JAPAN BANK FOR INTERNATIONAL COOPERATION (JBIC)

IMPACT ASSESSMENT OF JAMUNA MULTIPURPOSE BRIDGE PROJECT (JMBP) ON POVERTY REDUCTION
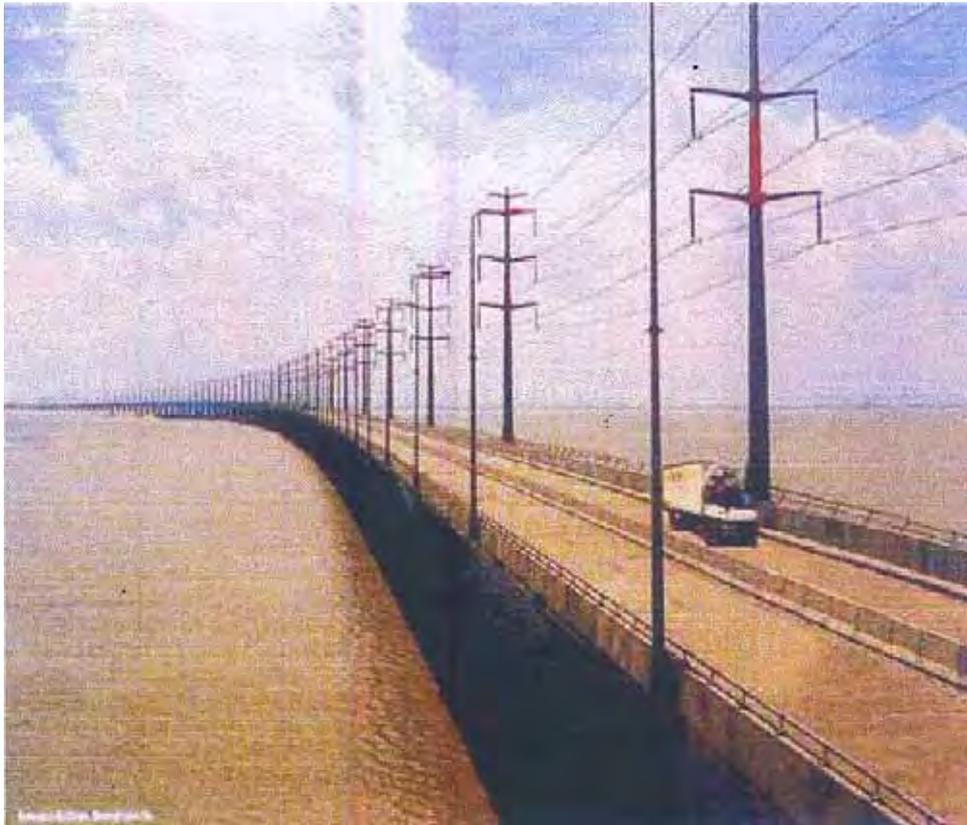
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SECTION ONE
APPROACH TO THE SUDY

1.0 Background to the Bridge

The Jamuna is one of the three largest rivers in Bangladesh. Running from the north to the south through central Bangladesh, seemingly, the river divides the country into two halves: the east and the west. In the east, lie the capital city of Dhaka and the major port city of Chittagong - both providing windows of economic opportunities for economic growth and poverty reduction for the eastern region. The western part – especially the north western - embraces mostly greater Rajshahi Division, widely known as pervasively poverty stricken and less integrated with the eastern markets due to communication problems.[2] Until the Jamuna Multi Purpose Bridge Project (JMBP) started functioning, ferries accounted for more than 60% of all cross-river traffic between the east and the west, and were the only means of crossing the river. Intermittent influence of the weather made things even worse deterring the mobility of goods and services to and from Rajshahi Division. The hindrances pushed up transport costs and spoilage, and thus, hampered smooth trade flows. Reportedly, a one-way trip took more than two hours; the water level and the width of the river changed significantly between the dry and rainy seasons to render it difficult to expand and improve the existing ferry facilities. Trucks carrying commodities were required to wait for an average of 36 hours before boarding. By and large, Jamuna formed a formidable bottleneck in east-west traffic, hindering the transport of agricultural products grown in the granaries in the west to the consumption centers in the east. In addition, regions in the west were deprived of infrastructural development, including gas, electricity and communications that were, hitherto, concentrated mostly in the east.

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[2]Out of 64 districts of Bangladesh, 16 districts belong to Rajshai Division. These are: Bogra, Dinajpur, Gaibandha,Joypurhat,Kurigram,Lalmonirhat,Noagaon,Natore,Nwabgonj,Nilphamari,Pabna,Panchagarh,Raj shahi,Rangpur,Sirajgong and Thakurgaon. The districts together account for 23% of total area, 48% of population and 22% of GDP of Bangladesh. In 1999-00, the per capita GDP of Bangladesh was $363: Dhaka $443, Chittagong: 360 and Rajshai $302 (BBS 2003/04).

To overcome these problems, construction of the bridge- now the 11th largest bridge in the world- began in October 1994 and finished in June of 1998. The Bridge was built with a view to providing the first road and rail link between the relatively less-developed Northwest region of the country and the more developed eastern part including the capital of Dhaka and the port of Chittagong. The total project cost of roughly US$960 million was co-financed as follow: ADB $200 million, Overseas Economic Fund of Japan: $200 million and the World Bank: 200 million and GOB providing the rest. The bulk of the project cost, roughly 87% went to river training and physical construction, while the rest went to access roads and technical assistance.

2.0 Research objectives and hypotheses
2.1 Specific Objectives

A. To present probable causal chain by plausible logic model from the completion of JMB to the incidence of impacts.

- o Identification of bottlenecks and policy implications to be addressed for them

B. To estimate JMB's impacts on social well-being of communities and households by difference-in-difference analysis and regression models.

- o Assessment of the magnitude of JMB's impacts on poverty reduction

2.2 General Objectives

(1) Identifying poverty trends:

(a) To identify the trends in poverty levels over the periods of comparison - 1997/98 (Pre-Jamuna period) and 2003/04 (Post-Jamuna period). To this end, to estimate various facets of poverty measurement e.g. Head-Count Index, Poverty Gap and Squared Poverty gaps.

(2) Identifying probable causality channels:

(a) To identify and describe probable causality channels between the construction of Jamuna Bridge and poverty reduction using a plausible logical model;

(b) To develop several hypotheses from the analysis conducted in (a) and

(c) To refine the hypotheses to minimize statistical biases (such as those arising from endogeneity) and to best use the available household data.

(2) Determining trends and decomposing income sources:

(a) To identify income changes and sources of income at household levels between the periods under comparison, and

(b) To provide a picture of the changes in the distribution of income over the periods.

(2) Describing panel data on socio-economic and demographic variables:

(a) To describe and summarize the data using tables;

(b) To summarize the data, create tables comparing before and after the project, and

(c) To summarize the data, create tables comparing 'with the project' and 'without the project'

(3) Empirical analysis of developed hypotheses:

(a) To use difference-in-difference analysis made possible by the availability of panel data, and

(b) To discuss the results in light of the probable causality channels identified

(4) Policy recommendations

(a) To propose policy recommendations to maximize the poverty impact of similar transport infrastructure projects.

2.3 Causal hierarchy or logical layout

Before submitting the testable hypothesis, it would be pertinent to place the logical framework or causal hierarchy, around which the hypotheses have been formulated. [3] Admittedly, in setting the hypotheses, we assume that JMBP (along with the consequent creation of other infrastructure) is likely to impinge the first round of impacts on the reduction of transaction costs related to distance. [4] Reduction in transaction costs are likely to affect agricultural practices, as northern western regions are reported to be rich granaries, and at the same time, home of a vast majority of the poor who live in rural areas and lean on agriculture for eking out a living The bridge, by allowing agriculture to flourish, would affect poverty through changes in areas under crops, cropping pattern and intensity. A further effect on poverty could come via the rural markets - e.g. tenancy labor and credit - as inputs would face competing claims in the wake of wider markets beyond the boundary of the villages. NGOs, even banks, would find villagers worthy of funding and credit flow would reduce working capital constraints. On the other side of the fence, in tandem with other infrastructures, the Bridge would help develop non-agricultural to pull labor out of agriculture, tighten the labor market and increase wages. This might also affect poverty.

By and large, the linkages would increase trade flows in the face of a reduction in transport costs by a big margin. Side by side, household income would increase as agricultural and non-agricultural activities would expand. The aforementioned linkages would also lead to consumption smoothing, food

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[3] The causal hierarchy or the logical layout has been built around the prime objectives that led to the construction of the bridge – as discussed at the beginning of this section – and a review of literature on the empirics of the effects of infrastructure on poverty reduction (discussed in Section 2)

[4] In fact, reduction in transaction costs is at the 'heart' of the JMBP impacts around which other impacts are likely to hover around.

security and ultimately, to the reduction in income and non-income poverty. The causal hierarchy can be visualized through a schematic presentation (Figure 1.1)

Figure 1.1: Schematic presentation of the channelized impacts of Jamuna Multi-Purpose Bridge Project (JMBP)

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                    ┌─────────────────────────────────────┐
                    │               JMBP                  │
                    └─────────────────────────────────────┘
                                    ↕
                    ┌─────────────────────────────────────┐
                    │      Reduction in transaction costs  │
                    └─────────────────────────────────────┘
                                    ↕
┌──────────────────────┐   ┌──────────────┬──────────┬──────────────┐
│ • Acreage shift      │   │ Agriculture  │ Markets  │Non-agriculture│
│ • Cropping pattern   │──▶│              │          │              │
│ • Cropping intensity │   └──────┬───────┴────┬─────┴──────┬───────┘
└──────────────────────┘          ↕            ↕            ↕
┌──────────────────────┐   ┌───────────────────────────┬──────────┐
│ Public/NGO action,   │   │ Tenancy, Credit, Irrigation,│ Non-farm │
│ technology in support│──▶│                            │          │
│ of:                  │   └──────────┬─────────────────┴────┬─────┘
└──────────────────────┘              ↓                      ↓
                    ┌─────────────────────┐   ┌────────────────────────┐
                    │                     │   │ Marketed output and    │
                    │ Productivity of     │   │ marketing margin, trade│
                    │ inputs              │   │ volume                 │
                    └──────────┬──────────┘   └───────────┬────────────┘
                               ↓                          ↓
                    ┌─────────────────────┐   ┌────────────────────────┐
                    │ Factor income       │   │ Non-factor income      │
                    │ • On-farm           │   ├────────────┬───────────┤
                    │ • Off-farm          │   │Consumption │Food security│
                    │                     │   │smoothing   │           │
                    └──────────┬──────────┘   └─────┬──────┴─────┬─────┘
                               ↓                    ↓            ↓
                    ┌─────────────────────────────────────────────────┐
                    │  Income and non- income poverty reduction        │
                    └─────────────────────────────────────────────────┘
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2.4 Stylized Core Hypotheses

Built upon the causal hierarchy and available research findings on the impacts of infrastructure, we can now postulate the following hypothesized channels of poverty reduction in project areas:

Hypothesis 1: JMBP reduced transaction costs by easing transport constraint ;

Hypotheses 2: Reduced transaction costs increased production and marketing especially of perishable products (output and trade effect);

Hypotheses 3: JMBP affected resource allocation, cropping intensity and shift in crop acreage (Allocation effect);

Hypothesis 4: JMBP led public and NGO actions to affect market, technology and credit (Market and technology effect);

Hypothesis 5: Infrastructure like Jamuna Bridge boosts rural non-farm activities (RNFA) through associated road and other communication networks (Non-agricultural Effect).

