0	0	0	0	100	100 (4%)
MYMENSINGH	84	0	0	0	0	84 (3%)
JESSORE	0	0	0	0	26	26 (1%)
RANGPUR	0	1041	0	0	0	1041 (41%)
KURIGRAM	0	192	0	0	0	192 (8%)
BOGRA	0	39	0	0	0	39 (1%)
PABNA	0	2	0	0	0	2 (.004%)
THAKURGAON	0	0	524	0	0	524 (21%)
GAIBANDHA	0	106	91	0	0	197 (8%)
NOT KNOWN	0	0	96	0	4	100 (4%)
ALL	85 (3%)	1403 (56%)	901 (36%)	0 (0%)	130 (5%)	2519 (100%)

TABLE: 6.13A

VILLAGE-WISE INCIDENCE OF PERMANENT AND TEMPORARY OUTMIGRATION

INDICATOR	PATARDIA	D.MARI	B.PUR	MAILMARA	SH.PASHA
HHs reporting permanently migrating in(%)	0 (0)	25 (14)	2 (2)	7 (5)	15 (6)
HHs reported as permanently migrating out(%)	1 (.07)	0 (0)	10 (8)	5 (3)	5 (2)
HHs reporting use of migrant labour (%)	4 (3)	30 (17)	21 (17)	0 (0)	4 (1)
HHs reporting hiring in non local labour (%)	5 (4)	1 (1)	6 (5)	0 (0)	1 (.37)
HHs reporting non local hiring out (%)	1 (1)	0 (0)	3 (2.5)	19 (13)	41 (15)
HHs reporting both hiring in and out of non local labour	2 (2)	0 (0)	9 (7.5)	0 (0)	2 (.74)

TABLE 6.13B

VILLAGE-WISE NET MIGRANT LABOUR USE

VILLAGE	Migrant in Person days	Migrant out person days	Net migrant out person days
PATARDIA	1489	90	(+) 1399
D.MARI	1403	0	(+) 1403
B.PUR	3449	495	(+) 2954
MAILMARA	0	4915	(-) 4915
SH.PASHA	338	4816	(-) 4478
ALL	6679	10316	(-) 3637

NOTE: 1) "Migrant In Persondays" is the total person days worked by all casual and migrant labour coming in, from outside the 3 miles orbit of the village.

2) "Migrant Out Persondays" is the total persondays hired out by the villagers beyond the three miles orbit of their village either casually or through seasonal outmigration.

TABLE 6.14A

MAIN OCCUPATION OF HOUSEHOLD MEMBERS BY ADOPTION STATUS AND VILLAGE TYPE.

OCCUPATION	MV VILLAGES		NON MV VILLAGES		ALL VILLAGES	
	ADOPTER HH.	NON ADOPTE R HH.	ADOPTE R HH.	NON ADOPTE R HH.	ADOPTE R HH.	NON ADOPTER HH.
TOTAL NO. OF HOUSEHOLDS	178	134	175	363	353	497
AV. NO. OF STUDENTS PER HH.	1.40	.70	1.43	1.11	1.42	1
AV. NO. OF HOUSEWIVES PER HH.	1.30	.95	1.17	1.20	1.23	1.13
AV. NO. OF INACTIVES PER HH.	.79	.74	1.10	.94	.94	.89
AV. NO. OF UNEMPLOYED PER HH.	.12	.24	.06	.10	.11	.13
AV. NO. OF WORKERS PER HH.	1.44	1.05	1.62	1.31	1.53	1.24
AV. HH. SIZE	5.05	3.69	5.41	4.67	5.23	4.40

TABLE: 6.14B

MAIN OCCUPATION WISE DISTRIBUTION OF FAMILY MEMBERS BY LANDOWNERSHIP AND ADOPTION STATUS (All VILLAGES)

GROUP	ADOPTION STATUS (NO.)	Per Household Av. No. Of					
		AV. FAMILY SIZE	STUDENT	HOUSEWIFE	UNEMPLOYED	INACTIVE	WORKER
LAND-LESS	Adopter	4.88	.77	1	.22	1.67	1.22
	Non Adopter	3.56	.42	.94	.16	1	1.04
FUNC-TIONAL LAND-LESS	Adopter	4.56	.98	1.15	.13	.93	1.37
	Non Adopter	4.25	.79	1.02	.15	1.02	1.27
MARGI-NAL	Adopter	5.15	1.48	1.26	.09	.78	1.54
	Non Adopter	4.81	1.43	1.29	.13	.64	1.32
SMALL	Adopter	5.86	1.93	1.33	.12	1	1.48
	Non Adopter	5.42	1.64	1.49	.08	.72	1.49
MEDIUM	Adopter	5.97	1.64	1.28	.08	1.19	1.78
	Non Adopter	5.58	2.29	1.48	.07	.63	1.11
RICH	Adopter	5.52	1.73	1.13	0	1.13	1.53
	Non Adopter	4.32	1.20	1.12	0	.80	1.2
LAND-LORD	Adopter	7.49	2.33	1.67	.08	.83	2.58
	Non Adopter	5.20	1.60	1.70	.10	.40	1.40
TOTAL	Adopter	5.24	1.42	1.24	.11	.94	1.53
	Non Adopter	4.39	1.00	1.13	.13	.89	1.24

TABLE: 6.14C

PRODUCTIVE EMPLOYMENT (MAN HOURS PER DAY) OF MALE WORKERS ACCORDING TO THEIR LANDHOLDING AND MV STATUS

Land holding status	Adoption status and (No.)	Productive Employment				Total Productive Labour
		Agriculture		Non- Agriculture		
		Self Labour	Empld. Labour	Self Labour	Empld. Labour	
Landless	Adopter (8)	.97	.97	1.31	.31	3.56
	Non- Adopter (89)	.38	1.06	3.09	.48	5.01
Funct. Landless	Adopter (135)	1.69	.91	2.28	.35	5.23
	Non- Adopter (214)	.83	1.15	3.73	.37	6.08
Marginal	Adopter (137)	3.43	.57	1.65	.35	6.00
	Non-Adopter (88)	1.99	.36	3.45	.37	6.17
Small	Adopter (56)	4.29	.79	1.03	.12	6.23
	Non-Adopter (38)	2.17	.24	3.65	.36	6.33
Medium	Adopter (44)	4.47	.04	1.11	.07	5.69
	Non-Adopter (26)	3.28	.15	1.60	.23	5.26
Rich	Adopter (16)	2.70	0	.97	0	3.67
	Non-Adopter (3)	3.42	0	0	0	3.42
Landlord	Adopter (16)	3	0	.03	.22	3.25
	Non-Adopter (11)	1.64	1.88	1.77	.45	5.72
All Villages	Adopter (412)	3	.62	1.70	.27	5.59
	Non- Adopter (469)	1.24	.87	3.36	.38	5.85
All Non MV. Villages	Adopter (202)	.32	.66	.49	.06	1.53
	Non-Adopter (356)	1.55	.95	.69	.25	3.44
All MV Villages	Adopter (210)	2.75	.58	.32	.47	4.12
	Non- Adopter (113)	.26	.62	.73	.79	2.40

TABLE:6.14D

PRODUCTIVE EMPLOYMENT (MAN HOURS PER DAY) OF SPECIALIZED AGRICULTURAL WAGE LABOUR ACCORDING TO THEIR LANDHOLDING AND MV STATUS

Land holding status	Adoption status and (No.)	TOTAL NO. OF WORKERS SURVEYED	TOTAL NO. OF WORKERS SELLING AGR. LABOUR	AV. HOURS OF AGR. LABOUR SOLD PER DAY PER WORKER	
				BY ALL WORKERS	BY ONLY THOSE WHO SOLD AGR LABOUR
Landless	Adopter	8	2	.97	3.88
	Non-Adopter	89	16	1.06	5.94
Funct. Landless	Adopter	135	24	.91	5.12
	Non-Adopter	214	44	1.15	5.61
Marginal	Adopter	137	14	.57	5.55
	Non-Adopter	88	6	.36	5.33
Small	Adopter	56	7	.79	6.32
	Non-Adopter	38	3	.24	3
Medium	Adopter	44	1	.04	2
	Non-Adopter	26	1	.15	4
Rich	Adopter	16	x	0	x
	Non-Adopter	3	x	0	x
Landlord	Adopter	16	x	.03	x
	Non-Adopter	11	2	1.88	10.37
All Villages	Adopter	412	48	.62	5.30
	Non- Adopter	469	72	.87	5.67

TABLE: 6.15

Estimated Coefficients Of The Agricultural Labour Supply Function (All Villages, 1992-93)

VARIABLES	PARAMETER ESTIMATES
CONSTANT	- 23.14 (4.82**)
FLOOD	20.39 (8.13**)
DRAUGHT	- 20.68 (9.02**)
PCIRN	.311 (6.46**)
BUS	4.476 (7.85**)
FSZ	.009 (1.76*)
TMVG	.007 (2.04*)
SUBP	.015 (.70)
WED	- .545 (4.31**)
Adjusted R-Square	.13
Value of F-Statistics	18.10 (Prob > F = .0001)

NOTE: Numbers in parentheses are t-statistics.
** indicates significance of 1 percent level.
* indicates significance of 5 percent level

EXHIBIT: 6.16

FACTORS INFLUENCING THE REAL AGRICULTURAL WAGE

FACTORS	NATURE OF EFFECT	REASON
UNEMPLOYEMENT	NEGATIVE	Existence of idle labour supply.
SEASONAL RISE OF AGRICULTURAL ACTIVITIES	POSITIVE	Periodic concentration of labour demand.
MIGRATION OF LABOUR	POSITIVE/NEGATIVE	Labour supply may decrease/increase if net migration is positive/negative
EXISTENCE OF ALTERNATIVE OPPORTUNITY FOR EMPLOYMENT IN NON-AGRICULTURAL SECTOR	POSITIVE	Part of the labour force moves away from agriculture.
INCIDENCE OF INTERLINKED TRANSACTIONS	NEGATIVE	Increases the bargaining power of employers over employees
LANDOWNERSHIP STRUCTURE	POSITIVE/NEGATIVE	If top heavy then hired labour demand increases more, alternatively if itis bottom heavy labour supply increases relatively more.

TABLE: 6.17

VILLAGE WISE ESTIMATION OF A FEW RELEVANT FACTORS THAT INFLUENCE THE LEVEL OF REAL AGRICULTURAL WAGE

FACTORS	VILLAGE				
	PATARDIA	D.MARI	B.PUR	M.MARA	SH. PASHA
AV. NOMINAL AGRICULTURAL WAGE (TK)	23	33	25	43	28
PRICE OF MV PADDY (SEER)	4.66	3.85	5.00	4.53	4.81
PADDY WAGE (SEER)	5	8	5	9	6
% OF LANDLESS HHs	37	71	58	25	62
% OF RICH AND LANDLORD HHs	.007	3	15	7	2
% OF MV LAND IN RICE LAND	83	99	30	32	71
% OF LANDLESS HHs WITH NON AGRICULTURAL OCCUPATION	35	81	30	32	63

TABLE: 6.17A

VILLAGE-WISE OCCUPATIONAL PROFILE OF THE LANDLESS AND FUNCTIONALLY LANDLESS HOUSEHPOLDS

VILLAGE	TOTAL NO. OF L.LESS AND F.L.LESS HHS (%)	NO. OF HHs ENGAGED IN		
		NON-AGRI OCCUPATION (%)	AGRI. OCCUPATION (%)	AGRI. WAGE LABOUR (%)
PATARDIA	48 (100)	17 (35)	21 (45)	10 (20)
D.MARI	137 (100)	111 (81)	14 (10)	12 (9)
B.PUR	69 (100)	21 (30)	22 (32)	26 (38)
M.MARA	38 (100)	12 (32)	15 (39)	11 (29)
SH.PASHA	169 (100)	107 (63)	10 (6)	52 (31)
ALL	449 (100)	269 (60)	67 (15)	112 (25)

TABLE: 6.18A

DIVERSITY OF LABOUR TRANSACTIONS AND IT'S EFFECT ON THE PAID NOMINAL WAGE RATE IN PATARDIA

TYPES OF LABOUR	AVERAGE DAILY WAGE PAID (TK.)		
	CASH (%)	KIND (%)	TOTAL
CASUAL	13.65 (63)	8.14 (37)	21.78
MIGRANT	14.06 (69)	6.29 (31)	20.35
PERMANENT	8.86 (30)	20.71 (70)	29.57
COTRACTUAL (TRANSPLANTING)	43.41 (100)	0 (0)	43.41
CONTRACTUAL (HARVESTING)	N.A.	N.A.	38.11
ALL*	X	X	22.96

NOTE: Average village level wage is estimated through a weighted summation of the wages for different types of labour. The weight of each type has been derived from the percentage of that type of labour in the total labour use of the employer HHs of that village.

TABLE: 6.18B

DIVERSITY OF LABOUR TRANSACTIONS AND IT'S EFFECT ON THE PAID NOMINAL WAGE RATE IN DARIKAMARI

TYPES OF LABOUR	AVERAGE DAILY WAGE PAID (TK.)		
	CASH (%)	KIND (%)	TOTAL
CASUAL	13.43 (58)	9.84 (42)	23.27
MIGRANT	30.24 (64)	17.36 (36)	47.60
PERMANENT	12.14 (45)	15.10 (55)	27.23
COTRACTUAL (TRANSPLANTING)	45.44 (100)	0 (0)	45.44
CONTRACTUAL (HARVESTING)	N.A.	N.A.	58.71
ALL*	X	X	32.94

NOTE: Average village level wage is estimated through a weighted summation of the wages for different types of labour. The weight of each type has been derived from the percentage of that type of labour in the total labour use of the employer HHs of that village.

TABLE: 6.18C

DIVERSITY OF LABOUR TRANSACTIONS AND IT'S EFFECT ON THE PAID NOMINAL WAGE RATE IN BAIKUNTHAPUR

TYPES OF LABOUR	AVERAGE DAILY WAGE PAID (TK.)		
	CASH (%)	KIND (%)	TOTAL
CASUAL	13.61 (55)	11.09 (45)	24.70
MIGRANT	20.73 (64)	11.43 (37)	32.16
PERMANENT	9.70 (39)	15.03 (61)	24.73
COTRACTUAL (TRANSPLANTING)	18.16 (100)	0 (0)	18.16
CONTRACTUAL (HARVESTING)	N.A.	N.A.	29.94
ALL*	X	X	25.21

NOTE: Average village level wage is estimated through a weighted summation of the wages for different types of labour. The weight of each type has been derived from the percentage of that type of labour in the total labour use of the employer HHs of that village.

TABLE: 6.18D

DIVERSITY OF LABOUR TRANSACTIONS AND IT'S EFFECT ON THE PAID NOMINAL WAGE RATE IN MAILMARA

TYPES OF LABOUR	AVERAGE DAILY WAGE PAID (TK.)		
	CASH (%)	KIND (%)	TOTAL
CASUAL	X	X	X
MIGRANT	X	X	X
PERMANENT	19.23 (45)	23.66 (55)	42.89
COTRACTUAL (TRANSPLANTING)	X	X	X
CONTRACTUAL (HARVESTING)	X	X	X
ALL*	X	X	42.89

NOTE: Average village level wage is estimated through a weighted summation of the wages for different types of labour. The weight of each type has been derived from the percentage of that type of labour in the total labour use of the employer HHs of that village.

TABLE: 6.18E

DIVERSITY OF LABOUR TRANSACTIONS AND IT'S EFFECT ON THE PAID NOMINAL WAGE RATE IN SHANKARPASHA

TYPES OF LABOUR	AVERAGE DAILY WAGE PAID (TK.)		
	CASH (%)	KIND (%)	TOTAL
CASUAL	25.27 (95)	1.28 (5)	26.54
MIGRANT	32.94 (67)	16.03 (33)	48.97
PERMANENT	15.38 (39)	23.85 (61)	39.22
COTRACTUAL (TRANSPLANTING)	34.76 (100)	0 (0)	34.76
CONTRACTUAL (HARVESTING)	N.A.	N.A.	N.A.
ALL*	X	X	28.09

NOTE: Average village level wage is estimated through a weighted summation of the wages for different types of labour. The weight of each type has been derived from the percentage of that type of labour in the total labour use of the employer HHs of that village.

TABLE: 6.18F

DIVERSITY OF LABOUR TRANSACTIONS AND IT'S EFFECT ON THE PAID NOMINAL WAGE RATE IN ALL VILLAGES

TYPES OF LABOUR	AVERAGE DAILY WAGE PAID (TK.)		
	CASH (%)	KIND (%)	TOTAL
CASUAL	17.66 (73)	6.48 (28)	24.14
MIGRANT	26.42 (64)	14.80 (36)	41.22
PERMANENT	14.40 (43)	19.43 (57)	33.83
COTRACTUAL (TRANSPLANTING)	24.30 (100)	0 (0)	24.30
CONTRACTUAL (HARVESTING)	N.A.	N.A.	37.94
ALL*	X	X	28.09

NOTE: Average village level wage is estimated through a weighted summation of the wages for different types of labour. The weight of each type has been derived from the percentage of that type of labour in the total labour use of the employer HHs of that village.

TABLE: 6.19A

VILLAGE WISE NOMINAL WAGE RATE OF CASUAL LABOUR AND IT'S COMPOSITION (1992-93)

SUBJECT	VILLAGE					
	PATARDIA	D.MARI	B.PUR	M.MARA	SH. PASHA	ALL
PERSONDAYS EMPLOYED	137	32	73	x	129	371
TOTAL CASH WAGE PAID	1870	430	994	x	3260	6554
TOTAL KIND WAGE PAID*	1115	315	810	x	165	2405
AV. DAILY CASH WAGE	13.65 (63%)	13.43 (58%)	13.61 (55%)	x	25.27 (95%)	17.66 (73%)
AV. DAILY KIND WAGE	8.14 (37%)	9.84 (42%)	11.09 (45%)	x	1.28 (5%)	6.48 (28%)
AV. TOTAL DAILY WAGE	21.78 (100%)	23.27 (100%)	24.70 (100%)	x	26.54 (100%)	24.14 (100%)

NOTE: * The wage paid in kind was transformed into equivalent taka value and the same was done for the following tables.

TABLE:6.19B

VILLAGE WISE NOMINAL WAGE RATE OF MIGRANT LABOUR AND IT'S COMPOSITION (1992-93)

SUBJECT	VILLAGE					
	PATARDIA	D.MARI	B.PUR	M.MARA	SH. PASHA	ALL
PERSONDAYS EMPLOYED	85	1403	901	x	126	2515
TOTAL CASH WAGE PAID	1195	42430	18685	x	4150	66460
TOTAL KIND WAGE PAID	535	24360	10300	x	2020	37215
AV. DAILY CASH WAGE	14.06 (69%)	30.24 (64%)	20.73 (64%)	x	32.94 (67%)	26.42 (64%)
AV. DAILY KIND WAGE	6.29 (31%)	17.36 (36%)	11.43 (37%)	x	16.03 (33%)	14.80 (36%)
AV. TOTAL DAILY WAGE	20.35 (100%)	47.60 (100%)	32.16 (100%)	x	48.97 (100%)	41.22 (100%)

TABLE:6.19C

VILLAGE WISE NOMINAL WAGE RATE OF PERMANENT LABOUR AND IT'S COMPOSITION (1992-93)

SUBJECT	VILLAGE					
	PATARDIA	D.MARI	B.PUR	M.MARA	SH. PASHA	ALL
PERSONDAYS EMPLOYED *	3	7	21	27	1	59
TOTAL CASH WAGE PAID	691	2210	5297	13503	400	2210
TOTAL KIND WAGE PAID	1616	2748	8209	16613	620	29806
AV. DAILY CASH WAGE	8.86 (30%)	12.14 (45%)	9.70 (39%)	19.23 (45%)	15.38 (39%)	14.40 (43%)
AV. DAILY KIND WAGE	20.71 (70%)	15.10 (55%)	15.03 (61%)	23.66 (55%)	23.85 (61%)	19.43 (57%)
AV. TOTAL DAILY WAGE	29.57 (100%)	27.23 (100%)	24.73 (100%)	42.89 (100%)	39.22 (100%)	33.83 (100%)

NOTE: * Usually the permanent workers are hired for six or more months and they are paid in terms of both cash and kind on a monthly or yearly basis. As usual here also the monthly or yearly kind payments were transformed into taka value. And one month of work has been treated as equivalent to 26 person days.

TABLE: 6.19D

NOMINAL WAGE RATE FOR CONTRACTUAL WORKERS FOR THE ACTIVITY OF PLOUGHING (1992-93)

SUBJECT	VILLAGE					
	PATARDIA	D.MARI	B.PUR	M. MARA	SH. PASHA	ALL
AMOUNT OF LAND UNDER CONTRACT (DEC)	50	58	1065	x	784	1957
PERSONDAYS REQUIRED TO FINISH	4	N.A.	83.7	x	354.56	442.26
TOTAL WAGE PAID (TK)	200	522	6602.25	x	4336	11659.25
AV. WAGE PER PERSONDAY	50	N.A.	79	x	12.22	26.36
AV. WAGE PER ACRE	400	900	620	x	549	595

TABLE: 6.19E

NOMINAL WAGE RATE FOR CONTRACTUAL WORKERS FOR THE ACTIVITY OF TRANSPLANTING (1992-93)

SUBJECT	VILLAGE					
	PATARDIA	D.MARI	B.PUR	M. MARA	SH. PASHA	ALL
AMOUNT OF LAND UNDER CONTRACT (DEC)	122	425	3025	x	2255	5827
PERSONDAYS REQUIRED TO FINISH	11.84	29.86	584.72	x	261.46	887.88
TOTAL WAGE PAID (TK)	514	1357.10	10619	x	9088.90	2157.88
AV. WAGE PER PERSONDAY	43.41	45.44	18.16	x	34.76	24.30
AV. WAGE PER ACRE	421	319	351	x	403	370

TABLE: 6.19F

NOMINAL WAGE RATE FOR CONTRACTUAL WORKERS FOR THE ACTIVITY OF WEEDING (1992-93)

SUBJECT	VILLAGE					
	PATARDIA	D.MARI	B.PUR	M.MARA	SH.PASHA	ALL
AMOUNT OF LAND UNDER CONTRACT (DEC)	x	116	300	x	x	416
PERSONDAYS REQUIRED TO FINISH	x	8.12	45	x	x	53.12
TOTAL WAGE PAID (TK)	x	232	2400	x	x	2632
AV. WAGE PER PERSONDAY	x	28.57	53.33	x	x	49.54
AV. WAGE PER ACRE	x	200	800	x	x	632

TABLE: 6.19G

NOMINAL WAGE RATE FOR CONTRACTUAL WORKERS FOR THE ACTIVITY OF HARVESTING (1992-93)

SUBJECT	VILLAGE					
	PATARDIA	D.MARI	B.PUR	M. MARA	SH. PASHA	ALL
AMOUNT OF LAND UNDER CONTRACT (DEC)	223	1729	2415	x	208	4367
PERSONDAYS REQUIRED TO FINISH	40.09	146.08	380.29	x	124.80	566.46
TOTAL WAGE PAID (TK)	1528	8576.5	11387.5	x	N.A.	21492
AV. WAGE PER PERSONDAY	38.11	58.71	29.94	x	N.A.	37.94
AV. WAGE PER ACRE	685	496	471	x	N.A.	492

CHAPTER VII

LAND MARKET AND MODERN VARIETY

7.1 Character of The Land Market In Bangladesh

In Bangladesh Land market refers to two entirely different kinds of land transactions:

a) Renting out or in of the land in the tenancy market under certain terms and conditions.

b) Selling and purchase of land.

In Bangladesh the first is the dominant form of transaction in land. According to 1983-84 Agricultural Census almost 40 percent of the farm households were involved in the tenancy market transacting 17 percent of the total operational land. The most common type of tenure in 1983-84 was the well known system of " Share-cropping " which is usually a verbal contract of land use between the share-cropper and the landlord, either for one season or a full year. Share-cropping covered at that time 74 percent of the total transacted land and 70 percent of total number of tenants.

The second important tenurial arrangement is the so called "fixed rent" system. In 1983-84 the proportion of fixed rent tenants among the tenants was about 15 percent and they got about 15 percent of the transacted land.[72]

[72] We have defined "fixed rent" system more broadly than the 1983-84 census, covering not only those holdings reporting fixed amount payment, but also those who have taken land on a permanent lease basis with usually a nominal fixed payment and also those who are enjoying usufruct of the land for a specified period of time in exchange of a cash advance to the landowner. These two latter systems are actually classified differently in the 1983-84 census and has been named as "On Lease" and "Khai-khalashi".

The third important form of tenure recorded in 1983-84 census was "Mortgage". The principal form of Mortgage in Bangladesh is locally termed as "Daisudi".[73] It is carried out by 11 percent of the tenants in 8 percent of the transacted in land.
The remaining 5 percent of the transacted in land were under miscellaneous types of tenures carried out by the remaining 4 percent of the tenants. Generally, in Bangladesh the small owners of land lease in land from the large landowners . According to the 1983-84 census only in some particular regions (Coxbazar and Patuakhali) there exists a high incidence of "inverse Share-cropping". That means: large leasing in from the small farmer! However, by definition, for the two forms of tenures such as "Dai-sudi" and "Khai-Khalashi" this type of inverse sharecropping is actually the universal practice. According to the 1983-84 census these two types of "inverse tenure" together covered about 16 percent of the tenants and about 9 percent of the transacted in land.
Thus, in general it can be asserted that the predominant form of land transaction in Bangladesh is land leasing done through sharecropping whereby the land surplus farmers lease out their land to the land poor households.

Very little macro level data is available on the amount of land sold and bought in the rural areas. The yearbook of agricultural statistics published in 1979-80 presents a small time series(1971 to 1976) on the amount of land purchased and sold as well as the number of sales and purchasing transactions in the rural areas. Since the total owned land

[73] "Dai-sudi", is a kind of taking loan against a mortgaged piece of land. Generally this occurs between a poor land owner and a rich creditor. If the poor land owner can't repay his loans within the specified time period , the rich creditor tenant gets the right to confiscate or purchase that piece of land. The "khai-khalashi" is a weaker and recent version of "Dai-sudi". Here the rich creditor tenant just enjoys the usufruct of the mortgaged land for a predetermined length of time after which he had to return back the land to it's owner. This fits more with the concept of a long term "Fixed Rent" system.

in the rural areas in 1977 was 19.35 million acres and the total amount of land bought and sold in the rural areas in 1976 was reported to be only 1.80 million acres and 1.27 million acres respectively so we find that only .009 percent to .006 percent of the owned land was disposed through buying and selling! This meagre percentage would come down further if we could isolate the arable land sold/bought from the other types of land. The level of sales and purchases of land may vary depending upon the crisis level of the rural economy, for example the time series(1971 to 1976) shows that the amount of land bought and sold suddenly jumped to the level of 1.98 million acres and 1.57 million acres in the famine year of 1974. Even then the relative proportions of those transactions with respect to the then operational land of the whole country had remained extremely insignificant.

et al.