Hypothesis 6: As a result of hypotheses 1 to 5 having been worked, Jamuna Bridge helped increased income, smoothen consumption and decreased poverty in project villages (Income and Poverty Effects)

3.0 Methodology and Data Sources

Five villages have been selected from northwestern side of the bridge to call them "Project Villages " as they are likely to be affected by the outcomes of the bridge. To conduct a comparison, we selected another two villages – may be called "Control Villages" from the eastern part of the bridge.[5] The villages are very close in terms of agro-ecological and socio-economic parameters.

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[5] Details on research methodology and data sources are submitted in Appendix-A.

4.0 Organization of the Report

The report contains seven sections. In Section 2, we shall review the literature pertaining to empirical evidences on infrastructure and growth-poverty nexus. Changes in the land use pattern in compared periods can be gleaned from Section 3. In Section 4, we shall discuss the changes in product and factor markets with focus on output and input prices, trade expansion etc. In addition, we shall also shed some light on changes in rural markets. An account of the occupational change and growth of income will be presented in Section 5, while changes pertaining to income and non-income poverty will be placed in Section 6. And finally, the attempted outcome of quantifying the causal relationship with the help of a regression model in Section 7 and some policy recommendations will be undertaken in Section 8.

SECTION TWO

REVIEW OF LITERATURE ON THE ROLE OF INFRASTRUCTURE

*"Infrastructure can deliver major benefits in
economic growth, poverty alleviation, and
environmental sustainability-but only when it
provides services that respond to effective demand
and does so efficiently"*
--**World Development Report 1994**

2.1 Introduction

Jamuna Bridge is an infrastructure like road and electricity, or for that matter, embankments or mechanized irrigation. The purposes for the different infrastructural projects undertaken are also, more or else, the same: greasing growth and pouncing on poverty. Apparently then, the impacts of the bridge are not likely to be different from that of other infrastructures. Noticeably, however, available literature seems to have paid very little attention to the impacts of Bridge *per se* on socio-economic uplift of the people. Whereas, an avalanche of research findings could be evidenced showing, at household or village levels, the relationship between roads, electricity and socio- economic development. Since we have presumed that the same impacts, more or less, would apply in the case of Jamuna Bridge, we thought it pertinent to run through the literature to glean the probable impacts of an infrastructure.

Fan et. al (1998), for example, deliberates on the role of various types of infrastructure on poverty reduction in rural India. They argue that government spending on productivity enhancing investments like agricultural R&D and irrigation, rural infrastructure (including roads and electricity) and rural development, targeted directly on rural poor, all have contributed to the reductions in poverty, and most have also contributed to growth in agricultural productivity.

Ruttan's (1984) "frontier model" pointing to the agricultural prosperity of North and South America and Australia also places at the center the role-played by transportation and communication. The author's "diffusion model"- explaining the process of technological spread in agriculture as a source of dramatic growth in

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agricultural production, assumes a central role by physical and institutional infrastructure (Ruttan 1984).

Mellor (1976) argues that the future of India's economic development critically rests on the infrastructural development in that country. He points out as to how development of infrastructure results in larger multiplier effects arising from agricultural growth and the expenditure of the agricultural income on consumption.

Ahmed and Donovan (1992) present a theoretical exposition of the impact of infrastructure on production. Figure 2.1 demonstrates how traditional theory conceptualizes the effects of infrastructure development on production for a competitive market economy. In a situation of inadequately developed infrastructure, firms or farms are confronted with higher marginal cost (MC1) at every level of production, and, given the market price of their output, produce at Q1. With an improvement in infrastructure, the marginal cost curve shifts down to the right (MC2) resulting in a total cost savings of area *abcd* for the earlier level of output, Q1, and an increase in output from Q1 to Q2.

"This is a simple abstraction with a profound conclusion. An increase in the complexity of this relation, by assuming different demand and cost functions and aggregation problems and other modifications, will not alter the central message of this construct that infrastructural changes can affect the relationships of the production function". It may be noted here that, the construct is simple and does not say anything about the factors behind the changes, what dimensions are involved etc. Moreover, the construct also does not say about social effects, environmental effects etc.

Figure 2.1: Infrastructure provision and the efficiency of production
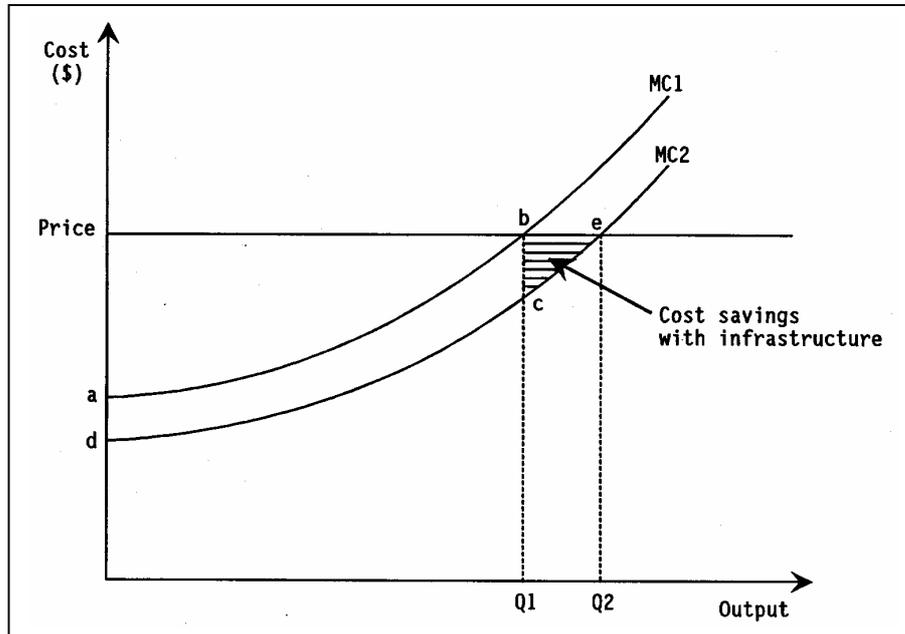
While Ahmed and Donovan attempted to drive to a general conclusion, Ahmed and Hossain (1990) picked up to present a specific example with regard to, say, the availability of transport services. Benefits of investment in transport development are measured by the "user cost savings" arising from the development (Figure 2.2). DD is the demand curve for transport services. The horizontal axis depicts the volume of traffic and the vertical axis represents the unit cost of transportation. Suppose, for the sake of simplicity that, before the project was on, walking or head loading were the means of transport. As can be observed from Figure 2.2, the unit cost is OC1 and the volume of traffic is) Q1. Now a road is developed and the unit cost comes down to OC2 to result in additional traffic (OQ2-OQ1), which is determined by the demand elasticity of DD. Note that this additional traffic is not considered to have arisen as the result of structural change brought about by the road project. The area AC1C2B, which consists of two components, gives the total benefit from development of road:

Cost savings on existing traffic = (OC1 - OC2) OQ1 = AC1C2E, and
Cost savings on generated traffic= ½(OC1- OC2)(OQ2 –OQ1) = AEB.

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This conventional approach, argues Ahmed and Hossain (1990) is applicable in developed countries where resources are fully employed. However, in developing countries- where resources are under or unemployed, road development usually brings about substantial structural change. If this happens, the demand curve will shift to the right to D'D'. Under this new situation, the benefit from additional traffic generated will be ABHF, which is much larger than the benefit AEB from additional benefit under static demand conditions.

Figure 2.2: Model for measuring the effect of transport development
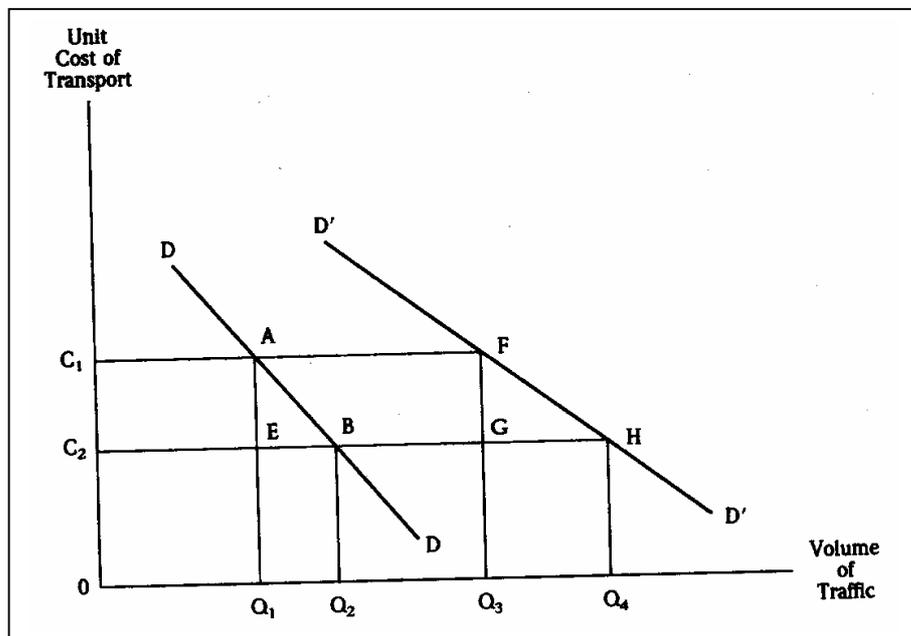
Adapted from Ahmed and Hossain (1990)

Ahmed and Hossain (1990) also discuss at length the economics of infrastructural development. Drawing heavily from their seminal study titled: "Developmental Impact of Rural Infrastructure in Bangladesh", we shall present some of the observations on impacts in the following paragraphs.[6]

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[6] We reckon that the submissions would go to reinforce our hierarchical or logical layout and the postulated hypotheses as discussed before in Section 1.