For land selling and buying there is no information in the census about "who is selling to whom". But numerous micro studies carried out at different times with wide period of intervals, such as, Mukherjeee, R. K.,[1957] , Rahman, A. (1986) Hossain, M.(1989), Rahman, Zillur and et.al. [1995], etc. found and mentioned repeatedly that small farmers under economic stress are generally forced to sell their land as an ultimate resort. Generally they take loans by mortgaging their land and when they fail to repay, the land has to be sold out to the creditor. Thus land alienation is not a one shot process in Bangladesh and perhaps that is the reason why we find such a low incidence of land buying/selling in Bangladesh in any particular year.[74]

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a

[74] This is not only peculiar to Bangladesh. It is an universal feature of all small holders in agriculture. Karl Kautsky in his famous book " The Agrarian Question " wrote that land to the small peasant is like what the ornament of a newly married bride is to her! However, Kautsky also argued that the process of polarisation was very slow even under capitalist agriculture.

reference ?

Unlike land buying and selling, we have available information on who is leasing in from whom? 1984 census reports that among the share croppers 62 percent belonged to the small land owner group. While only 5 percent of the large landowner group leases in land under sharecropping tenure. This indirectly proves that mainly large landowners are leasing out to the small in the rural areas of Bangladesh.

7.2 Land Market: Trends and Evidences

In order to examine the macro trends we used the two period census figures covering the years of 1960 and 1983. The detail information of the 1996 census is yet to be processed. We therefore also used the 1987-88 D.I.S figures based on a fairly representative sample survey of 62 villages throughout Bangladesh to have an updated information on the same indicators to reveal the more recent trends. The indicators for which the trends are depictable for at least two of the three periods are:

a) Percentage of farm households leasing land in.

b) Percentage of arable land transacted in.

c) Percentage of pure tenants (landless tenants) among the lease-holders.

d) Average farmsize of the pure tenants.

e) Average farmsize of the owner tenants.

f) Average farmsize of all farm households.

g) Proportion of sharecroppers among the tenants.

h) Percentage of transacted in land cultivated under the tenure of sharecropping.

i) Rural irrigated land price index.

j) Rural non irrigated land price index.

The macro trend based on the census figures (see Table 7.1) from 1960 to 1983 shows that almost all the above indicators had a declining trend, e.g. proportion of tenant household, proportion of sharecropper households, proportion of transacted in land, proportion of sharecropped land, average farmsize for all farm households as well as that of the different kinds of tenants, all had been consistently declining during that twentyfour years period (1960-1984). The only exception was the land price index which nearly doubled during the same period and the rate of price increase was also slightly higher in the case of irrigated land.

During this period the same demographic pressure which was working behind the declining trends of the first set of variables, was also causing the rise in land prices. And it was felt more in the irrigated areas which had of late become relatively more densely populated areas. Thus many scholars had explained those mutually consistent downward trends through the mechanism of population pressure on a fixed land.

But the trend after 1983 in general did not follow the old course and in the absence of a reliable national census one has to depend on large sample surveys. If that is allowed then from Table 7.1 it is found that during post 1984 period:

1) Average farm size was falling at a slower rate implying that there might have been a negative change in the demographic pressure in the recent period due to either a shift in occupation from agriculture to non agriculture or out-migration from the rural areas or increased population control or perhaps due to a combination of all these ~~three~~ changes.

2) In fact the figures on average farmsize of specially the pure tenants and also that of the owner-cum-tenants were showing an absolute rise during 1983-1987 period.

The rise was more dramatic for the pure tenant even though their relative proportion among the tenant households had increased almost twelve times during the same period. This implies that over time a class of pure tenants were emerging who were no more a decaying class and also may not be the poorest of the poor. They were increasing both absolutely and relatively, accumulating on average an increasing amount of land for MV cultivation.

one word: nowadays

A puzzle that needs to be ~~solved~~ explained is how could the landless actually obtain and cultivate an increasingly higher amount of land? One plausible explanation is that due to proliferation of NGO work and micro credit some pure tenants now a days might have overcome the constraint of lack of working capital. Thus with surplus labour, cash in hand and managerial skill they might have become now a days an attractive tenant group in the eyes of the landlord.

3) The census data had revealed that the relative importance of the sharecropping was declining during the period of 1960 to 1984 in terms of both numerical proportion and the proportion of transacted land under that arrangement. This leads to two other worthwhile investigations; firstly if it is true, then what other forms of tenure was acquiring relative importance; and secondly, ~~has~~ whether the same trend still continued after 1983-84?

The Table 7.2 presents an even more recent profile (1992-93) of our own sample of 850 households in terms of the same indicators. The profile is only for one year i. e. 1992-93, but it has the advantage of being disaggregated according to production environment or village type. For information on dynamic trend a small panel of 76 households were also used to estimate the same indicators for two reference years e.g. 1987-88 and 1992-93. These estimates are presented separately in the Table 7.2

Table 7.2 helps us to see whether some of the above indicators really vary across different types of villages namely MV villages and non MV villages. It shows that the relative importance of tenancy measured in terms of numerical proportion of the tenant HHs is slightly higher in the non MV villages but in terms of the proportion of operational land under tenancy, MV villages come first. Thus less numerous tenants were cultivating more amount of land in the MV areas as compared to the non MV areas. Another distinction lies in significantly larger incidence of pure tenancy (i.e. landless tenants) in the MV villages. From the Table 7.2 an above average proportion of pure tenancy is observed in the villages one, two and five. The first two villages constitute our MV village and even the non MV fifth village can also be termed as technologically dynamic village if dynamic criterion is used for such classification.

If one looks at the dynamic panel data (Table 7.3) one again finds a few more differences in their dynamic pattern between MV and non MV regions. They are:

1) The relative importance of tenancy in terms of both number and amount of transacted land was increasing among the panel HHs from the MV region, while the same was decreasing at a much faster rate among the non MV panel HHs. making the over all trend (i.e. MV+non MV) negative. which is also in line with

the national census figures presented in Table 7.1. This is also plausible because in the non MV villages farming is actually less productive and pure tenancy might have become non viable there.

Perhaps they were increasingly pushed into the non-farm labour market in those areas.

2) The panel data shows that in both MV and non MV regions the numerical proportion of the pure tenants had declined but their average farmsize has increased. This implies that after 1987, among the landless pure tenants in our sample some were giving up their tenancy and their transacted in land were reallocated to a fewer number of older and more viable pure tenants. Thus after 1987 the absolute number of pure tenants did not show any increase (rather there was ~~observed~~ a ~~trend of~~ decline) but at the same time their average cultivated land showed an increasing trend. These findings reinforces the puzzle posed before.

One possible explanation might be that over time a large portion of the landless had shifted ~~their occupation~~ from agriculture to various kinds of non agricultural activities. However, ~~Thus recently~~ the fewer landless who have been competing in the tenancy market for land ~~and~~ with increased availability of micro credits find their ability to lease in larger amount of land ~~might have also increased~~. ? OK

7.3 Effect of MV on Type of Tenure

Table 7.4 presents the relative importance of various tenancy arrangements in the sample villages. From the table it is observed that in the MV villages 45 percent of the transacted in plots were under type 2 arrangement which stands for the fixed rent system. But in the non MV regions the relative proportion of plots under fixed rent was only .02

percent. This is in line with the previous research findings in this field and implies that in the MV regions the traditional sharecropping practice is more likely to be replaced with the "Fixed Rent System". [Hossain, 1989]

The advantage of fixed rent system over "Borga" is it's positive incentive upon the tenant to invest more for production. The disadvantage is, it's imposition of the total burden of risk upon the tenant. The net advantage of the fixed rent system generally works in favour of the tenants of the MV regions, since under irrigated environment the risk of flood or draught is minimized considerably while the opportunity for increasing productivity through additional investment becomes much wider. The previous researchers also point out that such a shift towards fixed rent from sharecropping may make the distribution of the gain from MV technology more favourable for the tenant, because the percentage share of land income going to the tenant is relatively higher for fixed rent system in Bangladesh as compared to the system of sharecropping.[Hossain, M. et al. 1994]

The other important finding from the Table 7.4 is the more or less equal weight of "Daisudi and Khaikhalashi" in both kinds of villages. Together they constitute 12 and 13 percent of the transacted in plots in the MV and Non MV villages respectively. This evidence apparently goes against the argument that MV will induce first tenant eviction and subsequently lead to inverse sharecropping by big landlords. At least for the two principal forms of inverse tenancy Daisudi and Khaikhalashi no significant contrast exists between MV and non MV regions. These practices are equally prevalent in both types of villages. However the final judgement must wait till the detailed analysis of the landholding status of both lessor and lessee is completed.

7.4 Landholding Status of Lessors and Lessee

Table 7.5 and Table 7.6 presents classwise distribution of transacted in land and transacted out land for the lessee and the lessors across the two different types of villages. This analysis is important for determining whether the relationship between the tenant and the landlord is ~~of~~ semi-feudal ~~type or a relationship between more or less equals~~.

Our data shows that 96 percent of the tenants in the MV villages belonged to the small landowner class i.e. owning less than 2.50 acres of land. And they actually obtained 95 percent of the total transacted in land. However, Table 7.6 also shows that in the MV villages almost 79 percent of the transacted in plots came from either the middle (i.e. owning 2.5 to 7.4 acres of land) or the small farmers. Thus it is clear by no means the tenurial pattern in the MV villages can be called semi-feudal.

On the other hand 88 percent of the tenants belonged to the small farmer class in the Non MV regions and they obtained 85 percent of the total transacted in land. And again unlike the MV villages only 48 percent of the transacted in plots came from the middle and the small farmers in the non MV villages. Most of the transacted in land i.e. 52 percent had come from the large landowners. Here the tenurial pattern was more akin to semi-feudalism.

These facts suggest that in the MV regions "land leasing in" was carried out by mainly small landowners but they took land from mainly the middle or small farmers. Since small or middle were giving land not to a large farmer but another small, so this can in no way be termed as "inverse share cropping". Hence we can therefore also reject the contention that "MV is going to induce inverse sharecropping".

If any inducement for inverse tenancy is there, then it is more likely to be present in the non MV regions since at least 12 percent of the tenants in those areas belonged to the middle and large landowner class and they obtained about 15 percent of the transacted in land from the small farmers. It may not be also a mere coincidence that 15.12 percent of the transacted in plots in the non MV villages were coming from the small farmers.

In our review of literature it was pointed out that the big landowners after installing tubewell may become interested to lease in all the adjacent plots for reaping the benefits of positive economy of scale. Thus Tubewell owner group of a village may be the true initiators of inverse sharecropping and may have a disproportionate share of transacted land under them. This may again indirectly prove the inducement of MV for inverse share cropping.

Tables 7.7 presents the relevant data for checking the empirical validity of the above hypothesis. From the Table it is clear that in both MV and non MV villages the proportion of transacted in land in the tubewell owning farms is actually lower than the respective village level average proportion of transacted in land for all the farm households. Thus the tubewell owning farms are in most of the cases non-share croppers and as a group they do not have a more than proportionate share of the transacted in land in their village.

7.5 Location: A Neglected Factor

The decision to lease out a piece of land to another person may be contingent upon their respective resource complementarity or higher opportunity cost of either self cultivation or owner managed cultivation on the part of the landowner. This kind of explanation often used by the economists is obviously true in many cases but it misses one of the most important technical cause behind land leasing out i.e. the distance between the landowner's residence and the transacted out plot. The existing Economic models implicitly assume ~~takes it for grant~~ed that the landowner's owned land are situated not so far as to create a supra-technical compulsion for leasing out. But that is only an assumption and merits critical empirical test. Especially the MV cultivation requires a higher degree of closer supervision and in that case the distant location of the plot may become a serious constraint to the landlord who may become technically forced to lease out the distant owned plot. good

We collected data on the residential status of the lessor households which can be used to analyze this issue. The most distant plot is that the owner who ~~of which~~ lives in another district or town. This is the familiar case of absentee landlordism. The second in order are those plots whose owners live ~~the owner of which lives~~ in another neighbouring village. Locationally the least disadvantaged plot are those the owners who ~~of which~~ live in the same village where the plot is located. Table 7.8 provides the relevant figures describing the location-wise distribution of all plots from each type of village. From this table it appears that location may be a critical factor in both MV and non MV villages and perhaps a little bit more so in the MV regions. The data shows that about 21 percent of the transacted in plots in the MV villages were owned by absentee landlords. And another 49 percent were owned by those who reside in the neighbouring village. So together these plots constitute 70 percent of the transacted plots.

In the non MV villages 23 percent of plots came from the absentee landlords, while another 20 percent belonged to the neighbouring landlords. Thus together they constitute 43 percent of the transacted in plots which is not a small number at all, although smaller than that in the MV villages.

7.6 Tenancy and Technological Innovation

Table 7.9 presents village wise incidence of irrigation for the transacted in plots. From this Table it is found that the incidence of irrigation in the rented plots was much higher in the MV villages, and that is true even if one compares the two MV villages with the two of the three non MV villages while excluding the saline - prone third completely non MV village. In the two non MV ~~mv~~ villages 53 and 55 percent of transacted in plots were found to be irrigated. But in the two MV villages the rate of irrigation for the rented in plots was 95 and 99 percent! This definitely proves that tenancy can not be an effective barrier against technological innovation or MV adoption via irrigation. On the basis of this evidence ~~these evidences~~ and additional support from the previous studies ~~findings~~ (see section 4.10), one is forced to reject the famous hypothesis of semi feudalism forwarded by Bhadury i.e ~~(Bhadhury,~~ 1973) Actually the counter critique of this hypothesis had already argued it out theoretically that if the landlord is powerful enough to vary the who are the critics? where they make their criticisms

terms of share cropping then he could extract more surplus from the tenant by allowing the tenant to have higher production through technological innovation and still also maintain the indebtedness of the tenant. Bhadury's model unrealistically assumes the share term to be constant (50:50) and then deduces that innovation may raise the surplus of the tenant, and make him able to come out of his debt bondage through the repayment of his debt. Thus landlord may stand against innovation by the tenant and continue to maintain his surplus extraction in the forms of both interest and rent. This explanation is static and empirically non substantiable. But the counter argument based on changing and dynamic nature of the terms and conditions of sharecropping also requires to be empirically substantiated.

However in four of the five sample villages there has not been found any variation at all in the share terms of sharecropping. In the other four villages the harvest share rule is always 50:50 with all the costs are to be borne by the tenant only. And it is equally true for both non MV and MV crop cultivators in all these four villages.
The only exceptional village is the Shankarpasha. The nature of variation in the harvest share rule in the village of Shankarpasha is very interesting and renders direct evidence against the assumption of non variability of the share rule. But Bhadury's model used to argue that due to stickiness of the terms of share cropping innovation in the share-cropped land would increase the income of the tenant and thus his increased bargaining power would snap away the semi-feudal bondage. Thus ultimately landlord would never encourage innovation in the share-cropped land. Others have shown consistently within the model if one allows flexibility of the terms of share cropping then the landlord can encourage innovation and by imposing a more ~~harsh~~ unfavorable term on the tenant can still retain

* You might like to refer to some empirical findings from others to reject the hypothesis.

his semi-feudal grip intact. This second hypothesis seems to get support from the evidences presented below.

During the wet season only the traditional rice variety is cultivated in Shankarpasha under the usual 50:50 terms of harvest share while the cost of cultivation is totally borne by the tenant. This is actually similar to the dominant traditional practice in the whole country. And it is also similar to that of all other sample villages. However in the dry season when there is no risk for the tenant, many tenants go for the cultivation of MV, but this time they have to agree to pay a higher share of output to the landlord. The share became nine-sixteenth of the harvest instead of half, while as usual the full cost had to be borne by the tenant. This seasonal variation in the share term signifies that the landlords of at least one village were powerful enough to vary the share term in their favour when innovation had been improving the ability of the tenants to pay a higher surplus. Thus it is proved again that even if semi-feudal relation exists, it is not an unsurmountable barrier against technological development. Which at the same time provides a support to the counter theories which had been developed to refute the ~~famous~~ so-called "Bhaduri-Model of Semi-Feudalism".

7.7 Decision to Lease In: A Multivariable Logit Model

There are two different sets of people who lease in land for cultivation. Those who have their own self cultivated land may choose to lease in additional land to become the so called owner-tenant. There are also people without any self cultivated land and they also may decide to lease in land and thus become pure tenants.

Conversely both these sets of people may choose to remain as before i.e. a non-tenant. Since the decision to become a tenant or non tenant is binary variable so a logit model has been used to explain such decisions. The model will be run for two sets of HHs using almost a similar set of independent variables. The first set consists of 414 HHs from all five villages who have non zero self cultivated owned land. The second set consists of 850 HHs which includes all HHs from all the five villages irrespective of whether they have zero or non zero self cultivated land.

The independent variables and the expected nature of their influence upon the decision variable are briefly described below.

MODEL: *TEN= F(RATIO, TWORKER, EDN, SCLVT, LSTVLN, TOTLSTV, EQUIP1, SALINE, FLOOD, DRAUGHT)*

VARIABLES:

TEN= It is the dependent variable of the model and assumes value 1 if the sample HH leases in some land; else it is zero.

RATIO= It is the ratio between the total number of adult male workers of a sample Household and the amount of owned land cultivated by self. It is expected to be positively related with the dependent variable because HHs with excess labour power in relation to their own cultivated land may be more eager to balance it against extra transacted in land. This variable is relevant for the smaller sample of HHs (414) with non zero self cultivated owned land

TWORKER= It is the total number of mail adult workers of the HH. This variable is relevant for the larger sample of HHs (850) with or without any self cultivated owned land, since in their case the previous variable

RATIO= is infinity and therefore can't be used as an appropriate explanatory variable.

EDN= Number of years of formal education of HH head. It is expected to be negatively related with leasing in land since sharecropping is mostly considered as a symbol of lower status in rural Bangladesh to the more educated people. They are thus more likely to lease out and opt for skilled jobs. However, this variable's negative effect may become effective only after a threshold minimum of say 8 to 10 years is crossed.

SCLVT= The amount of owned land cultivated by self. This is expected to be negatively related with the leasing in decision.

LSTVLN= It is a ratio between the total value of livestock owned by a HH (*TOTLSTV*) and the total amount of owned self cultivated land of that HH (*SCLVT*). It is expected to be positively related with the leasing in decision. Because HHs with surplus livestock value are generally interested to make them useful by leasing extra land for ploughing. This variable is relevant only for the smaller (414) set of sample HHs.

TOTLSTV= It is the total value of livestock owned by the sample HH. Keeping other things constant higher the value of this variable, greater is the possibility of leasing in. It is relevant for the larger set of HHs (850).

EQUIP1 = This is a dummy variable which assumes a zero value if the HH is not an owner of modern irrigation equipment and a value of one if he is. It is expected that ownership of tubewell may turn out to be a significant positive influencer of leasing in decision, when the effect of other variables are properly controlled for.

SALINE, FLOOD and DRAUGHT are the old three environmental Dummy variables and are used to capture the effects of non favourable environments on the leasing in decision. Since the villages which have 0 values for all these dummies are the two MV villages in our sample, so the intercept value in this model by default will capture the effects of favourable environment and/or MV technology upon the leasing decision of a HH.

The above model was first run for only those HHs among the five sample villages who have non zero self cultivated owned land by using the appropriate set of independent variables. The number of such HHs was 414. The same model was run again for the larger sample of all the 850 HHs from all the five villages including both types of HHS. Both of these model functions were estimated by using maximum likelihood estimation procedure which gives asymptotically unbiased estimates of the parameters for large samples. The estimated parameters, their T-values, their level of significance, R statistic and the maximum likelihood ratio test for the overall fitness of the models are presented in the Table: 7.10.

From the MLR. score presented in the Table, it becomes clear that both of the estimated equations were statistically significant at less than one percent level of significance. That means the explanatory variables taken together significantly influence the decision to lease in on the part of both sets of HHs. A statistic called R, which measure the predictive ability of the model was found to be respectively .25 and .37 for the smaller sub sample and the larger sample. Besides the MLR test, and R statistic, the overall fitness of the logit equations can also be judged with the help of the "Contingency Tables" generated for each model by the software package of SAS. Those Tables (See Table 7.10A and Table 7.10B) show that the rate of correct prediction for the larger sample based model was 73 percent and that of the smaller sub sample was 67 percent. Since by all three criteria of "R statistic" , "MLR score" and the "rate of correct prediction" the second estimated equation based on the larger sample of HHs (850) had abetter performance so we shall concentrate on the estimated parameters of this second equation only.

The estimated model reveals the following five parameters to be significant at 1 percent level of significance.

1) INTERCEPT was significant and had a negative value. That means the effect of favourable environment and/or MV technology is negative on leasing in decision. This does not differ from what we found before in the two way tabular analysis [see Table 7.2]. However one should remember that although the MV had a negative influence against leasing in yet it may have a positive influence on the amount of transacted in land provided that terms and conditions of leasing were

Pure econometricians usually place too much emphasis on interpreting the intercept.

flexible and adjustable. However, this is a different issue and will be taken up latter.

2) As expected the parameter value of TWORKER was positive as well as significant at 1 percent level of significance.

3) As expected the parameter value of SCLVT was negative and significant at 1 percent level of significance. The parameter value was very small because the unit of measurement used for SCLVT was decimal which inflated it's value relatively.

4) As expected the parameter value of TOTLSTV is positive and significant at one percent level of significance . Here also because of relative discrepancy in the scale of measurement the coefficient turned out to be very small.

5) Two of the environmental dummies have been found to be significant : SALINE and DRAUGHT. And they also positively encourage tenancy. This implies that non MV villages may encourage tenancy. In our sample SALINE stands for village Mailmara and Draught stands for the village B.PUR. Actually the higher tendency of tenancy in these two villages can also be explained by their peculiar socio-economic condition. Salinity in Mailmara might have encouraged the landowners to lease their land for shrimp cultivation during at least one season of the year. Again the draught prone B.PUR had the highest inequality of land distribution in our sample and also a historical feudal tradition, which can easily cause a higher incidence of leasing in.

Non Significant Parameters

Interestingly, we also find that education, equip1 and the flood dummy had no significant effect on the leasing decision. Among the 850 hhs most of them had low education (the average value of EDU was only 2.86 and the st.dev. was 3.98) and less than 10 percent had crossed the threshold level of 8. Thus the variation range was here not large enough to capture the negative effect of EDU on leasing decision. The parameter value thus turned positive, but it was insignificant. Flood parameter in this model had a negative value which goes against conventional wisdom which argues that with the advantage of sharing risk cropshare arrangement may become a mutually attractive option in the floodprone villages. However, the flood parameter had a T-value of only 1.52 and therefore turns out statistically insignificant even at a ten percent level of significance.

In general the model developed and estimated above to explain leasing in decision in the sample villages show that resource complementarity may be the most important determinant of the leasing decisions. Thus with a relatively higher SCLVT the HH refrains from leasing in while the HH with surplus labour and livestock is encouraged to lease in.

7.8 Polarization: Through Buying and Selling Of Land?

In the second chapter of this thesis [Review of literature] it was stated that many of the early authors of GR believed that with the advent of MV the pace of polarization in the distribution of land would increase. The authors from the latter periods argued differently. They argued that MV would rather protect and stabilize the land-ownership of the small owners by increasing their staying power through rise in their agricultural income. Even the pure tenants may receive some land if they have the requisite capital and draft power. This will be so because of the particular labour and management advantage of these HHs, only if somehow they are able to surmount their problem of lack of cash capital and irrigation constraint.

These two broad opposite views had a long history of theoretical quarrels. The relevant hypotheses of the earlier radical school about the process as well as the end result of Green Revolution in the context of overall polarization of land ownership can be summarily expressed in terms of the following hypothesis:

a) ~~No~~ Number. as well as the amount of land selling by the small owners to the large owners would be significantly higher in the MV village.

b) No. as well as the amount of land buying by the large owners from the small owners would be significantly higher in the MV villages.

c) The amount of mortgaged out land by the small to the large would be higher in the MV villages.

d) The amount of the mortgaged in land by the large from the small would be higher in the MV villages.

e) The incidence of distress selling of land will be higher in the MV villages.

f) The percentage of landless households will also be higher in the MV villages

g) As a result of long run polarization of income and asset the gini of both land distribution and non-land asset distribution is expected to be higher in the MV villages.

These hypotheses can be tested empirically in various ways by using our two sets of available survey data. And indirectly can lend support to either of the contending views.

The Tables 7.11 to 7.14 present some evidences for checking the above hypotheses. The findings from these evidences are discussed below. Table 7.11 presents the general incidence of land selling and buying for both MV villages and non MV villages. As a whole the MV villages show a tendency of net accumulation of land. The villagers of MV region sold 5.40 percent of their cultivable land during the survey period and bought 7 percent of the same. While the non MV villagers sold only 1.45 percent and bought 2 percent respectively. Thus the non MV villages as a whole were also a net accumulator of land. But one thing comes out quite prominently that the rate of net accumulation was much higher in the MV villages. And also the land market was more active in the MV villages in the sense of higher amount of land transactions were going on there. Table 7.12 presents the overall incidence of land mortgaging in both kinds of villages. In this case the MV villagers as a whole mortgaged out about 5 percent of their total cultivable land and they mortgaged in about 8 percent land. On the other hand the residents of non MV villages as a whole mortgaged out 1.16 percent of their cultivable land and mortgaged in only .005 percent of the same. This clearly shows that the non MV villages were actually a net looser in the mortgage market. They were actually mortgaging out more than what they were taking in. Thus although at aggregate level in terms of buying and selling both types of villagers were net accumulators, but in terms of mortgaging transactions, which in our context, is only a slower process of loosing land, the non MV villagers were obviously under a stronger stress. However the absolute amount of land sold or bought as well as mortgaged out or mortgaged in are quite insignificant in the Non MV villages.

It is noteworthy that the non MV villagers are loosing a small amount of land through the various operations of the land market but the more important question is whether the small and the weak are the main net losers in this process. Or in other words whether they were the net sellers or net outgiver of mortgaged land? We do not have the figures of classwise distribution of amount of land sold and bought in our sample villages. Thus no conclusive answer to this question is possible. Still we may have look at some of the figures in Tables 7.13 and 7.14 for an indicative answer.

From Table 7.13 it is observed that out of 34 buyers of land in the MV villages overwhelming majority i.e. 29 (85 percent) belonged to the small farmer category which means that those who own less than 1.5 acres of land were able to buy land. But in the non MV villages out of 33 land buyers only 19 (58 percent) belonged to small farmers. This shows that in the non MV villages the smaller farmers entered the land market relatively more as a seller. This implies in the non MV regions the small farmers had either relatively lesser incentive or lesser capacity to buy land.