Cost of marketing

Infrastructures" ability to reduce the cost of marketing agricultural produce is obvious and well known. An IFPRI study shows that, African farmers receive only 30-50 percent of the final prices paid by consumers compared to 70-85 percent received by farmers in Asia (Ahmed and Rustagi 1987/88). About two-thirds of this difference is adduced to the substantial difference in transportation costs between countries in the two continents. This has a direct relation with infrastructural development.

Comparative advantage

Marketing margins have far reaching consequences for the comparative advantage in the arena of international market. Very high marketing margins in agricultural products coupled with production costs could make fob prices larger than competing countries. Likewise, internal transport costs, when added to the cif price, make the domestic price of imported products quite high, reducing the scope for trade. High marketing costs, therefore, tend to constrict trade flows between countries.

Price transmission

The role of infrastructure in the process of transmission of prices is no less important. Lack of infrastructure facilities is considered as the perennial source of price discrimination, market fragmentation and information asymmetry. One study shows that the short-run effect of devaluation of the exchange rate is reflected in prices at farm level to the extent of about 50 percent in the Asian context, but without any systematic effect in African countries (Scandizzo 1984).

Labor market imperfection

In developing countries, labor is the most important factor of production of agricultural goods, and is also an influential source of income for households. Imperfections in rural labor markets, particularly interlocking of labor markets with land, credit and product markets, has traditionally been viewed as constraints to increased income and employment generation in rural areas (Bardhan 1979;

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Bardhan and Rudra 1978). Most of these imperfections could be attributed to the backwardness of infrastructure or a lack of it.

Infrastructure and diffusion

Infrastructure also helps diffusion of technology. Extension workers travel frequently in areas where transport and communications function better. Demonstration plots by extension officers get relocated in areas with better infrastructure. Modern technology package originates in urban areas and a communication system helps them reach farmers at the quickest possible time. The distribution of fertilizer and modern varieties is likely to be more cost effective in developed than under developed villages. Similarly, access to health care services, credit institutions and other developments are likely to follow good infrastructural facilities.

Household consumption

The impact of infrastructure on the pattern of household consumption is likely to be substantial. It is realized through changes in prices and expansion of demand. The price effect is quite obvious and easily recognized, but the demand effect is not. Largely as a result of the price differences between imported and domestically produced goods, average and marginal propensities to consume local products remain high. Many products, particularly services, are not available in infrastructurally under-developed areas; so consumption and services of these products remain to be narrow. However, as soon as infrastructure develops, the latent demand for these services becomes effective demand. The linkage effect of household demand to the second or third rounds of economic activity is quite strong. This multiplier effect, in the context of Malaysian rural area, was equivalent to 75 cents out of a dollar's worth of incremental income that was the indirect effect of an original investment in infrastructure (Bell, Hazell and Slade (1982).

Rural non-farm activities

A body of literature suggests that better infrastructural facilities tend to promote rural-non-arm activities. Business, trade, services and non-agricultural labor market appear to get a boost with the growth of roads, electricity and other items. In fact, as noted earlier, infrastructure hardly has any direct effect on employment and income generation. It affects indirectly by creating conducive environment for the growth of non-farm activities. Thus, roads could be used in the transport of inputs and outputs, for carrying out business and trade related activities, or services. All these are called non-farm activities.

Poverty reduction

And finally, infrastructural facilities operating through the markets and institutions as discussed above are likely to lead to poverty reduction. In a research report released by IFPRI, Fan and et.al. (2002) showed how infrastructural development in rural China helped reduce poverty and regional inequality.

Hayami and Kikuchi (1999/00), while describing the development of a village in the Philippines showed how, with replacement of kerosene lamps by electric bulbs, television became the focus of entertainment in place of transistor radios and refrigerators and hi-fi became symbols of affluence. "Electricity provided longer hours to read and write as well as to the images of urban life via the broadcasting media, which increased villagers' educational aspirations and attainment, and there by prepared them to adapt to urban market activities in future decades".

Louis Berger Group, Inc. (2003) examined the impacts of Jamuna Bridge on the economy of Northwest Bangladesh. Based on a "before and after" simulation exercise, the report submits that the Bridge imparted positive impacts in that area. Especially, marketing margins of commodities decreased, price integration has increased and more so, the share of traded output increased as a result of decreased transportation costs.

Other impacts

The above-mentioned areas of impacts, allegedly, bypassed some of the non-economic impacts of infrastructure. For example, the effects on household savings and investment behavior cannot be hypothesized on the basis of a priori logic. In many countries, infrastructural backwardness is basic cause of ineffective administration of various welfare measures and their distribution to the rural poor.

The process of attitudinal change in the rural population is hastened by the movement of people and ideas which the development of infrastructure indirectly facilitates (Ahmed and Hossain 1990). Besides, the spread of NGOs to supply credit to the poor, as in Bangladesh, has mostly been concentrated in relatively developed areas where infrastructural facilities are in good shape. Information and Communication technology (ICT) in rural areas could only be made available with good access to roads and electricity. In rural Bangladesh, for example, villages with access to paved roads and electricity received the first generations of village pay phones. Besides access to paved roads and electricity also tend to help the rural growth centers and cottage industries.

2.2 Concluding Observations: A Critical Note

Notwithstanding the observed positive or negative impacts arising from infrastructure, many of the studies, discussed above, seem to be flawed on methodological approach adopted to assess the impacts. Generally, the evaluation of the effects of a project (s) is based on a comparison, at the time of evaluation, of variable values for a sample project group and control group. The validity of the results of such comparison depends critically on the assumption that, before the initiation of the project, the two groups were similar in all spheres. However, more often than not, it becomes very difficult to find a control group that meets this requirement. It could be mostly due to the lack of knowledge about pre-project paraphernalia.

The best methodology for evaluation a project- say, for a barrage or a bridge- involves selecting project (target) and control areas/households before implementation of the project, collecting information for both project and control villages/households through benchmark survey at the time of implementation, and assessing changes in those variables during the period between benchmark and evaluation points.

This is clarified with the help of Figure 2.3. The horizontal axis denotes the time, the vertical axis the values of the variable against which the effect of the project is to be measured- e.g. effect of a road or bridge on poverty reduction or of an irrigation scheme on agricultural production. In this figure, the value of production in the project area at the benchmark point was P_O, which is increased to P_n at the time of evaluation of the project, n. It would be incorrect to ascribe the changes (P_O-P_n) entirely to the project, since certain autonomous changes would surely have taken place in the project area during the period T_O-T_n even in the absence of the project. In the evaluation of the project, such autonomous changes need to be disassociated.

Figure 2.3 : Measuring the effects of a project by tracing changes in project and control areas
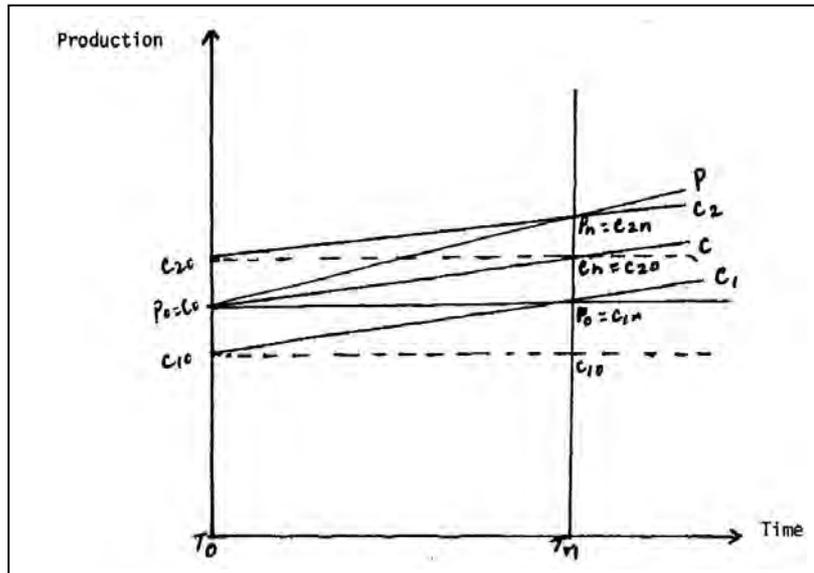
Source: Adapted from BIDS/IFPRI (1985): Development impact of the Food-for-Work Program in Bangladesh, Technical Papers for the World Food Programmes.

The control area is selected for this purpose. The curve C, C_1 and C_2 depicts the autonomous changes in the control area in three different situations during this period. The slopes of the curves are the same indicating that production would have increased by P_OC_n even in the absence of the project. The real effect of the project is thus an increase in production by the amount P_nC_n. The point here seems to be that if a control such as C is selected in which the level of production is exactly the same as that of the project area at the benchmark point, no information for the benchmark period is needed. If such a control as C_2, which was better off ($C_{2O}<P_O$) at the benchmark point had been selected, the conclusion would have been that the project did not have any effect on production ($P_n=C_{2n}$), unless the effect of time on production had been traced out for both the project and the control areas. If that is done, the same conclusion is reached- namely, that the project increased production by P_nC_n, which is equal to the changes in the project area (P_OP_n) minus the changes in the control area ($C_{2O}C_{2n}$). Similarly, if a control such as C1 had been selected, the wrong conclusion- that the project increased production by P_nC_{1n}, which is larger than P_nC_n- would have been reached.

Many of the impact studies on infrastructure in Bangladesh do not seem to have taken this aspect into consideration. Available empirical studies (e.g. Hossain 1998; BIDS/World Bank 1996; The Louis Berger Inc. 2003) are based on information collected after the end of the project, and hence, seems to be flawed with a failure to take cognizance of the tracing out effects. However, the advantage that we claim to have for an evaluation of the effects of the JMBP is that, benchmark information were collected for both Project and Control households spanning over a period between 1997/98 and 2003/04 i.e. for pre-Jamuna and post-Jamuna periods.

SECTION THREE

CHNGES IN LAND USE PATTERN

(HYPOTHESIS 1)

"*The fact that small subsistence-oriented farmers*
('peasants' who mainly use family labor) adopted
the new biological technology at a dramatic speed supports
the hypothesis of T.W. Schultz (1964) that they are rational
and efficient in resource allocation and are responsive
to new profit opportunities arising from changes
in technology and market demands".

Yujiro Hayami (1997).

3.1 Introduction

Available empirical evidences point to the changes in land use pattern following access to infrastructure (Ahmed and Hossain 1990). A priori reasoning suggests that, one of the impacts Jamuna Bridge would be to change the areas under crop production, cropping pattern and cropping intensity**.** This is primarily because, the access to the bridge might cause a resource reallocation in the face of growing markets, getting price signals and availability of inputs, extension, credit facilitates. Arguably, all of these factors of production could have been facilitated by the bridge. And, since the largest segment of the poor live in rural areas, and lean on agriculture for eking out a living, changes in land utilization pattern following the bridge could, possibly, cause a reduction in poverty.