But one must also look at the ~~S~~s ellers' profile of the sample villages in order to have a proper idea about the so called polarization process. Who were the sellers? From the Table 7.14 we find that in the MV villages out of the 27 sellers overwhelming majority (24, i.e. 89 percent) again belonged to the small farmers category. Whereas in the non MV villages out of 15 sellers only 9 belonged to the group of small farmers i.e. 60 percent. Thus in general we can conclude that both land selling and buying in MV villages were carried out mainly by the small farmers. This fits with one of our previous findings (see chapter six) that among the small farmer group there is ~~going on a~~ an on-going differentiation process whereby too tiny plot holders are now giving up owner farming in order to become full time ~~professional~~ wage labourers and those who are just below the border line are acquiring more land in order to become full time agriculturists. This is specially true for MV regions since there it is possible to thrive with a small farm as well as the higher level of agricultural activity enable the landless to have more employment due to an expanded demand for agricultural wage labour. Whereas in the non MV villages there is found a significant number of both buyers and sellers among the non small farmer groups.

All these profiles of sellers, buyers and mortgaging households prove that there was no systematic tendency of transfer of land from poor to rich in the MV villages. The transactions actually took place among the small farmers themselves. On the other hand in the non MV villages these transactions were confined among the members of the richer classes. Thus neither evidences suggest the polarization hypothesis.

TABLE: 7.1

MACRO TRENDS IN THE LAND MARKET IN BANGLADESH

INDICATORS	1960/1977	1983-84	1987[1]
TENANT HHs (% of farm HHs)	39.2	40	43.5
LEASED IN LAND (% of cultivated land)	22.87[2]	17.38	
PURE TENANT (% of all tenants)	4.08	3.74	32.18
AV. FARMSIZE OF PURE TENANTS	2.42	.90	1.04
AV. FARMSIZE OF OWNER TENANT	4.25	2.58	2.60
AV FARMSIZE OF ALL FARMS	3.54	2.27	2.18
SHARECROPPERS (% of all tenants)	93.64[2]	70.28	
SHARECROPPED-IN LAND (% of all leased in land)	92.15[2]	74.20	
RURAL IRIGATED LAND PRICE INDEX	100	207	
RURAL NON IRRIGATED LAND PRICE INDEX	100	213	

NOTE: 1) All statistics for 1987 are from the BIDS survey of the 62 villages and were cited by Hossain and sen (1992) in the final report of the study on rural poverty in Bangladesh. Remaining statistics are from <u>Agricultural Censuses</u> and various issues of <u>B.S.Y.B.</u>

2) These figures from <u>L.O.S.</u>, relates to the year 1977.

TABLE: 7.2

INCIDENCE OF TENANCY IN SAMPLE VILLAGES

INDICATORS	V1	V2	MV. VILLS	V3	V4	V5	NON MV VILLS
PERCENTAGE OF TENANT HHs. (of farm HHs)	49	75	56	65	65	55	61
LEASED IN LAND AS PERCENTAGE OF OPERATIONAL LAND	28	42	37	27	38	38	34
PURE TENANT AS PERCENTAGE OF ALL TENANTS	42	39	40	39	7	40	26
AV.FARMSIZE OF PURE TENANTS	50	95	72	172	96	83	119
AV.FARMSIZE OF OWNER TENANTS	106	200	163	306	241	219	249
AV.FARMSIZE OF ALL FARM HHs	88	153	118	354	227	135	224
NO.OF SHARE CROPPED PLOTS AS A PERCENTAGE OF ALL LEASED PLOTS	72	28	43	99	96	60	86

NOTE: 1) Farm HHs are those who have non zero cultivated land. And the tenant HHs are both owner-tenant and pure tenant.

TABLE: 7.3

INCIDENCE OF TENANCY AMONG THE PANEL HOUSEHOLDS: 1987-1992

INDICATORS	1987-88			1992-93		
	ALL VILL.	MV VILL.	NON MV VILL.	All VILL.	MV VILL.	NON MV VILL.
PERCENTAGE OF TENANT HHs. (of farm HHs)	62	54	69	57	59	56
LEASED IN LAND AS PERCENTAGE OF OPERATIONAL LAND	32	31	33	20	32	17
PURE TENANT AS PERCENTAGE OF ALL TENANTS	34	36	33	25	23	26
AV.FARMSIZE OF PURE TENANTS	96	49	125	104	71	124
AV.FARMSIZE OF OWNER TENANTS	210	175	229	220	182	246
AV.FARMSIZE OF ALL FARM HHs	216	165	254	262	141	339

NOTE: 1) There are seventysix panel HHs of which 47 belongs to the three NON MV villages and 29 belongs to the MV villages. Of the 47 from the non MV villages 12 were non cultivators and out of 29 from the MV vllages, 3 were non cultivators in 1987. In 1992-93 the number of non cultivators in the same panel were 13 in the non MV villages and 7 in the MV villages.

TABLE: 7.4

RELATIVE IMPORTANCE OF VARIOUS TENANCY ARRANGEMENTS IN THE SAMPLE VILLAGES

Villages	Number of Plots Under					Total No. of Plots (%)
	Type1 (%)	Type2 (%)	Type3 (%)	Type4 (%)	Type5 (%)	
Patardia	87 (72)	1 (1)	33 (27)	0	0	121 (100)
D.Mari	60 (28)	150 (69)	0	8 (3)	0	218 (100)
MV. Villages	147 (43)	151 (45)	33 (10)	8 (2)	0	339 (100)
B.Pur	171 (99)	0	0	0	1 (.60)	172 (100)
M.Mara	186 (96)	0	7 (3)	0	1 (.50)	194 (100)
Sh.Pasha	105 (60)	1 (1)	65 (37)	0	3 (2)	174 (100)
Non MV. Villages	462 (86)	1 (.02)	72 (13)	0	5 (.08)	540 (100)

NOTE: 1) Data was collected plot wise and on average the plot sizes of the two MV villages were 21 and 16 decimals respectively while that for the three non MV villages were 45, 53, 35 decimals respectively. For MV villages and Non MV villages as a whole the average sizes were 18 and 45 decimals respectively.

2) "Type1" to "Type4" stands for the following four types of tenures respectively: Borga, Fixed Rent, Daishudi and Khaikhalashi. The "type5" stands for numerous other types of tenures of negligible importance.

TABLE: 7.5

CLASSWISE DISTRIBUTION OF LEASED IN LAND (MV VILLAGES AND NON MV VILLAGES)

LAND OWNERSHIP STATUS	MV VILLAGES TENANTS				NON MV VILLAGES TENANTS			
	N	%	AMT. of LAND LEASED IN	%	N	%	AMT. of LAND LEASED IN	%
SMALL	100	96	7626	95	173	88	21029	85
MEDIUM	3	3	366	4.56	19	10	3265	13
LARGE	1	1	17	.44	5	2	397	2
ALL	104	100	8009	100	197	100	24691	100

NOTE: 1) Small stands for all those who own less than 2.50 acres, medium owns up to 5 acres and large owns more than 5 acres of land.

TABLE: 7.6

LESSORS' LAND HOLDING STATUS AND THE NUMBER OF PLOTS LEASED OUT BY THEM

LESSORS' LAND HOLDING STATUS	MV VILLAGES		NON MV VILLAGES	
	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
BIG	64	21	271	51
MEDIUM	151	49	177	33
SMALL	92	29.94	78	15.12
INSTITUTIONAL	7	.06	5	.88
TOTAL	309	100	531	100

NOTE: 1) Big stands for landownership above 7.5 acres, medium is in between 2.5 and 7.5 acres and small have less than 2.5 acres of land. Institutional land is mainly "Khas Land".

2) The number of plots in this table is marginally less than that shown in a previous table(table: 7.2), because of the inability of some tenants to report the land holding status of their landlords.

TABLE: 7.7

COMPARISON OF AVERAGE FARMSIZE AND RENTED IN LAND BETWEEN THE TUBEWELL OWNING HH AND AN AVERAGE HH FROM THE SAME VILLAGE

VILLAGE	NO. OF T.WELL OWNERS	T.WELL OWNER HHs			ALL FARM HHs		
		AV. FARM SIZE	AV. LEASED IN LAND	% OF LEASED IN LAND	AV. FARM SIZE	AV. LEASED IN LAND	% OF LEASED IN LAND
PATARDIA	1	247	0	0	63	25	39
D.MARI	4	545	109	20	77	41	53
MV VILLAGES	5	486	87	18	70	32	46
B.PUR	16	669	57	9	354	97	27
M.MARA	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
SH.PASHA	20	254	96	37	135	52	38
NON MV VILLAGES	36	439	79	18	223	70	31

TABLE: 7.8

NUMBER OF LEASED IN PLOTS BY RESIDENTIAL STATUS OF THE LESSOR OF MV AND NON MV VILLAGES

RESIDENTIAL STATUS	MV VILLAGES		NON MV VILLAGES	
	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
SAME VILLAGE	96	30	307	57
NEIGHBOURING VILLAGE	159	49	106	20
OTHER DISTRICT OR TOWN	69	21	122	23
TOTAL	324	100	535	100

NOTE: 1) The number of plots in this table is marginally less than that shown in a previous table(table: 7.2), because information regarding the residential status of the landlords were missing for 15 plots in the MV villages and 5 plots in the non MV villages.

TABLE: 7.9

VILLAGE WISE INCIDENCE OF IRRIGATION FOR THE LEASED IN PLOTS

VILLAGE	NUMBER OF LEASED IN PLOTS	NUMBER OF IRRIGATED LEASED IN PLOTS	PERCENTAGE OF IRRIGATED LEASED IN PLOTS
PATARDIA	121	115	95
D.MARI	170	168	99
MV VILLAGES	291	283	97
B.PUR	172	94	55
M.MARA	194	1	.50
SH.PASHA	174	92	53
NON MV VILLAGES	540	187	35

TABLE: 7.10

ESTIMATES OF THE RENTED IN LAND FUNCTION (LOGIT REGRESSION MODEL, 1992-93)

VARIABLES	PROPENSITY TO RENT IN	
	HHs WITH NON ZERO SELF CULTIVATED LAND (N=414)	FOR ALL HOUSEHOLDS (N=850)
CONSTANT	(-) .046 (.19)	(-) 1.907 (8.59)***
RATIO	(-) 1.13 (1.47)	N.A.
TWORKER	N.A.	.247 (4.66)***
EDN	(-) .014 (.51)	.009 (.42)
SCLVT	(-) .003 (3.76)***	(-) .004 (5.69)***
LSTVLN	.002 (2.76)***	N.A.
TOTLSTV	N.A.	.0001 (7.50)***
EQUIP1	.126 (.61)	.102 (.47)
SALINE	.987 (3.53)***	.562 (2.38)**
FLOOD	(-) .058 (.19)	(-) .313 (1.52)
DRAUGHT	1.124 (3.02)***	.723 (2.92)***
R	.25	.37
2 LOG L(Constant Only)	(-) 573.93	(-) 1104.93
2 LOG L (Full Model)	(-) 522.61	(-) 938.17
MLR (Chi Sq.Probability)	51.32 (.0001)***	166.76 (.0001)***

NB: 1) Figures in parentheses below parameter estimates are T-values.
2) * indicates significant at 10 percent level of significance,
** indicates significant at 5 percent level of significance and
*** indicates significant at 1 percent level.

TABLE: 7.10A

CONTINGENCY TABLE FOR THE ESTIMATED LOGIT FUNCTION (ALL HOUSEHOLDS)

CASE TYPE	NO. OF CASES	NO. OF CASES PREDICTED CORRECTLY	RATE OF CORRECT PREDICTION (%)
NOT RENTING IN	549	489	89
RENTING IN	301	132	44
TOTAL	850	621	73

TABLE: 7.10B

CONTINGENCY TABLE FOR THE ESTIMATED LOGIT FUNCTION (HOUSEHOLDS WITH NON ZERO SELF CULTIVATED LAND)

CASE TYPE	NO. OF CASES	NO. OF CASES PREDICTED CORRECTLY	RATE OF CORRECT PREDICTION (%)
NOT RENTING IN	207	154	74
RENTING IN	207	122	59
TOTAL	414	276	67

TABLE: 7.11

VILLAGE WISE INCIDENCE OF LAND SELLING AND BUYING

VILLAGE	AMT.OF LAND SOLD	% OF CULTIVATED LAND	AMT. OF LAND BOUGHT	% OF CULTIVATED LAND	NET ACCUMMULATION AS A SHARE OF CULTIVATED LAND
P.DIA	368	6	453	7	+1
D.MARI	333	5	491	7	+2
MV VILS	701	5.40	944	7	+1.60
B.PUR	123	.004	447	2	+1.99
M.MARA	520	3	661	4	+1
S.PASHA	260	2	121	.007	-1.99
NON MV VILS	903	1.45	1229	2	+.55

TABLE: 7.12

VILLAGE WISE INCIDENCE OF LAND MORTGAGING

VILLAGE	AMT.OF LAND M-IN	% OF CULTIVATED LAND	AMT. OF LAND M-OUT	% OF CULTIVATED LAND	NET ACCUMMULATION AS A SHARE OF CULTIVATED LAND
P.DIA	183	3	98	2	+1
D.MARI	813	12	512	8	+4
MV VILS	996	8	610	5	+3
B.PUR	115	.004	.106	.003	+.001
M.MARA	90	.004	138	.007	-.003
S.PASHA	104	.006	475	3	-2.99
NON MV VILS	309	.005	719	1.16	-1.15

TABLE: 7.14

LAND HOLDING STATUS OF THE SELLERS OF LAND: MV AND NON MV VILLAGES

VILLAGES	SELLERS FROM THE SAMPLE VILLAGES				BUYERS FROM ANY PLACE			
	N	SMALL (%)	MEDIUM (%)	BIG (%)	N	SMALL (%)	MEDIUM (%)	BIG (%)
P.DIA	16	14 (87)	2 (13)	0	16	10 (62)	6 (38)	0
D.MARI	11	10 (91)	0	1 (9)	11	6 (55)	2 (18)	3 (27)
MV VILLS	27	24 (89)	2 (7)	1 (4)	27	16 (59)	8 (70)	3 (11)
B.PUR	7	6 (86)	0	1 (14)	7	6 (86)	0	1 (14)
M.MARA	7	3 (43)	3 (43)	1 (14)	7	4 (57)	0	3 (43)
S.PASHA	1	0	0	1 (100)	1	1 (100)	0	0
NON MV VILLS	15	9 (60)	3 (20)	3 (20)	15	11 (73)	0	4 (27)
ALL	42	33 (79)	5 (12)	4 (9)	42	27 (64)	8 (19)	7 (17)

NOTE: 1) Small are those who own less than 1.5 acres, medium owns 2.5 to 5 acres and the large owns more than 5 acres of land.

2) Here the buyers are those to whom the land was sold by the respective respondents of the sample villages. The landownership of these buyers are taken from the seller respondents, hence may be only approximately correct.

TABLE: 7.13

LAND HOLDING STATUS OF THE BUYERS OF LAND: MV AND NON MV VILLAGES

VILLAGES	BUYERS FROM THE SAMPLE VILLAGES				SELLERS FROM ANY PLACE			
	N	SMALL (%)	MEDIUM (%)	BIG (%)	N	SMALL (%)	MEDIUM (%)	BIG (%)
P.DIA	16	15 (94)	1 (6)	0	16	12 (75)	4 (25)	0
D.MARI	18	14 (78)	2 (11)	2 (11)	18	15 (83)	1 (6)	2 (11)
MV VILLS	34	29 (85)	3 (9)	2 (6)	34	27 (79)	5 (15)	2 (6)
B.PUR	14	6 (43)	3 (21)	5 (36)	14	8 (57)	1 (7)	5 (36)
M.MARA	12	7 (58)	3 (25)	2 (17)	12	11 (92)	0	1 (8)
S.PASHA	7	6 (86)	1 (14)	0	7	5 (71)	2 (29)	0
NON MV VILLS	33	19 (58)	7 (21)	7 (21)	33	24 (73)	3 (9)	6 (18)
ALL	67	48 (72)	10 (15)	9 (13)	67	51 (76)	8 (12)	8 (12)

NOTE: 1) Small are those who own less than 1.5 acres, medium owns 2.5 to 5 acres and the large owns more than 5 acres of land.

2) Here the sellers are those from whom the land was bought by the respective respondents of the sample villages. The landownership of these sellers are taken from the buyer respondents, hence may be only approximately correct.

TABLE: 7.14

LAND HOLDING STATUS OF THE SELLERS OF LAND: MV AND NON MV VILLAGES

VILLAGES	SELLERS FROM THE SAMPLE VILLAGES				BUYERS FROM ANY PLACE			
	N	SMALL (%)	MEDIUM (%)	BIG (%)	N	SMALL (%)	MEDIUM (%)	BIG (%)
P.DIA	16	14 (87)	2 (13)	0	16	10 (62)	6 (38)	0
D.MARI	11	10 (91)	0	1 (9)	11	6 (55)	2 (18)	3 (27)
MV VILLS	27	24 (89)	2 (7)	1 (4)	27	16 (59)	8 (70)	3 (11)
B.PUR	7	6 (86)	0	1 (14)	7	6 (86)	0	1 (14)
M.MARA	7	3 (43)	3 (43)	1 (14)	7	4 (57)	0	3 (43)
S.PASHA	1	0	0	1 (100)	1	1 (100)	0	0
NON MV VILLS	15	9 (60)	3 (20)	3 (20)	15	11 (73)	0	4 (27)
ALL	42	33 (79)	5 (12)	4 (9)	42	27 (64)	8 (19)	7 (17)

NOTE: 1) Small are those who own less than 1.5 acres, medium owns 2.5 to 5 acres and the large owns more than 5 acres of land.

2) Here the buyers are those to whom the land was sold by the respective respondents of the sample villages. The landownership of these buyers are taken from the seller respondents, hence may be only approximately correct.

CHAPTER VIII

A BRIEF EXCURSION TO CREDIT MARKET AND RICE MARKET

8.1 Credit Market

We have argued earlier

~~In the methodology section we ar~~gued that all the factor markets in the rural areas mutually interact with each other in response to the penetration of MV into the rural areas. So far, we have discussed about the two important factor market's responses to MV. They are labour and land market. But ~~the~~ labour and land, although ~~a~~ necessary ~~condition for production~~, are not sufficient. for production To fulfil the sufficient condition for MV crop production additional capital is required. They can be either in kind (e.g. fertilizer, water and water supplying machines, insecticides, MV seeds, etc.) or in cash. ~~Leaving aside the lengthy controversy on capital theory, we can, for empirical purpose use credit and credit market as a suitable representation of cash form of capital and capital market. By doing so we are assuming that in Bangladesh rural areas, the possessor of cash capital can easily procure the capital in kind, which is obviously only an approximation of the reality. But have to admit this because our data does not permit us to look into the details of physical input markets, which perhaps would have been more realistic.~~ rural

capital

In the context of ~~credit~~ our main interest is to see whether the credit is really available to all types of landowners including the poor and the small MV adopter HHs at a reasonable cost. Many early critiques of Green Revolution argued that credit was heavily biased towards rural rich while poor and small farmers lacked adequate cash resources to be engaged in MV crop production. Since it is already proved that in the long run rural poor and small farmers have been able to adopt MV in a large scale manner. so it is obvious that in someway or another they were able to collect the minimum requisite cash capital for MV. So the next question is "Where did they get their capital?". In reply to this question the Pro-Green Revolution authors or the later period economists suggest that credit has already penetrated the rural areas widely; small farmers do need credit but the size is not large. Moreover after two or three cycles of MV production the small borrower becomes self sufficient. MV inputs are in general divisible into small amounts and can be procured in small doses for small lands. (Osmani, 1993)

Two issues will be examined empirically with the available data in the context of this controversy.

1) The availability issue i.e. whether credit is available in the rural areas and if yes then whether it is equally available to the small landowners.

2) Whether the adopter farmers have access to the credit and whether they are getting a relatively larger share of credit than the non adopters.

8.2 Available Sources Of Credit

Table 8.1 presents the distribution of the credit recipients in the sample villages according to the source of their credit. It was found that credit was available through Three sources in all the five villages e.g. "Formal Sources", "Non-Formal Sources" and "Personal Sources". In total 230 HHs out of 850 HHs from all the five villages obtained loan from these sources. Thus credit was advanced to more than a quarter of the villagers (27 percent) in the studied regions. Taking all the five villages together we find most of the loanees (about 84 percent) obtained their loans from the formal sources. The formal sources of loan operating in the sample villages are: Bangladesh Krishi Bank. Local Branches of National Commercial Banks, Grameen Bank, NGOs and Cooperatives. Besides these formal institutions the credit was also available from the so called "Non Formal" sources. Only 16 percent of the loanees from all five villages obtained their credit from there. These "Non Formal" sources embrace Rural Money Lenders. Rural Merchants and the Landlords who have simultaneously transacted out land to the borrower. The last remaining source of credit is Personal meaning Friends and Relatives. But it is also insignificant since only 4 percent of the borrowers from all five villages reported to have obtained their loans from this source.

Thus it is at least true that the credit market in the country side is now a days no longer dominated by the monopolist money lenders. From Table 8.1 we also find that in the Non MV village of B.Pur the proportion of loanees among the villagers was the highest, 37 percent, and at the same time the proportion of loanees taking loan from the formal sources was relatively the lowest (58 percent). However in the two other Non MV villages the source-incidence of formal loan was as high as 86 percent and 84 percent which are even higher than that of the topmost MV village D.Mari. Thus it is obvious that large majority of the borrowers had the opportunity to get access to the credit from the formal sources even in these non MV villages. Thus whatever factors had constrained these two latter villages against large scale adoption of MV, those factors were neither the non availability of former credit nor the predominance or monopoly power of the so called Moneylenders.

8.3 Large Farmer Bias of Credit: Myth or Reality ?

Once credit becomes available the immediate relevant question is : "~~has~~ Has it any bias towards the rich"?

Table 8.2 shows the distribution of the 230 loanees from the studied villages by their land holding status and sources of loans. From the Table we find that taking all villages together, 29 percent of the small farm HHs (By small we mean HHs with less than 2.50 acres of owned land) were able to get loans and they constituted the overwhelming majority group in the total population of loanees (195 out of 230 i.e. 85 percent!). And most of these 195 small borrowers got their loans from the formal sources. Data shows that only 10 percent of the small farmer borrowers received loans from the Non Formal sources.

As we move up through the land holding ladder we find successively lesser incidence of borrowing which may be a reflection of lesser need of credit from outside at higher levels of land ownership. Among the medium land owners only 20 percent had obtained credit and they constituted only 13 percent of the population of borrowers from the studied villages. Among the big landholders only 13 percent obtained credit and they constituted only 1.73 percent of the total borrowers.

From the Table 8.2 it is also observed that not the small but the medium and the big land holders take their loans relatively more from the Non Formal sources. We find that 16 percent of the medium borrowers and 75 percent of the Big borrowers were taking their loans from the Non Formal sources, while only 10 percent of the small borrowers actually did so. Perhaps the credit worthiness of the big and medium to the Non Formal money lenders is relatively higher and they may often need large amount of money at a short notice for short term use, which is not possible to get from the formal sources. Moreover formal sources like Grameen Bank and BRDB (Government Cooperative Ventures) and numerous NGOs in the rural areas have recently increased their loans to target groups which necessarily exclude large farmers.

8.4 Adopter's Access to Credit

Table 8.3A and 8.3B presents the distribution of respectively formal and non formal loan transactions among the adopters and non adopters of all the five villages divided according to their land holding status. Although the total number of borrowers in the five villages were 230 yet the number of loans taken by them were 364, implying that some of the borrowers took loans twice or more. So if we consider each loan transaction as one separate case then it is found that out of all the 364 loan transactions 293 (80 percent) were supplied from the Formal Sources (see Table 8.3A). And only 71 (20 percent) loans were supplied from the Non Formal sources. Thus in terms of loan transaction number the formal source is the dominant source in our sample villages.

As expected on average the loansize of the adopters of MV were higher than that of the non adopters. For example it was on average 2626 tk. for the non adopter borrowers and 2905 tk. for the adopter borrowers in the case of Formal Loans [See Table 8.3a. last column]. But in the case of seventy one Non Formal loans the average loan size for the non adopters was 3088 tk.(6% higher) and that of the adopters was 4483 tk. (54% higher). [see Table 8.3b]. Thus although non formal source was not a major source in terms of transaction number, but in general their loan size was bigger!

But the most interesting finding from these two Tables are revealed in the figures presented in the first, second, third and the fourth column. From all the figures presented in the first four columns of ~~the~~ Table 8.3A we find that although the adopters constituted 42 percent of all the HHs (850) in the studied villages they actually were able to grab 52 percent of the total number of loans coming to these villages from the Formal sources. While the 63 percent non adopters in these five villages could get hold of only 48 percent of loans coming to these villages from formal sources. This disproportionate hold of the Adopter HHs on credits coming from formal sources becomes stronger at lower levels of landownership. For example among the big farmers numerically a naturally larger proportion i.e. 64 percent were adopters but they actually were able to grab a lower proportion, only 50 percent of the Formal loan transactions offered to their group. Among the medium HHs, 56 percent adopters grabbed 83 percent of the Formal loan transactions offered for them. And among the Small, 37 percent adopters were able to grab 47 percent of the formal loans offered to them. Thus regarding access to formal loan transactions it is proved that adopter HHs especially from the small and medium land holding classes had a distinct advantage over their counterparts i.e. the non-adopters within the same group. On the other hand in case of large farmers the non adopters although proportionately constitute a smaller section yet can get proportionately a larger access to the formal loan transactions.