3.1.1 Areas under crops

It seems that the impacts are quite in consort with available empirical findings in Bangladesh and elsewhere, and also in tune with pour testable hypothesis. We observe that - between 1997/98 (pre-Jamuna) and 2003/04 (post-Jamuna) periods - the gross cropped areas under Modern Varieties (MVs) of rice increased in Project areas (by about 24 per cent). However, as opposed to this shinning sign, the Control areas witnessed a decline by 4 per cent during the

same period of time (Appendix Table 3.1). It needs to be noted that, before the bridge was opened for traffic, the control villages were ahead of project villages in terms of adoption of MV rice. This means that, inter alia, adoption of modern agricultural technology was reinforced in Project villages with the inception of the bridge. Again, a lack of the access might have constricted the pace of adoption of modern technology in Control villages. The improvements in Project villages so observed could be due to increased dissemination by extension workers, development of information networks, enhanced marketing opportunities, smooth flow of inputs from factories etc. – all likely to be facilitated by the JMBP.

We also observe that, in the post-Jamuna periods, areas under perishable but high value products, like vegetables, onion, spices, and oilseeds, increased in Project areas by about 10 per cent, while the same declined in Control areas by about 18 per cent. Almost the same trend applies for cash crops in these two types of villages. The observations, seemingly, confirms one of our hypotheses that Jamuna Bridge would have promoted production of perishable crops*.*

But, have the benefits been reaped by the poor farms? In other words, how and to what extent such benefits have been bagged by the poor? Arguably, the tenants are usually the poor farms in rural areas, and that they have to pay a sizeable return as rent to the land lords. Quite obviously, their response to infrastructural or technological developments should assume relatively more weight in the strategy of poverty reduction.

To enquire into that, we have collected land use information on changes in land use patterns in rented-in lands (Appendix Table 3.2). First, we notice that, land under tenancy increased at a faster rate in Project villages: from 33 to 40 per cent (of cultivated land) compared to that of the Control villages from 30 to 34 per cent. The change in tenancy market seemingly upholds are hypothesis that JMBP might have impacted upon tenancy market. Quite obviously, the poor benefited from such growth as they are mostly the tenants. Second, we observe that, tenant farmers in Project areas have also increased lands under MV rice between pre-Jamuna and post-Jamuna periods. This contrasts with their

counterparts in Control areas who seem to have put in less acreage under MVs (Appendix Table 3.2). More importantly, in the Project villages, these tiny farmers have also been increasing the share of land under perishable or high value agricultural crops. Compared to the pre-Jamuna period, they have increased lands under these crops by 5-10 times. As opposed to this, tenants in Control areas witnessed a decline in crop acreages in perishable products.

In sum, our field level information from panel data tend to reveal that since the opening of the bridge, land emerged more importantly as a source of livelihood especially for the poor. The increased land productivity through modern technology released lands for non-rice crops and helped crop diversification.

3.1.2 Cropping intensity and use of modern inputs

In Project areas, cropping intensity for farms increased by about 9 per cent.[7] During the same period of time, however, the cropping intensity in control areas decreased by about 5 per cent (Appendix Table 3.1). In other words, apparently, land in project areas have been used more economically and intensively than those in Control areas. More importantly, Project villages took the lead over the control villages in the post-Jamuna phase, although they were lagging behind, in terms of cropping intensity, in the pre-Jamuna period. [8]

However, if we look at the cropping intensity of the rented in land – a proxy for the poor farmers – we also observe that the index increased in Project villages, as much as by 32 per cent over the periods, while it decreased in control areas during the same period of time.

Appendix Table 3.3 presents information on yield levels along with a summary of key agricultural performances. We observe that yield levels in project villages were higher than in control villages. Likewise, areas under MVs and irrigation

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[7] Defined as (Gross cropped area/Net cropped area) X 100.
[8] Our finding contrasts a recent study on cropping intensity in 62 villages in Bangladesh that found a fall in cropping intensity over the years.

significantly rose in project villages compared to control villages between 1997/98 and 2003/04.

The cause of the apparent positive correlation between the bridge and cropping pattern and intensity is not, perhaps, difficult to detect. As we argued before, the development of infrastructure helps lower the marginal costs of production by shifting the marginal cost curve to the right. The supply curve shifts to the right when farmers face a fall in input prices and a rise in output prices – an observation that we will take up next.

3.1.3 Tenancy market

We observe that in both Project and Control villages, land under own cultivation declined while land under tenancy increased between the two comparable periods in both types of villages. In fact, throughout Bangladesh, the proportion of tenant farmers has increased from 42 per cent to 57 per cent, and land under tenancy cultivation increased from 22 per cent to 33 per cent between 1988 and 2000. Most of the tenants are small land owners who find it economical to rent land to increase the capacity-use of the farm establishment (Hossain et.al 2002). As can be observed from Appendix Table 3.4, from almost same level, the share of rented in land in Project areas increased at a much faster rate than in control villages. Not only that, land under share cropping arrangement – as arrangement usually considered as exploitative and inefficient – drastically fell in Project villages and the lands under fixed rent system increased over the years. This points to the changes in etnuarl conditions that help the poor most.

3.1.4 Credit market

Appendix Table 3.5 presents information on access to credit. We notice that although Project villages lagged behind Control villages in terms of access to financial credit but, over time, the access increased substantially in Project villages. For example, in the pre-Jamuna period, only 4 per cent of the households in Project villages accessed to NGO credit. But by 2003/04, the

proportion of borrowers from NGO increased 5 times compared to two times in Control villages.

SECTION FOUR

THE BRIDGE AND THE PRODUCT MARKET

(HYPOTHESIS 2)

> *"Ever since humankind domesticated*
> *plants and animals, the relations of men*
> *and women to land, water, forests, and*
> *pasture have largely determined their state*
> *of well-being. These relations, in tern have*
> *been mediated by the relations of human*
> *beings in the particular society they have*
> *built up and belong to".*
> Amiya K. Bagchi (2002)

4.1 Introduction

Following hypothesis 2, we shall take up the issue of the prices of outputs and inputs. A priori reasoning would suggest that, with the inception of Jamuna Bridge, farmers would be able to get a better price for the produce. On the other hand, quick and cheap supply of agricultural inputs would keep their costs of production low. As a result, total production and marketed supply would also go up.

4.2 Impacts on Product Market

4.2.1 Marketing ratio and market participation

We can glance at the information on (a) marketed output – as percentage of total production – and (b) market participation for all sizes of farms (Appendix Table 4.1). It can be observed that for all crops, market orientation in Project villages seems to have increased faster than in Control villages. Special mention may be made of paddy: marketed output increased from 33 per cent in 1997/98 to 41 per cent in 2003/04. Likewise, market orientation of perishable and high value crops also increased by a respectable margin. However, Control villages seem to look pale when compared with Project villages in this regard.

4.2.2 Market participation by stratification [9]

By farm size:

We can also observe the changes in market participation and marketed output by farm size to test the null hypothesis that it is only the large or medium farms that mostly benefit from infrastructure and marketed output (Appendix Table 4.2). About one-third of the poor farmers (owning up to 0.41 ha) sold their paddy in the market in post-Jamuna period, compared to one-fourth in pre-Jamuna period. Market participation of poor farmers, thus, increased over the years. For small size farms (owning 0.41 to 1.00 ha), the proportion rose to two-thirds in 2003/04 from 55 per cent in 1997/98. Over four-fifths of medium and over 90 per of large farmers participated in the paddy market in 1997/98 and their share rose/declined marginally in 2003/04. It follows, therefore, that market participation of all groups of farmers in Project villages increased since the opening of the Jamuna Bridge.[10]

Appendix Table 4.2 also shows the price received by farmers. Generally, the price received by the medium and large farms is on the higher side than their small and poor counterparts. For example, the price of paddy received by large farms increased roughly 6 per cent per annum between 1997/98 and 2003/04. This compares with roughly 4 per cent rise for the poor farms. Again from another angle, the price received by poor farms was 95 per cent of that received by large farms.

By tenancy group:

The above mentioned trend in marketed output and paddy prices can also be examined from tenurial side (Appendix Table 4.2). The proportion of pure tenant households selling paddy in the market increased from 35 per cent in 1997/98 to 44 per cent in 2003/04. Their marketed share increased from 23 to 27 per cent over the same period of time. Tenant owners also marked a rise and so did pure

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[9] We are considering the case of Project village only.
[10] It needs to be mentioned, however, that the proportion of sales positively varied with land sizes.

owners. Interestingly, however, the pure tenants witnessed the largest increase in the participation between pre-bridge and the post- bridge period.

4.2.3 Determinants of marketed supply:

Which factors affect marketed output? This is an important question looming large on the heels of a presumption that, generally, the large farms tend to sell more in the market and poor and small farms are subsistence farms. To test the hypotheses, we ran a multivariate linear regression for searching the causal factors (Appendix Table 4.3).

It is assumed that marketed output is dependent on a host of factors. But important factors are, for example: (a) MV paddy price (PMVP); (b) Total paddy production (TOPP); (c) household size (HSZ); (d) education of household head (EDHH); (d) proportion of MV paddy area (MRVA); (e) total land owned by household (LOWN); (f) good infrastructure (DUMINF) and (g) tenancy (DUMTNT). We found that, among other important factor, good roads (proxied by access to electricity) appeared as one of the influential factors behind the marketed output.

4.3 Impact on prices

One of the important objectives in building the Jamuna Bridge was to even out the prices across the regions. It had been alleged that, in the absence of a bridge connecting the northern part of Bangladesh with Dhaka or Chittagong, farmers failed to reap home a better price for their harvests but, at the same time paid higher prices for inputs. It was expected that, as a result of the access to the bridge, three kinds of benefits would flow. First, growers would get a better deal for their crops in terms of increased price. Second, growers would face relatively lower costs of inputs since supply would smoothen by the bridge. Third, market integration would increase as mobility would increase following quick and cost-effective transportation. And finally, marketing margin would decrease. In the following paragraphs, we shall try to test hypothesis 3 in the light of price situations prevailing in target and control villages.

4.3.1 Output prices

 Let us take up the issue of the prices of some selected commodities (Appendix Table 4.4). We observe that, on average, prices of products in project villages rose faster than those in Control villages during the comparable periods. For example, price of HYV paddy increased at roughly 6 per cent per year in target villages compared to about 3 per cent in Control villages. Arguably, access to wider markets helped farmers to get a better price. Especially, for perishable products (like vegetables   pulses) the price increase was substantial. [11] In contrast, farmers in control villages faced a feeble or negative rise in prices. One could, thus, argue that Jamuna Bridge might have helped farmers in Project villages receiving a better price, while the absence of it in control villages just caused the opposite. It could be due to competition from venders for purchases or it could be due to government procurement centers located nearby. In any way, farmers' bargaining power seems to have increased in the post-Jamuna phase.

4.3.2 Input prices

But, just the reverse seems to have occurred in the case of agricultural inputs. Although the prices of all inputs increased between 1997/98 and 2003/04, the increase was more in control villages than in target villages (Appendix Table 4.4). The relatively less increase in the prices of fertilizers in Project villages could be due to the fact that in the pre-bridge period, dealers transported these by waterways – with delays and wastages - but after the bridge, they used trucks. However, the price of TSP fertilizer and irrigation costs increased at a higher rate in control than in target villages.

But noticeably, the wage rate rose faster in target than in control villages. For example, wage rate increased at a rate of 4.4 percent per annum in Project villages compared to only about 2 percent cent in control villages. It implies, perhaps, that labor market in target villages grew tighter to increase wage rate. It could also be due to increased non-farm activities in target villages or higher mobility of labor from those villages. By and large, the empirical evidences on the

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[11] The Louis Berger, Inc. (2003) report shows that for example, Cabbage prices increased by 47-60 per cent and rice by 9-12 per cent in some of the Northwestern during the post-Jamuna periods.

change in input prices seem to corroborate the a priori hypotheses raised earlier in relation to the impact of the bridge.

4.4 Market integration and volume of trade

To examine whether the markets have been growing integrated following the construction of the Jamauna Bridge, we collected retail prices in sample villages and Dhaka prices for both pre and post-bridge periods (Appendix Table 4.5). The purpose was to compare the differences between the two periods. A narrowing down of the differences would mean that Dhaka prices and the prices prevailing in sample villages were integrated.[12] We observe that, for most of the products, the retail price difference between Dhaka and Project villages declined. This , intuitively, implies that there has been a decline in the marketing margin and rise in market integration.[13]

4.5 Has trade increased?

One of the most difficult parts of the exercise on impact study had been to quantify the volume of trade between the pre and post-Jamuna periods. The survey was done in villages where villagers had little idea about the volume of trade outside their regions as they simply supplied to the local markets. Again, their marketed supply also could not fully capture the story of the traded transactions. However, our discussions with traders in towns, truckers on roads and some wholesalers in different spots gave us some "guestimates" about the possible expansion in trade during the post-Jamuna phase (Appendix Table 6.2).[14] First, commodity flows increased, on average, between 13 per cent to 55 per cent over the per-Jamuna periods. Reportedly, rice trade increased by about 13 per cent, on average, but trade of vegetable, fruits and construction materials

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[12] These are the prices at nearby village markets at the time of the survey.

[13] The Louis Berger, Inc.(2003) report opines that Dhaka rice market has got more integrated with rice markets in the Northwest during the post-Jamuna periods. Likewise, the same report says, for some food products such as soap, sugar, long cloth etc., the price difference has reduced more than observed in a comparable non-northwestern market.

[14] We do not claim to be conclusive on this but, nevertheless, the information submitted should serve as indications to the possible outcomes

are reported to have increased substantially in the post-Jamauna phase. [15] The other indicators like reduction in transport costs, transport time and increased in the number of vendors in and around sample village markets, also point to a sign of surging of trade in the post-Jamuna phase.

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[15] The Louis Berger, Inc (2003) reported that, rice trade might have increased by 10 per cent and vegetables by 50 per cent in the post-Jamuna phase.

SECTION FIVE

OCCUPATIONS AND INCOME

"Not only the rate of growth but also the pattern of growth is relevant, especially for better understanding of the role of income distribution in the process of development. The persistence of poverty – even with creditable rates of growth is the shame of inadequate development policy".
Gerald M. Meier (2001).

5.1 Occupational Change

Tables 5.1 and 5.2 present information occupational of working members of households. As can be observed, labor force in Project households has been moving more towards non-agricultural activities. Especially, business, trade and non-agricultural labor occupation like transport have lured the labor most. This is quite expected since the Bridge is likely to affect the non-agricultural sector. Another noteworthy finding is that multiple occupation index fell in the post-Jamuna phase for project villages, but it increased in for the Control households. A priori reasoning suggest that at a high poverty level, households generally bank on more than occupation for eking out a living, but with poverty going down, they tend to substitute leisure for work.

5.2 Income Change

5.2.1 Methodological niches

Estimates of household income, especially those from rural areas, had always been fraught with flaws. The reasons are not far to seek. There is hardly any record keeping system for inputs purchased and output produced in the vast spectrum of informal transactions taking place in rural areas. The incomes, thus reported, mostly come from memory recalls. Again, be it advertent or inadvertent, under reporting about income sources and the level of income, make it difficult to give correct judgment. Sometimes the "guestimates" so provided often fail to face cross checks. Further, some of the available estimates of income do not consider households' own production from own resources as also the income in-kind.

Such omissions, more often than not, open the door wide for under estimation of the level of income.

In arriving at the level of household income from sample villages through household surveys, we were posed with the same kind of problems. However, we adopted a different technique to income estimation, and hopefully, we could minimize the errors or omissions. To this effect, we proceeded as follows: (a) considered income received both in kind and in cash, and thus, dispelled one the factors contributing to inaccuracy in measurement. A money value was imputed to in-kind earnings at the prevailing prices in survey areas. (b) Households' self produced products and by products, and livestock fisheries and forest products were also considered as income, because an expenditure saved is also an income earned. And (c) the income from crop-product activities is estimated as the value of the main product and by product net of the costs of used inputs for production: irrigation, fertilizer seed, payment to hired labor and draft and mechanical power. The income, thus, includes the imputed value of the use of resources owned by the households, such as land, family workers and draft animals.

Admittedly, due to the lack of data, no allowances could be given to the depreciation of fixed assets and owner occupied-housing. In the context of rural Bangladesh, information on these counts is hard to come by. Second, receipts from sale of assets and borrowing are not included as they are prone to heavy over or under estimation. And finally, we agree that implicit transfer on account of non-market access to public services such as education and health care should ideally be included in income accounting. But, unfortunately, the survey lacked information on this subject.

To facilitate comparison, the income has been estimated in US dollars using the exchange rate prevailing during the year of the survey (Table 5.1). This method

is another way of looking at real changes in income. [16]The following major points may be noted from the pattern of rural household incomes by sources. The following points need mention.

5.2 Major Findings

5.2.1 Income level and change

The construction of a Bridge like Jamuna should affect, first, the occupational mobility (horizontal mobility or moving from here and there) and malleability (vertical mobility such as moving to a more remunerative one) of the work force. Second, it should also affect household income and the structure of income. We observe that, between pre-Jamuna and post-Jamuna periods, some changes took place in the level, growth and structure of household income in Project villages. We shall highlight few of them from Appendix Tables 5.3.

- o The per capita income of Project villages stood at US$ 225 in pre-Jamuna phase. This compares with US$232 for the Control Villages. In other words, the per capita income of Project villages was lower by 3 per cent during the pre-Jamuna period.

- o In the post-Jamuna period, the per capita income of Project Villages rose to US $266 depicting a growth of 3 per cent per annum. In Contrast, the per capita income of the Control households stood at US$ 241- 10 per cent lower than that of Project villages- and increased at less than one per cent during the same period of time.

- o The structure of household income shows that, among agriculture, Project villages advanced on account of non-rice crops and non-crop agricultural income over the comparable periods. But Control villages could not make much progress in this regard.

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[16] Adjustment or deflation through CPI index could be another way.

o In project villages, income as non-agricultural wages increased by about 10 per cent per annum as against a decline by 4 per cent in Control villages, perhaps, pointing to the growth of employment in non-agricultural activities like transport, construction etc. Again, income from trade and business increased in Project villages by 1.2 per cent per annum compared to a decline in Control villages.

o The occupational changes also show that there had been a big shift in occupations in Project villages compared to Control villages. In fact, the multiple occupation index – a proxy for the pervasiveness of poverty – declined in Project areas over the comparable periods.

o The major sources of non-agricultural income for Project households stemmed from Trade and business and non-agricultural labor whereas the major source for control villages was remittance.

5.2.2 Distribution of Income

The degree of inequality in the distribution of income was measured by the Gini coefficient, as proposed by Sen (1973). The concentration coefficient was estimated by ranking households in the scale of per capita income. The share of income in both per capita income and household income are shown separately with the assumption that welfare of an individual is better reflected by per capita income than by household income (Hossain et. al 1994). A Gini decomposition analysis was conducted to identify the factors contributing to overall income inequality by following the procedure suggested by Pyatt *et.al* (1980) and Shorrocks (1983). Appendix Table 5.4 presents information on the distribution of income. The major points of consideration are as follows:

It appears clearly that, the bottom 40 per cent of households (representing the poorest segment) gained their income share at 16 per cent in the post-Jamuna period compared to 14 per cent during the pre-Jamuna period. On the other hand, the top 10 per cent (representing the richest segment) lost their share from 36.6 per cent to about 33 per cent over the same period of time. The inequality – reflected by the gini-concentration ratio declined from 0.448 to 0.433.

We presume that in earlier periods, the access to the household assets, mostly, non-land assets were mostly captured by the richest segment of the rural society. For example, the modern technology in rice production was first seized by this group. But in later periods, perhaps, with the opening of the bridge, poor farms began to adopt technology. Besides, free primary education and stipends for girls in secondary level also increased the access of the poor. Again, as tenancy market grow thinner and labor market tighter, the benefits accrued to the poor to lower he gini index.

6.4.3 Agricultural income

The distribution of income and the changes in the gini-coeffcient can also be looked at from agricultural and non-agricultural income. Such division should help us understanding which types of income are more inequitable (Appendix Table 5.5).

We observe that, in the case of agricultural income, the bottom 40 per cent of the households somehow could cling to their income share over the entire period, although they witnessed a decline in the share in 1997/98. The richest 10 per cent increase share but the middle 40 per cent lost share in agricultural income. By and large, we find that the concentration ratio or gini-index remained almost constant between 1997/98 and 2003/04.

The non-agricultural income had always been more unequal than agricultural income as reflected by the relatively higher value of gin-index. But, surprisingly, the index depicted the same trend as agricultural or per capita income. However, still the non-agricultural gini-index seems to be high and represents skewed distribution. One of the reasons for relatively less egalitarian non-agricultural income could be the access to education and credit. Generally, speaking, non-farm activities require more capital, education and better infrastructure in which the poor have relatively have less access. While the richer ones could have access easily to these opportunities that results in higher degree of inequality.