The same phenomenon was examined with respect to the non Formal loans and exactly an opposite picture was revealed! From the Table 8.3B it can be observed that although the non adopters were 58 percent of the total population yet they grabbed 75 percent of the total number of Non Formal loan transactions. In the case of small landowners , the 63 percent non-adopters received 81 percent of the non formal loans offered to them. For the medium land owners the 44 percent non adopters grabbed 63 percent of the loan transactions going to them and in the case of big, 36 percent non adopters grabbed 60 percent of the non formal loan transactions offered to them. This shows that Non Formal Loans are in general captured disproportionately by the non adopters and that holds good irrespective of the landholding status of the non-adopter. But the above observations speaks nothing about the respective size of the loans in both formal and non formal credit markets! But the above mentioned Tables do have those size figures. From there it is found that the average loansize for adopter households are in general higher than that of the non adopter households. And that is true for all classes of borrowers in the case of loans coming particularly from formal sources. Thus it is clear that not only relatively larger number of loans are sanctioned to the adopters but also relatively greater portion of the amount of loan is shared by the adopters of MV as compared to the non adopter households, at least in the case of loans coming from the formal sources. The argument of "rich/ non-adopter biasness of credit" becomes further weakened by looking into the distribution of the volume of credit coming from the formal sources among the different classes of farmers. From Table 8.3a it can be easily calculated that about 86 percent of the amount of disbursed loans from the formal sources actually went to the small landowners who constituted about 77 percent of all HHs in our sample. On the other hand the rich constituted 4.94 percent of all households in our sample and they received only 1.47 percent of total disbursed credit from the formal sources. Thus 18 percent middle farmers had actually received the remaining 12.53 percent of the disbursed formal credit. And if one takes up the borrowers together then also one will find that small farmers were over represented in the borrowers sample and constituted about 85 percent of the borrowers but still they were able to obtain 86 percent of the credit disbursed from the institutional sources. Thus it is more than clear that the access to formal credit both in terms of number of loans and size of credit were at least not rich biased in the formal credit market. There is therefore neither any special barrier against small farmers nor any special advantage for the rich farmers regarding access to the formal credit market in the countryside of today.

Let us now have a brief look at the non formal credit market. In the case of non formal loans the average loan size of the medium and large adopter households were larger than the non adopter households. However they grabbed proportionately smaller number of loans from the non formal sources (see Table 8.3b). In case of small farmers, the adopters of MV grabbed relatively both smaller number and smaller sized credits from the non formal sources as compared to the non adopters in the same group.. Thus apparently it seems that there may be some particular rich and/or non-adopter bias in the non formal credit market.

Actual calculations from the Table 8.3b shows that out of the total number of 71 borrowers from non formal sources the number of rich households were only 5 (7 percent) and they had borrowed only 19500 taka which constitutes only 7.98 percent of the total non formal credit. On the other hand the number of small borrowers from the non formal sources was 47 i.e. about 66 percent and they borrowed taka 95220 which is only 39 percent of the total disbursed credit from the non formal sources. Therefore here it is true that in terms of number of borrowers, the rich over represents themselves in our borrowers' sample and they are also obtaining proportionately a slightly larger share of the kake. On the other hand the small farms are under represented (66 percent in the sample as against 77 percent in the population!) and also get a significantly smaller share of the credit from the non formal sources. Together these findings obviously imply a relatively larger access of the rich farmers than the small farmers in the non formal credit markets. Therefore the non formal credit market is biased against small farmers and is partly in favour of the rich. But one should remember that the non formal credit market serves only 12 percent of the loanees in all these five villages. Thus it's rich biasness can no longer put an unsurmountable barrier against the poor man's access to credit.

In general we can conclude that lack of credit availability for the poor and the exploitation of the money lenders are no more a serious and universal obstacle against adoption. Now a days the poor may lack capital but they do not necessarily lack credits.

8.5 Rice Market

The rice market enters into the debate on the impact of MV technology on the factor markets in many ways. Among them two were chosen as most important and most relevant. The first relates to the argument that MV induced fall in rice price does not have much effect upon real agricultural wage since the rice price and nominal agricultural wage always moves in the same direction. But this issue has already been examined in the preceding chapter 6 [Modern Variety And Labour Market] under the heading of "Rice Price and Nominal Wage". We need not repeat that analysis here. The second unexamined issue is that since the large farmers are likely to sell a relatively larger portion of their output so any fall in the price of rice will put a larger burden upon them . But the small farmer's suffering would be not only relatively less due to relatively smaller volume of sales but also relatively more gain will accrue upon them through cheapening of their staple consumption (i.e. rice) which occupies a larger proportion of their total expenditure. The second part of the above argument is well established. All National level HH expenditure surveys in Bangladesh prove that the poorer HHs spend relatively more on food items, the principal component of which is rice. [B.S.Y.B. various issues] But the first part of the above argument has been little examined in Bangladesh and needs empirical verification.

Tables 8.4A to 8.4E present separately for each village the proportion of marketed rice output of both MV and LV by land based classes. In the MV villages (Patardia and D.Mari)the big landowners sell from 40 to 59 percent of their MV paddy output in the market. In both the villages the small and the medium owners also sell a part of their MV paddy production in the market but their proportion ranges from 28 to 42 percent only (see Tables 8.4A and 8.4B). This general pattern does not change in the non MV villages. Moreover there it holds good for both local and modern variety paddy output. Thus, in Bangladesh the rich actually have a relatively higher marketed surplus of both MV and LV paddy and in the long run is going to bear more the burden of price fall of rice unless they can cover it up by increased efficiency in production.

On the other hand as Sen (Sen, A.K. 1980) has shown in his analysis of famine that the crucial factor behind South Asian famines was not the lack of availability of food but failure in entitlement over food of the weaker sections of the society. The most crucial ratio which determines the entitlement of food for the weakest class i.e. the landless agricultural labour, is the ratio between nominal wage and rice price. The MV technology seems to count doubly for these poor landless labourers because it actually helps to increase this ratio by simultaneously increasing money wage and reducing rice price!

TABLE: 8.1

DISTRIBUTION OF LOANEES ACCORDING TO THEIR SOURCES OF LOANS
(Current loans for all villages)

VILLAGES	NUMBER OF LOANEES TAKING LOANS FROM				LOANEES AS A PERCENTAGE OF THE VILLAGERS (%)
	FORMAL SOURCES (%)	NON FORMAL SOURCES (%)	PERSONAL SOURCES (%)	ALL SOURCES (%)	
P.DIA	34 (87)	4 (10)	1 (3)	39	30
D.MARI	27 (77)	7 (20)	1 (3)	35	19
MV VILLS	61 (82)	11 (15)	2 (3)	74	24
B.PUR	26 (58)	14 (31)	5 (11)	45	37
M.MARA	18 (86)	3 (14)	0	21	14
SH.PASHA	89 (99)	0	1 (1)	90	33
NON MV VILLS	133 (85)	17 (11)	6 (4)	156	29
ALL VILLS	194 (84)	28 (12)	8 (4)	230	27

TABLE: 8.2

DISTRIBUTION OF THE LOANEES BY THEIR LANDHOLDING STATUS AND SOURCES OF LOANS

LAND HOLDING STATUS[3]	NUMBER OF LOANEES (%)[1]	NUMBER OF LOANEES FROM		
		FORMAL SOURCES (%)[2]	NON FORMAL SOURCES (%)	PERSONAL (%)
SMALL	195 (29)	170 (87)	20 (10)	5 (3)
MEDIUM	31 (20)	23 (74)	5 (16)	3 (10)
BIG	4 (13)	1 (25)	3 (75)	0
ALL	230 (100)	194 (84)	28 (12)	8 (4)

NOTE: 1) This percentage is with respect to the total number of HHs in that lanholding group in all the sample villages.

2) This percentage and all others in the subsequent columns are with respect to the number of loanees presented in the second column.

3) Small owns up to 2.50 acres of land, medium owns from 2.51 to 5 acres of land and big owns more than 5 acres.

TABLE: 8.3A

DISTRIBUTION OF FORMAL LOANS AMONG THE ADOPTERS AND NON ADOPTERS OF MV FROM THE DIFFERENT CLASSES (ALL VILLAGES)

LAND HOLDING STATUS	NUMBER OF HHs		NO. OF LOANS RECEIVED BY		AVERAGE LOAN SIZE (TK.)	
	ADOPTER (%)	NON-ADOPTER (%)	ADOPTER (%)	NON-ADOPTER (%)	ADOPTER	NON-ADOPTER
SMALL	242 (37)	416 (63)	117 (47)	134 (53)	2941	2638
MEDIUM	84 (56)	66 (44)	33 (83)	7 (17)	2591	2329
BIG	27 (64)	15 (36)	1 (50)	1 (50)	9000	3000
ALL	353 (42)	497 (58)	151 (52)	142 (48)	2905	2626

NOTE: 1) Small owns up to 2.50 acres of land, medium owns from 2.51 to 5 acres of land and big owns more than 5 acres.

2) An adopter is a HH who has non zero amount of cultivated MV rice land in any season during the loan period i.e. 1992-93.

TABLE: 8.3B

DISTRIBUTION OF NON-FORMAL LOANS AMONG THE ADOPTERS AND NON ADOPTERS OF MV FROM THE DIFFERENT CLASSES (ALL VILLAGES)

LAND HOLDING STATUS	NUMBER OF HHs		NO. OF LOANS RECEIVED BY		AVERAGE LOAN SIZE (TK.)	
	ADOPTER (%)	NON-ADOPTER (%)	ADOPTER (%)	NON-ADOPTER (%)	ADOPTER	NON-ADOPTER
SMALL	242 (37)	416 (63)	9 (19)	38 (81)	1878	2061
MEDIUM	84 (56)	66 (44)	7 (37)	12 (63)	7829	1962
BIG	27 (64)	15 (36)	2 (40)	3 (60)	4500	3500
ALL	353 (42)	497 (58)	18 (25)	53 (75)	4483	3088

NOTE: 1) Small owns up to 2.50 acres of land, medium owns from 2.51 to 5 acres of land and big owns more than 5 acres.

2) An adopter is a HH who has non zero amount of cultivated MV rice land in any season during the loan period i.e. 1992-93.

TABLE: 8.4A

MARKETED OUTPUT OF MV. AND LV. PADDY BY CLASSES (VILLAGE PATARDIA)

CLASSES	TOTAL OUTPUT (mds)		TOTAL MARKETED OUTPUT (mds)		% OF MARKETED OUTPUT	
	MV	LV	MV	LV	MV	LV
SMALL	5340	56	1631	10	30	18
MEDIUM	472	0	130	0	28	N.A.
BIG	186	0	75	0	40	N.A.
ALL	5998	56	1836	10	31	18

NOTE: 1) Small stands for all those HHs who own less than 2.5 acres. Medium HHs own less than 5 acres and the big owns more than 5 acres.

TABLE : 8.4B

MARKETED OUTPUT OF MV. AND LV. PADDY BY CLASSES (VILLAGE DARIKAMARI)

CLASSES	TOTAL OUTPUT (mds)		TOTAL MARKETED OUTPUT (mds)		% OF MARKETED OUTPUT	
	MV	LV	MV	LV	MV	LV
SMALL	5630	125	2338	18	40	14
MEDIUM	1448	0	613	0	42	N.A.
BIG	1793	0	1050	0	59	N.A.
ALL	8871	125	4001	18	45	14

NOTE: 1) Small stands for all those HHs who own less than 2.5 acres. Medium HHs own less than 5 acres and the big owns more than 5 acres.

TABLE: 8.4C

MARKETED OUTPUT OF MV. AND LV. PADDY BY CLASSES (VILLAGE B.PUR)

CLASSES	TOTAL OUTPUT (mds)		TOTAL MARKETED OUTPUT (mds)		% OF MARKETED OUTPUT	
	MV	LV	MV	LV	MV	LV
SMALL	1009	1038	149	168	15	16
MEDIUM	1334	867	523	260	39	30
BIG	4323	2761	2283	1076	53	39
ALL	6666	4666	2955	1504	44	32

NOTE: 1) Small stands for all those HHs who own less than 2.5 acres. Medium HHs own less than 5 acres and the big owns more than 5 acres.

TABLE: 8.4D

MARKETED OUTPUT OF MV. AND LV. PADDY BY CLASSES (VILLAGE M.MARA)

CLASSES	TOTAL OUTPUT (mds)		TOTAL MARKETED OUTPUT (mds)		% OF MARKETED OUTPUT	
	MV	LV	MV	LV	MV	LV
SMALL	69	3511	15	827	22	24
MEDIUM	0	1422	0	416	N.A.	29
BIG	0	1693	0	886	N.A.	52
ALL	69	6626	15	2129	22	32

NOTE: 1) Small stands for all those HHs who own less than 2.5 acres. Medium HHs own less than 5 acres and the big owns more than 5 acres.

TABLE: 8.4E

MARKETED OUTPUT OF MV. AND LV. PADDY BY CLASSES (VILLAGE SHANKARPASHA)

CLASSES	TOTAL OUTPUT (mds)		TOTAL MARKETED OUTPUT (mds)		% OF MARKETED OUTPUT	
	MV	LV	MV	LV	MV	LV
SMALL	2357	334	629	51	27	15
MEDIUM	1155	212	510	80	44	38
BIG	832	32	380	10	46	31
ALL	4344	578	1519	141	35	24

NOTE: 1) Small stands for all those HHs who own less than 2.5 acres. Medium HHs own less than 5 acres and the big owns more than 5 acres.

CHAPTER: IX

FINDINGS AND CONCLUSIONS

9.1 Findings

[A] Before presenting the findings from our survey data we presented the findings from the currently available empirical studies on G.R in South Asia in chapter two of this thesis. The literature on Green Revolution is voluminous. We chose sixteen from amongst them to determine the common empirical findings on the selected issues and hypotheses. All these studies were focused on the Subcontinent i. e. India, Pakistan and Bangladesh. All these countries have undergone the process of Green Revolution during in and around 1960's and by now that process has reached a crucial juncture everywhere. Further progress has become more constrained. and more difficult. So the time has been ripe for a comprehensive evaluation of past experiences in Green Revolution in these countries.