6.4.4 Contributory factor to inequality

And finally, we present some information on the role of different factors in inequality.(Appendix Table 5.6). First, agriculture in general ,and rice farming in particular, appears to be an equalizing factor with a decline in its contribution to the gini co-efficient. It may be so, because the richer segment of the population have been leaving rice farming and the poor have been embracing it. Second, among agriculture, non-rice crop and non-crop agriculture, to some extent, increases inequality, possibly, because non-crop agriculture also requires some amount of land and capital in which the poor have less access. Third, the largest contributor to inequality appears to be non-agricultural income. The gini index has depicted an upward trend. Excepting services and other non-agricultural activities, all the elements of non-agricultural income appear as more in equitable. It not surprising given the fact persuasion of non-agricultural activities like trade and business, even remittances, require high amount of financial and human capital to which the rich has more access than the poor.

SECTION SIX
INCOME AND NON-INCOME POVERTY

Poverty is like heat: you cannot see it;
you can only feel it;
so to know poverty
you have to go through it"

A poor man., Adaboya, Ghana
(Cited in **Voices of the Poor:**
Crying Out for a Change
by Deepa Narayan et.al 2000)

6.1 Measurement of poverty: Theoretical underpinnings

Before we embark upon a presentation of the profiles of poverty in sample villages, a clarification on some of the concepts concerning the measurement of poverty itself should be on board. In fact, the level and the trend of poverty could differ widely across studies at similar times and for similar households, depending on the yardstick used to measure poverty. In the available literature, researchers generally rely on three such measurements. We discuss them below:

(a) *The head-count index* counts the number of people in households with an income or consumption expenditure below the poverty line and expresses it as a percent of total population. This is a measure of *incidence of poverty*. The measure has the advantage that it is easy to interpret and has appeal to policy makers and practitioners. But, hindsight, it amounts to tell nothing about income distribution among the poor. An increase in income of a poor household does not affect this measure unless it is large enough to pull it above the poverty line.

(b) *The poverty-gap index* measures the mean distance of income of population from poverty line, where the mean income is estimated for the entire population, counting for the non-poor as zero poverty gaps. This is a measure of the *depth of poverty*. This gives the amount of income transfers needed from the rich to the poor to pull the latter out of poverty. The measure, however, is not sensitive to the changes in income inequality among the poor. If, for example, if the income

of a moderate poor household had increased by reducing the same amount of income from the hard-core poor, the poverty measured by this index would remain unchanged, although the society would treat such income transfers unwelcome.

(c) **The squared poverty index** or FGT index-Foster, Greer and Thorbeck index has rarely been used in Bangladesh. In order to capture the changes in income distribution among the poor in the poverty measure, Foster, Greer and Thorbeck proposed that the gap of income from the poverty line for each household should be squared and the arithmetic mean be estimated for the entire population, again counting the non-poor as with zero poverty gap. Thus, in this measure, greater weights are given to individuals with larger income gaps and hence it is a measure of the *severity of poverty*.

6.2 Difficulties in the Determination of poverty line

Any attempt to determine the poverty line in Bangladesh is generally prone to two problems: operating within the limitations of the Household Income and Expenditure Survey (HIES) data sources provided by the Bangladesh Bureau of Statistics (BBS), and being restricted to the normative criterion of a minimum consumption bundle related to bare physiological survival. We have, on the one hand, the requirement level used by the Food and Agricultural Organization (FAO), and on the other, the norm used by the National Nutritional Council (NNC). However, for the purpose of this study, two poverty lines have been computed on the basis of (a) a per capita minimum diet of 2,120 calories (FAO norm) and (b) 2260 calories (NNC norm). In both cases, however, a 30 percent allowance for non-food basic needs has been adjusted. Appendix Table 6.1 provides with the details of the computation. However, some key aspects of the measurement are discussed below.

Since relevant prices to be used for converting the minimum calorie bundle into value terms have been taken (imputed) from the HEIS consumption-expenditure data itself, these prices may be considered as a better approximation of rural consumer prices than the prevalent practice of adopting an arbitrary method of discounting urban retail prices by a certain percentage. This may be argued on several counts. First, in this method, the average price for each of the generic items included in Appendix Table 6.1 (e.g. fish, pulses, other vegetables) could be derived without the difficulties usually encountered in specifying prices of individual commodities to be taken as a proxy for these generic items. For instance, in the case of pulses, an imputed price would show an average price irrespective of type (e.g. *masur/khesari* etc). Similarly, with respect to fish, an imputed price would capture an average price of all fresh water fishes regardless of species. A similar point holds true with respect to the pricing of other vegetables. Thus, average price shown against the item of other vegetables would not reflect the price level for any particular vegetable type, but indicate an average price level calculated for all kinds of vegetables (both leafy and non-leafy types) that are consumed by rural households.

Second, the prices of each of these items are computed on the basis of actual per capita expenditure incurred, on average, by rural households. Therefore, the cost-saving possibilities of households are, in effect, taken into account while deriving the prices used for costing the minimum diet. Third, for certain luxury items like milk, sugar and meat, prices of specific commodities have been derived from the HIES data. Thus, in calculating milk prices, the prices for milk powder have not been considered while with respect to sugar, only prices of indigenous sugar (i.e. *gur*) have been chosen. Similarly, in calculating the cost of the meat tem, only prices for beef have been used, since its consumer prices are relatively low in Bangladesh compared with those for mutton or chicken. Fourth, the income/expenditure distribution among the rural population, as indicated by the grouped data (which provides the basis for estimating the poverty ratios), is

the outcome of the underlying HIES prices.[17] Hence, it would be more logical to cost the minimum diet on the basis of prices imputed from the HES data and then to apply the poverty line yardstick derived in the process to the grouped data relating to income /expenditure distribution contained in the HES reports.

Apart from the question of costing, considerable discrepancies also exist in the literature regarding the provision of some non-food basic need items, expressed as a certain percentage of the total cost of the minimum diet. Ahmad and Hossain (1984) allow for 15 percent of the cost of food items to be the minimum cost of non-food items in ascertaining the poverty line. Several studies have assumed that the minimum cost of non-food items would be about 25 percent of expenditure on food. A closer look at the HIES data recorded for successive years would reveal that, for an average rural dweller, the share of non-food expenditures (including house rent) in total expenditure has steadily increased over time-from 25 percent in 1973/74 to 31 percent in 1981/82 rising further to 35 percent in 1985/86. It may be argued that the actual weight of basic non-food expenditures would be less by the respective share of the imputed value of the house rent, since most of the dwellers in the rural areas reside in their own houses. However, to the extent that the income/expenditure distribution of the rural population provided by the HES data contains an imputed value for house rent, the costing of non-food basic items in ascertaining the poverty line must take into account provisions for some house rent. In this study, the cost of non-food basic items has been taken as 30 percent of the cost of minimum diet in arriving at the poverty line (expenditure level) for each point of observation.

However, based on the normative food basket and the price attached to each unit of food items, we estimated the poverty line both for moderate and extreme poverty. Appendix Table 6.2 presents such information for several years with a view to glancing the shift of then poverty line over time.

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[17] Without having access to the individual household primary data generated by the BBS, individual researchers are compelled to carry out the analysis of poverty and income distribution on the basis of the grouped data reported in BBS publications on the HES.

6.3 Changes in income-poverty

6.3.1 Quantitative estimates

Appendix Tables 6.3a and 6.3b report on changes in the head-count ratio along with other two measurements of poverty.[18] We shall call it income-poverty, as the calorie intake needed to lift out of poverty is a function of income of the household. There is, of course, non-income poverty arising, for example, from the lack of access to health, education, housing etc. We shall come to that at a later stage. The major observations from Appendix Tables 6.3a and 6.3b are as follows:

➢ Level of rural poverty measured by head count index declined between pre and post-Jamuna periods in both Project and control villages. The trend applies for both norms of measurement. However, under FAO norm, control villages witnessed faster fall in headcount index compared to Project villages.

➢ Using the FAO norm, however, the reduction in extreme poverty in Project villages were 2.5 times more than that of Control villages. In other words, Project villages could drastically reduce their extreme poverty.

➢ Depth of poverty measured by the poverty gap index also recorded substantial decline, especially in Project villages;

➢ Severity of poverty measured by the squared poverty gap index showed appreciable decline in Project villages;

➢ Under the NNC norm, Project villages experienced greater decline both in head count index and extreme poverty compared to Control villages.

➢ By and large it appears that, in the post-Jamuna phase, the Project villages witnessed better progress in terms of poverty reduction.

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[18] The households or persons failing to fetch the income level corresponding to a balanced minimum diet of 2,110 calories and with a 30 percent allowance for non-food basic items are defined as absolute poor in this study. The changes in the proportion of the absolute poor as percentage of total rural population would give trends in rural poverty. On the other hand, those failing to touch 1800-calorie line would be dubbed as extreme poor.

It needs to be mentioned here that about four-fifths of the poor in rural areas comprise extreme landless households (owning land for homestead only) and functionally landless households (owning land up to 0.2 ha). We presume that the reduction in extreme poverty in Project villages applied to this group. How could they benefit from the bridge? First, it could be due to the increasing tenancy market. The share of land under tenancy rose over the years. Large and medium land owners leaving land for non-agricultural pursuits. The threshold level of land for escaping poverty is 0.4 ha (Hossain et.al forthcoming).Second, it could be due to NGos that came with credit for the functionally landless households and third, it could be due to the tight labor market due to non-farm activities.

6.3.2 Changes in income-poverty and perceptions of people

In poverty discourses, the objective or quantitative measurement of poverty, such as shown above, are generally faced with two criticisms. First, the estimates are sensitive to the estimate of the poverty line, and hence, different levels of poverty would emerge on different assumptions of the estimates. To this effect, a clear example could be the two estimates that we presented earlier i.e. based on FAO norm and NNC norm. Just because of different assumptions on the required calorie levels, other things remaining constant, we arrived at two different estimates. Second, according to the critics, such objective estimates tend to preclude the perceptions of the population about their own economic conditions. In other words, researchers' findings may not conform to the people's views about their economic conditions. Whereas," at the start of the 21st century any policy document on poverty should be based on the experiences, reflections, aspirations and priorities of poor people themselves" (Narayan et.al 2000). Thus, participatory and qualitative poverty assessments have emerged as important tools in the recent literature on poverty (Sen and Hulme 2003/04).

We have already faced the first problem by arguing that, the estimates point to a trend of declining poverty levels over the periods under consideration, although the magnitude of change differed between the two estimates. We also tried to compare our estimates with other available studies and confirmed the declining trend. To address the second problem, and as it has rarely been raised by researchers, we have estimated the incidence of poverty based on self-perception of the economic conditions of the respondents.

What do people think about their economic conditions and changes over time? An idea on that would, probably, reinforce the argument that poverty has declined over time. Again, we draw upon the "feeling" and "assessment" of the changes as revealed by respondents (Appendix Table 6.5). For the period 1997/98 to 2003/04, we observe that, on average, about 27 per cent of the households in Project villages seem to have gained in net change (defined as improvement minus deterioration) by improving their economic conditions. This compares with about 22 per cent of households who reported net improvement in economic conditions. Thus, in terms of households' perception about economic conditions, we note that households in Project villages perceived positive gain over pre-Jamuna period whereas, those in control villages perceived a change from positive to negative positive gain in the Post-Jamuna phase.

6.3.3 Change by socio-economic characteristics
Appendix Table 6.5 presents changes in economic condition by land ownership and education. First, positive net change in economic condition is positively related to land ownership. That is, those with larger land size witnessed larger net economic improvement over the periods. Second, those with services and trade also were economically better off than those with wage labor or farming. And finally, net economic improvements are positively related to the level of education: higher levels of education brought in more net economic benefits.

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The policy implications seem to be obvious. In the absence of redistributive land reforms, investments on human capital formation through imparting education could be one of the ways to improve economic conditions of the poor people. And second, access to credit in rural areas for carrying out trade and business activities could also count in improving economic conditions.

6.3.4 The reasons for change

Appendix Table 6.7 presents information on the reasons for changes in economic conditions as perceived by the respondents. We find that the reasons for improvement in economic conditions are mostly economic factors while the reasons for deterioration are mostly social factors. Important economic reasons are, for example, hard work, business and services. However, adoption of modern rice technology and additional rented in land were also reported to have boosted economic condition. Among social factors, increase in family size and health related problems were reported as causing deterioration in economic conditions of sample households.

6.4 Changes in Non-Income Poverty:

So far we have enquired into the dynamics of income poverty from different angles that tend to corroborate our findings that income poverty in rural households declined over time. However, of late, non-income measurement of non-income poverty assumed special significance since it has been alleged that only income poverty does not tell the full story as far as the discourse on poverty is concerned. It is being said that "even if some persons live in severe income-poverty in the present period, they should not be excluded from access to basic social services, or what Rawls (1971) would term ""primary goods". Such access will have considerable favorable effects on their lives, work capacity and non-income dimensions of well-being in the current generation, but, more importantly, will make a decisive difference to the future of their children in terms of human capital and otherwise, with favorable implications for overcoming inter-

generational poverty" (Sen and Hulme 2003/04). Appendix Tables 6.8a and 6.8b provides some interesting insights into the domain of non-income poverty. [19]

First comes hunger. We enquired whether household members could have access to three meals a day. We assumed that households with access to three meals a day would be above hunger and those without three meals are facing hunger. It appears that there has been substantial decline in non-income poverty, between pre and post-Jamuna phase, for both Project and Control Villages. The most important observable change in non-income poverty seems to be in the case of access to food. We notice that, in Project villages, the proportion of households with members not having three meals a day declined dramatically in the comparable periods. But that should not provide any room for consolation, as a large number of people still do not have three 'effective' meals a day. That means, hunger haunts everyday to put them to premature deaths. However, there have been noteworthy improvements in terms of clothing and housing conditions over the periods. But, disconcertingly, the there had been minor improvements in terms of access to education above primary levels. [20]

Why hunger reduced? The phenomena could be explained by a volley of variables, but we shall mention a few. We reckon that the reasons were partly market driven and partly state-sponsored. Among market driven factors, first comes the adoption of modern technology in rice production and the associated increase in rice production. This kept the food prices within the purchasing capacity of the rural population. Poor people benefited in two ways in the process. First, since modern technology is labor intensive, there was more employment in rice crop production to ensure exchange entitlements for poor agricultural labor households. Second, due to the infrastructural developments

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[19] We have taken the following indicators: households' access to three meals a day (hunger), access of members to winter clothes (clothing), quality of house (housing) and access to education (human capital). In fact, these are the basic needs that household members need to have to pursue a productive life.
[20] Lower rate of school attendance in project villages could be due to a sharp rise in income earning opportunities where households have, possibly, been using child labor. But as income grows, hopefully, the attendance rate would shoot up.

and the concomitant increase in non-farm activities in rural areas, the agricultural labor market appeared relatively tight, and the wage rate increased. Third, the increase in the proportion of poor households in tenancy market and the associated changes in contractual arrangements favorable to them also helped the poor farmers raise income and increase access to food. And finally, various state-sponsored programmes such as safety nets, VGF and food for education contributed to the increasing access of the poor to food basket.

On the other hand, the positive changes in housing and clothing conditions followed from the rise in income and the fall in income-poverty. In a regime of real wage increase, households are generally left with some surplus to look after things next to food.

But who are these hungry people and what are the correlates to hunger? An enquiry into the dynamics is necessary to suggest policy prescriptions dealing with hunger and poverty (Appendix Table 6.8b). First, we notice that the highest proportion of households with hunger – without access to three 'effective' meals a day – belong to the households who have only homestead land, and that such proportion is inversely related to owned land size. Again, from the point of view of farm sizes, the largest proportion of hungry population belongs to the non-farm groups. Among farm groups, hunger is inversely related to farm size. But in this case also, dramatic improvements could be observed across farm size and over the years. And finally, hunger tends to persist in a big way among the households with their heads having no formal education, although, there has been remarkable decline in the proportion over the periods under consideration. Similar trend tends to prevail in the case of the proportion of households with poor quality housing, and households with members (aged 6-15) no attending schools.

We, thus, observe that the profiles of the income-poor are akin to the profile of the non-income poor. It appears that per capita income is the propeller in both

cases. That is, we cannot possibly think about poverty reduction of any kind without addressing the issue of raising income. The most pertinent question is who fails to fetch income? Our data shows that size of land (both owned and operated) and the level of education appear to be the principal determinants of both income and non-income poverty. Therefore, to address the issue of poverty, these two vital factors need to be considered. However, as we mentioned before, since redistributive land reforms (unless politically poised) is very difficult to materialize, we are left with two options. First, increasing the access of the poor to education, and second, enabling the poor to have more operated land through the tenancy market. The former needs to be undertaken by the state – as per the provisions of the Constitution. The second option has to do with expansion of infrastructural development and non-farm activities in rural areas to pull labor out of agriculture.

SECTION SEVEN

THE BRIDGE AND THE POVERTY

7.1 The Model and the variables

We presume that household level income is the proxy for poverty: the higher the income, the less is likely to be the pervasiveness of poverty and vice versa.[21] A multivariate regression model was estimated with the household level data to assess the relative contribution of different factors, including Jamuna Bridge, in increasing household income and, hence, in reducing poverty. First we start with describing the explanatory variables.

The income earning capacity of the household would quite obviously depend on the size of land owned and operated by the household, the number of family members in the working age group, and the amount of non-land assets used in production activities. The productivity of land, in turn, depends on the composition of different types of parcels (differentiated by soil types, flooding depth etc) in the land portfolio, the access to irrigation facilities and the adoption of modern varieties and improved farm practices. Tenancy cultivation would contribute to growth in household incomes, if the rent received by the tenant household is higher than the opportunity cost of labor and working capital employed on the rented holding. The productivity of family workers and the choice of economic activities would depend on the quality of labor embodied through investment on human resources, particularly education and training.

The location of the village(s) with respect to infrastructural facilities should be an important determinant of the profitability of economic activities, as it opens up opportunities from non-farm employment, and creates economic environment for high productive agricultural activities, such as perishable fruits, vegetables and livestock products. The improvement in marketing facilities that follows

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[21] Although, with equal force, we admit the limitation of income as an indicator of household welfare.

infrastructural development reduces marketing margins, raise farm gate prices for agricultural produce and lower prices for inputs, thereby increase farm profits and promote incentives for growth.[22]

Second, it also needs to be noted that the co-efficient in the model would show marginal returns. That is, at the margin, how much the factors provide to the household kitty. If we divide that marginal product by the average product, we get the elasticity or share of the factor in changing income.

We have three equations each for (a) all households; (b) for land owning households and (c) for landless households. The regression results are presented in Appendix Tables 7.1 to 7.3.

7.2 Results from the Regression

7.2.1 All households

First we take up all households (Appendix Table 7.1)). The model appears a good fit with adjusted R^2 at 0.801 in 2003/04 and 0.748 in 1997/98. That is, more than 70 per cent of the variations, on average, are explained by the explanatory variables. For all households, the most significant factors affecting income are: owned land (both irrigated and rainfed), agricultural and non-agricultural workers, agricultural and non-agricultural workers and remittance for abroad.

However, the impact of the Bridge seems to be positive, but not statistically significant. For example, household income in Project villages was lower than Control villages in 1997/98 (pre-Jamauna period), but was up in 2003/04 (post-Jamuna period) due to the bridge. But, we refrain from being conclusive on this as the co-efficient was not significant to support our hypothesis.

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[22] In fact, in the previous sections, we discovered some correlation between the Bridge and various parameters under consideration but, we did not try to find out the causal relationship. That is, whether the bridge had helped increase income or reduce poverty could not be ascertained in the absence of an econometric model.

7.2.1 Land owning households

Second, we consider land owning households (Appendix Table 7.2). The model again seems to be a good fit as reflected by high Adjusted R^2 .The significant factors are more or less as before. For the land owning households, the Jamuna Bridge has positive impact on household income, but the result is not statistically significant. In this case also, Project households had lower income in 1997/98 (pre-Jamuna period) compared to Control households, but surpassed Control villages after the construction of the bridge (Post-Jamuna period).

7.2.3 Functionally landless households

Finally, we take on the household income and its determinants for the landless households (Appendix Table 7.3). The model is a good fit with adjusted R^2 at 0.662 and 0.568, respectively, for 2003/04 and 1997/98 equations. Excepting income from irrigated lands, all variables that significantly affected household income in previous two cases, also apply for the landless households.

But, surprisingly, landless households emerged distinct from other two cases with the news that the coefficient of the Jamuna Bridge access appeared significant at 5 per cent level of confidence. That is, at the margin, landless households in Project areas add $ 120 to the household kitty because of the bridge. This is roughly 17 per cent of the household income of landless households. It may be mentioned here that, landless households in Project villages, compared to those in Control villages, had relatively lower income in 1997/98 i.e. in Pre-Jamuna period. With the passage of years, they have only furthered the difference. However, if we consider the incremental income due to the bridge, it would stand at $67 (=$120-53) i.e. $67 per annum went to the landless households as incremental income due to the bridge.