There is observed a wide divergence in the opinions or/and findings on the same aspect of the same country from author to author. This is so because either the time or place of the different studies were not exactly same or sometimes the interpretation of the same data of the same country was done differently by different authors. ~~Let me put~~ The following briefly summarizes some of these conflicting findings thos~~e conflicting findings in bri~~ef:

1) In Table:1.1 we presented the findings on the " Inter-Regional Adoption Disparity" of eleven different authors. Of them five were selected from India and three each from Pakistan and Bangladesh. From the findings of these studies it is clear that everybody agrees that there has been a significant regional adoption bias in the process

of G.R. in all these three countries. But the authors do not agree among themselves regarding the true explanation of this common phenomenon. It is difficult to validate any specific hypothesis from these conflicting findings. However, most of the later period studies revealed that the adoption disparity was decreasing over time. Moreover in some cases regional agricultural productivity and income gap between M.V. and non M.V. areas were also narrowing down. Unequal regional water endowment seems to be the only commonly agreed ground which can cause significant regional disparity in the adoption of MV. But whether that can persist for a long time or the final significance of that in terms of regional income disparity remains controversial.

2) Table 1.2 refers to the empirical evidences on Intra-Regional adoption Disparity. In total twelve studies were examined of which six were from India and three each from both Pakistan and Bangladesh. The general findings from these studies show that on the basis of a traditional definition of adoption (i.e. the percentage of land devoted to MV cultivation), the socalled pro-rich bias of M.V. technology has either become invalid or turning invalid quickly in all these countries. However the definition of "Adoption" varies and the conclusion largely depends on the definition used. Two other definitions used as the proxy indicator of "Adoption" were numerical ratio of adopters and the complex index of participation. The number of studies which have used these definitions are few and they do not reveal any systematic bias in the MV technology.

3) Table 1.3 refers to evidences on Mechanization and Employment effects of G.R. All the studies reviewed, in general point out to the crucial role of the non agricultural sector in determining the nature and consequences of agricultural mechanization. "Induced Mechanization" hypothesis in it's crude form is also rejected by most of the

authors and in case of a labour abundant country like Bangladesh it seems highly improbable. In case of Pakistan politically induced mechanization was observed although it's actual consequences remains controversial.

4) Table 1.4 refers to price effects of M.V. technology. Most of the studies suggest that "price of foodgrain" is a highly sensitive politico-economic variable. It's movement therefore can't be determined alone by the economic and technological forces.

5) Table 1.5 presents the evidences regarding the most controversial issue of the G.R. i. e. the issue of Distributive Impact. From all the conflicting findings the little consensus that emerges is that M.V. can at best have a reducing impact on absolute poverty but that may or may not sustain in the long run, depending upon other accompanying conditions.

From this brief review of the empirical findings on G.R. in South Asia it becomes clear that most of the early studies on G.R. had been very harsh and critical about it's potential negative future consequences. But the more recent studies, as argued earlier , in general show a more pragmatic attitude towards the G.R. The different empirical findings of these new studies today call for a fresh study of G.R. to re-scrutinize the earlier findings.This requires preferably a longitudinal set of data covering the old and the recent years as well.

[B] Let me now present the findings from our both village level survey and the longitudinal panel data:

1) Our village and panel level longitudinal data both together reveal that the dry season adoption intensity gap between the rainfed villages and the irrigated villages has been waning away with time. But the adoption intensity gap during the wet season between the two irrigated villages and the two non-irrigated villages has been increasing over time. However, the across region average rice yield gap in the wet season was decreasing in spite of the increase in the inter-regional adoption intensity. Thus the net effect of the increase in the wet season adoption intensity gap were also partly offset by the partial reduction in the average rice yield gap during the same season. The macro evidences on the trend of coefficient of variation in the inter-district adoption intensity also shows a declining trend over time for at least the dry season.

2) Our data also shows that the socio-economic factors symbolized by the land-ownership and tenurial status have very little influence on the propensity or the intensity of adoption among the different classes of farmers in a village at least in the dry season which is also the main season of adoption in Bangladesh. By and large they are determined by the technical factor of irrigation and the natural environmental factors.

3) But in the wet season there is in general a low level of adoption in Bangladesh and that is mainly due to the high risk arising from the uncertainty of rainfall and flood in that season. And this uncertainty coupled with lower risk bearing capacity of the pure tenants, small landowners and other poor or weaker sections may cause a relatively higher socio-economic disparity in adoption propensity and intensity during the wet season.

4) Analysis of data on **labour market** reveals the following interesting findings:

a) In general MV technology increases the productivity of agricultural labourers and thereby increases the demand for labour directly in the agricultural operations.

b) It also has positive forward and backward linkage effect on employment creation.

c) This increased demand for labour is partly met by casual labour supply by small farmers.

d) A significant part of the increased demand in the more prosperous areas is also met by professional agricultural labour from the locality and also by migrant labour supply.

e) The incidence of contractual labour and piece rate also increases in the more prosperous MV areas for special operations.

f) In general these changes tighten the labour market for the employers and increases the bargaining strength of the labour power sellers.

g) The institutional changes like switching to permanent labour or interlocked labour transaction on the part of the employers in response to the tighter situation in the labour market is not found to be a common practice in Bangladesh.

h) However migrant labour inflow from more backward areas to more developed areas somehow slackens the tightness of the labour market and helps the employers of the prosperous areas to limit the increase of the wage rate. But from another point of view it implies a positive spillover effect of MV technology for the labourers of the non MV areas!

i) In Bangladesh it seems to be generally true that wage increase is likely to lag far behind rice price increase and conversely employers are unlikely to pay lower nominal wage if the rice price falls. In this situation MV technology has an added income benefit for the poor through inducing a fall in the rice price or at least restraining it's increase.

5) Following are the major findings from the analysis of mainly secondary data on **Mechanization:**

a) MV technology has not induced mechanization in Bangladesh.

b) The labour displacing effect of limited mechanization was in general small enough to be offset by the effect of increase in cropping intensity.

c) Mechanization in some places may lead to eviction and further concentration of land in the hands of the few. But this can not be attributed to the MV technology even indirectly since none of the direct causes of the limited mechanization in Bangladesh were directly influenced by MV.[75]

6) Following are the major findings from the analysis of data on **Land Market:**

a) The relative importance of tenancy measured in terms of numerical proportion of the tenant HHs is slightly higher in the non MV villages but in terms of the proportion of operational land under tenancy, MV villages come first. Thus less numerous tenants were cultivating more amount of land in the MV areas as compared to the non MV areas.

b) The relative importance of tenancy in terms of both number and amount of leased land was increasing among the panel HHs from the MV region, while the same was decreasing at a much faster rate among the non MV panel HHs.

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[75] One may argue that MV technology by increasing the income of the large farmers may increase their leisure preference and thus indirectly push them further towards mechanization. Although the second part of the argument is true, but the first is not since large farmers have resorted to mechanization in spite of less MV while the small did not mechanize inspite of high MV.

c) There was a shift from traditional sharecropping to fixed rent arrangements in the MV villages.

d) The Tenurial arrangement were not of semi-feudal character in the MV villages and in one non MV village although it was semi-feudal by nature but it could not prevent technological progress.

e) In general the sample villages show that resource complementarity may be the most important determinant of the leasing decisions. Thus with a relatively surplus self cultivated land the HH refrains from leasing in while the HH with surplus labour and livestock is encouraged to lease in.

f) The socio-economic profiles of sellers of land, buyers of land and mortgaging households (in or out) prove that there was no systematic tendency of transfer of land from poor to rich in the sample villages. The transactions actually took place among the small farmers themselves in the case of MV villages. On the other hand in the non MV villages these transactions were confined among the members of the richer classes from both sellers and buyers sides.

7) Following are the major findings from a very brief analysis of the data on **credit market**.

a) Majority of the borrowers from both MV and non MV villages had the opportunity to get access to the credit from the formal sources even in the non MV villages.

b) The small farmers were not in a relatively disadvantageous position with respect to access to the formal sources of credit. If any relative disadvantage they have, they have it with respect to the informal credit market.

c) In general the average size of the loans for the adopters was higher than that of non adopters.

d) It is more than clear that the access to formal credit both in terms of number of loans and size of credit were at least not rich biased in the formal credit market. If the credit has any bias at all then it was for the adopter HHs irrespective of their land ownership status.

9.2 Conclusions

favorable

The findings from our own survey in general goes in favour of a more liberal view of the impact of MV technology in the rural factor markets. The favourable mechanism of MV induced growth in the rural areas can be summarized ~~depicted~~ as follows: First, ~~of all~~ the previous and the current study disproves the old hypothesis of regional and intra-region class disparity in the adoption and diffusion of this technology. Thus whatever benefit is arising from the application of this technology in the rural areas, it will not be confined among the richer sections alone. The Regional bias will also be decreasing overtime unless there are very obvious natural constraints such as salinity, draught, flood, etc.

Secondly , because of it's intrinsic labour intensive nature MV creates a tighter condition in the labour market and puts an upward pressure on the wage rate in the rural labour market. If mechanization, offsetting population growth and negative policy interventions are not there then the real wage of the agricultural worker ~~wage labour~~ will ~~may~~ increase.

This real wage increase in the rural areas is further reinforced if there is a downward pressure on the rice price ~~market~~ via increase in the supply of rice as a result of the adoption of the MV technology. If there is also a positive linkage effect of agricultural growth on the non farm employment then this above mentioned tendency will be reinforced further through expansion of employment opportunity in the rural areas.

Low rice prices actually ~~will~~ benefit the poorer classes relatively more since they are the major consumers of rice. And with a higher nominal wage and a low or stable or slowly growing rice price, the food entitlement of the poor wage earners is bound to grow. However, it is true that the landless workers do not have land to adopt MV technology. And if they live in the remote non MV villages then the indirect effects may not reach them at all. But now a days the availability of credit and the comparative advantage of those landless households who have surplus stock of labour and animal power enable them to get land from the tenancy market. Tenancy in the MV areas are by no means any longer semi-feudal by nature. And land is generally going to those who can use this scarce resource most effectively. Tenancy arrangements shifting from share cropping to fixed rent system are creating opportunities for better use of this land. And since land goes from big to small in general, so it has a general equalizing effect too. ? ?

Even in villages where large owners of land predominate tenancy does not act as a barrier against technological innovation.

Finally, with an increased staying power of the poor due to rising income from the rural labour market, better access to credits, adoption of a more productive technology and a more optimum use of their resources through the adjusted operation of the land market, the process of polarization in the land-ownership is checked, if not halted. Absolute poverty declines, ~~if not the relative poverty!~~

But this grand elegant story also has it's own pitfalls. It can unfold itself completely only under a favourable initial condition and only in the long run. Any short run view and focus on a particular area where there is unfavourable state policies encouraging premature mechanization, excessively high price of inputs charged by the monopolists and artificial encouragement of large scale capital intensive farming. or lastly wherever there exist an insurmountable natural-technical constraint against the very adoption of the technology, the benefits of the MV technology will not materialize fully.

However, the chief lesson to be learnt from the past mistakes of the early extreme negative evaluations of the G.R. is to avoid all abstract and hasty generalizations in either directions. Today there is also a great risk of swinging from over pessimism of the structuralist to over optimism of the technocrats; from an earlier extreme negative bias to an another extreme positive bias for G.R. If we want to avoid such undesirable swings in our current evaluations, we must form all our conclusions conditionally, contextually and within a holistic framework of analysis.

9.3 Scope and Limitations

Today in Bangladesh it is a well recognised fact that MV driven technology does have a threshold limit. Sometimes that limit against further expansion is set by either the falling yield rate as MV is cultivated in more and more marginal lands or due to the intensive cultivation without balanced fertilisation of the soil. And sometimes the particular variety of seed itself loses some of it's desirable qualities and more and more yield is lost due to pest susceptibility. The limiting constraint may also originate from an excessive rise or/and fluctuation of price of inputs without any commensurate rise in the output price. Sometimes environmental hazards due to excessive withdrawal of

I thought your work shows that these constraints do not ~~are not really existent~~ really exist.

ground water may also put up a constraint against further expansion. Sometimes need for diversified cropping can also put a limit to expansion of MV if it is confined to rice crop only. All these constraints can work together and be further reinforced by a more unequal distribution of land, capital, and the overall power structure in the rural areas. But the important thing that comes out of the analysis of our thesis is not to take a one sided view of any one of the constraints. For example the structuralist radicals usually assert that without breaking the power structure in the rural areas through land reform no growth is possible. By saying so they are actually asserting the priority of tackling the socio-economic constraints over other kinds of constraints. Similarly the technocrats often assert that developing new varieties with new qualities (Such as Hybrid Seeds, or New Varieties that can bear abiotic stress better, etc) and dissemination of that knowledge among the farmers as well as by arranging complementary socio economic irrigation, flood control and supplying other inputs through market will ensure a new period of growth in Bangladesh.

I thought the important thing that comes out from your analysis is that these constraints have lost their strengths or loosing in rural Bangladesh

This debate is a very old debate. Similar debates were launched at the early stage of the first Green Revolution in the late 60's. Our analysis has already pointed out to the futility of such debates. These debates were like the debate of "Chicken first or Egg first". In order to have a sustainable agricultural growth in Bangladesh today we will have to adopt a balanced and holistic strategy of fighting both the technical constraints and the socio-economic constraints simultaneously instead of counterpoising them against each other. The important question is not which is more important but to start with positive action in either front.[76]

[76] As Sen has so wonderfully put it, " For example, Buridan's ass, which died of hunger being unable to decide which of the two haystacks in front of it happened to be superior, could have rationally chosen either of the haystacks, since he had good reason for choosing either rather than starving to death, but it had not enough reason to choose one haystack rather than the other, and choosing either of them would have been only partially justified. Rational public decisions have to come to terms with such partially justified choices." [Sen, A.K. 1987]

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