Another important deviation is in the role of NGOs. The NGO coefficient was not significant in the pre-Jamuna period, but emerged as highly significant in the post-Jamuna phase. This, perhaps, forestall our earlier observation that, in the

post Jamuna phase, the proportion of borrowers from NGOs increased at higher rate in Project than in Control villages.

We also observe that the foreign migration coefficient became highly significant in the post-Jamuna period, whereas, it was not significant in the pre-Jamuna period. It might have so happened that the opening of the Jamuna Bridge opened up the door for the poor households to send members abroad.

7.2.4 Puzzling results?

Apparently the result might sound puzzling. But we have some points to ponder over the puzzle. First, in the post-Jamuna phase, the wage rate in the Project villages increased at roughly 6 per cent per annum. This could be due to a tight labor market on the heels of growing non-farm activities, especially, trading/business and transport services. We have shown that, labor from the Project households has been moving towards that direction. Second, we also observed that the tenancy market in the Project villages grew stronger with poor households operating lands left by the relatively rich and middle farmers.[23]

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[23] May be, the opening of the bridge gave 'golden opportunity' for these households to go for trade, business or settle in towns looking for more remunerative investments.

SECTION EIGHT

COCLUDING REMARKS AND POLICY IMPLICATIONS

The following policy implications seem to follow from the analyses. First, infrastructure plays a pivotal role in uplifting rural livelihood and reducing poverty. Especially the construction of the Jamuna Bridge went a long way in reducing the poverty in Northwestern part of the country. The findings for the study should indicate that the construction of a bridge over Padma could also contribute to the reduction in poverty in Southern part of Bangladesh.

Second, we observe that, along with the bridge, people's access to credit should be increased. This could be provided by the NGOs or government aided agencies. Rural credit is an important plank for poverty reduction. [24]

Third, in the absence of drastic land reforms, notwithstanding its economic feasibility and political reality, reforms should be undertaken in the tenancy market.

Fourth, over the years, the share of income from remittances, for functionally landless households, has been increasing. Since migration, especially, in foreign countries is a function of human capital, initiatives should be taken to see that the poor households get access to good education.

Fifth, since farmers in the Project villages are increasingly putting in land sunder high value crops, necessary storage facilities should be created in the vicinity of the villages to help farmers earn a better return. This is not to argue that government will have to set up cold storages, but to argue that infrastructural facilities like electricity should be made available by the government to crowd in private investment.

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[24] However, reduction of financing cost would come from more active borrowing from NGOs. Discussions reveal that more NGOs were going to project areas and marginal reduction in borrowing cost was evident.

At this stage, few remarks on further steps and potential areas of studies need to be highlighted. First, there could be follow up studies to derive useful inputs to total ODA evaluation. Second, the study shows that, in case the Padma Bridge is considered, there should be a bench mark survey involving a larger sample so that future impact studies could take place. Third, some of the unique findings from the study need to be furthered through in-depth analysis e.g. reduction in transaction costs, marketing margins and trade volumes. And finally, potential areas of studies could also see whether JMBP affected environment, women's empowerment or access to natural gas.

Appendix-A

Research Methodology and Data sources

(a) Quantitative panel data

Most of the analysis at household level is based on panel data collected from sample households drawn from five villages in the northwestern side and two villages on the eastern side of the bridge. The former groups of Villages/households would, henceforth, be called "Project Villages" as they lie in areas where the Bridge is likely to impart some effects. The latter, that is, villages/households, on the eastern side would be called "Control Villages" as they have been selected to compare the situation without the bridge.

 The sample villages for the present impact assessment study stem from the basket of village/household level data generated by the Bangladesh Institute of Development Studies (BIDS) and International Rice Research Institute (IRRI) in connection with another study. The Project and Control villages were selected randomly from the list.

In 1997/98 season, before the Bridge began to operate, we visited the villages to conduct a Census of all households. The location, names and size of samples could be seen in Appendix B-D). Structured questionnaires were administered for seeking information on socio-economic and demographic indicators. The census carried out in 1997/98 gave 1,585 households. In 2003/04, the same households were approached with the same questionnaires. But due to migration and river-erosion, the size of households surveyed was reduced to 1,146 in 2003/04 (Appendix Table A).A further reduction in the number of households took place when data were prepared for a panel since some of the households had to be omitted due to bad or incomplete responses. By and large, the analysis from the panel data relates to 1,146 households. The households were classified into four land ownership groups: (1) functionally landless (up to 0.2 ha of land); (2) small landowner (0.2–1.0 ha); (3) medium landowner (1.0–2.0); and (4) large land owner (over 2.0 ha).

(*b) Rapid Rural Appraisal Method*

The present impact assessment also draws upon qualitative information. Visits and revisits were made in both 1997/98 and 2003/04 in sample villages, unions and the Thanas (lowest administrative unit) with open ended questionnaires. Discussions were held with Thana level agricultural and administrative officials block supervisors working in villages, NGOs, traders, marketing agents and local level elites to extract information about qualitative changes in the livelihood systems of the sample villages in the pre and post-JMBP periods. The qualitative

component of the research used focus group interviews to complement longitudinal survey data collected by the quantitative study. The focus group methodology was judged to be a cost effective means of building on an existing large-scale quantitative study while still maintaining a relatively large coverage and sample size that would be attractive to researchers more used to quantitative approaches.

(c) Secondary information

Besides primary data generation, the study also draws upon secondary sources of information, mostly to reflect macro perspective. Special mention may be made of the Bangladesh Bureau of Statistics (BBS) that provides regional statistics and the Asian Development Bank (ADB) sponsored "Jamuna Bridge Impact Study" (Final Report) as prepared by The Louis Berger Group, Inc (2003).

Appendix B: List of villages and size of households

Villages	District	1998	2004	Missing/dropped*
Darikamari	Bogra	173	152	21
Dhop Majgram	Pabna	251	200	51
Taghor	Rajshahi	204	173	31
Khidir	Gaibandha	300	218	82
East Ratnoir	Dinajpur	305	183	122
Shujolkor	Tangail	153	122	31
Rashidpur	Tangail	196	98	98
Total	6	1582	1146	436

*Missing due to migration or non-response; dropped due to inconsistent information.

Appendix C: Distance (Km) of sample villages from selected points

Villages	District	Link Road	Feeder Road	Highway	Jamuna Bridge	Access to Electricity
Darika mari	Bogra	<0.5	1.0	1	105	Yes (1981)
Khidir	Gaibandha	<0.5	<0.5	2	170	Yes (2003)
Teghor	Rajshahi	<0.5	<0.5	12	168	Yes (1996)
Dopmazgram	Pabna	<0.5	1.5	8	98	Yes(2003)
Rotnoir	Dinajpur	<0.5	1.0	25	250	No
Suzalkar	Tangail	<0.5	2	2	100	No
Rashaidpur	Tangail	10	10	10	40	No

Appendix-D

Study Areas

hahagram (Birol)

Malibari (Gaibanda)

Ashekpur (Bogra Sadar)

Birtara (Modhupur)

Noahata (Paba)

Katuli (Tangail Sadar)

Khetupara (Sathia)

Roads (National)
All Other Roads

Union Boundary
Study Areas (Unions)

Appendix Table 3. 1: Areas under crops (All farms)

Crops grown	Project villages		Control villages	
	1997/98	2003/04	1997/98	2003/04
	Per cent of land	Per cent of land	Per cent of land	Per cent of land
TV rice	24.54	25.12	10.82	10.35
MV rice	106.13	131.41	117.78	113.12
Wheat	16.35	7.82	6.55	3.22
Jute	4.07	2.89	14.10	11.18
Sugar cane	0.03	0.28	2.69	1.06
Oilseeds	0.52	1.15	2.26	1.59
Pulses	4.08	1.29	12.32	9.26
Potato	8.48	7.54	0.90	-
Onion	2.77	3.14	1.30	0.54
Spices	1.19	2.90	3.41	0.81
Vegetables	2.15	2.24	3.44	3.00
Mix Rabi crop	0.89	1.07	-	0.18
Other crops	-	0.29	0.47	13.34
Cultivated Land (ha)	56.35 (100.0)	57.80 (100.0)	22.54 (100.0)	23.12 (100.0)
Cropping intensity	171.56	186.77	176.03	167.66

Appendix Table 3.2: land under cultivation 1999/00 to 2003/04 (Rented Land)

Crops grown	Project Villages		Control Villages	
	Per cent of land	Per cent of land	Per cent of land	Per cent of land
	1997/98	2003/04	1997/98	2003/04
TV rice	20.54	20.20	10.81	12.44
MV rice	107.87	156.57	121.46	113.07
Wheat	11.88	7.01	5.86	1.25
Jute	2.30	2.18	10.35	7.32
Sugar cane	0.11	0.28	1.71	0.60
Oilseeds	0.79	1.22	2.14	1.02
Pulses	2.08	0.32	7.16	11.32
Potato	9.78	11.34	0.54	-
Onion	1.21	0.75	0.59	-
Spices	0.33	3.60	2.0	0.50
Vegetables	0.33	2.44	5.81	3.08
Mix Rabi crop	0.60	1.65		-
Other crops	-	1.15	0.65	5.18
Cultivated Land	19.04 (100.0)	22.9 (100.0)	6.76 (100.0)	7.86 (100.0)
Cropping intensity	157.83	208.72	169.09	155.78

Appendix Table 3.3: Areas under crops, cropping intensity and yield

Indicators	Project Villages			Control Villages		
	1997/98	2003/04	% change	1997/98	2003/04	% change
Cropping intensity	172	187	8.70	176	168	-4.50
Cropping intensity*	158	209	32.30	169	156	-7.60
Yield (ton/ha)						
TV rice	2.40	2.46	2.50	1.94	1.69	-12.90
MV rice	4.65	4.51	-3.00	4.53	4.42	-2.40
Area under MVs (%)	48	70	45.80	30	58	93.00
Area under irrigation	25	55	150.00	22	45	104.00

* Rented-in land

Appendix Table 3.4: Cultivation of land under different arrangements

Arrangement	Project village (% of cultivated land)		Control village % of cultivated land)	
	1997/98	2003/04	1997/98	2003/04
Own cultivation	67.2	60.3	70.0	64.0
Rented in	32.8	39.7	30.0	36.0
Share cropping	20.9	23.8	23.9	28.0
Fixed rent	6.8	9.6	4.0	4.6
Mortgaged	5.1	6.3	2.1	2.4
Total	100.0	100.0	100.0	100.0

Appendix Table 3.5 :Sources of Credit

Sources of credit	Project village (% of household borrowers)		Control village % of household borrowers)	
	1997/98	2003/04	1997/98	2003/04
Commercial banks	10.0	8.0	8.0	9.0
NGOs	4.2	20.2	6.0	12.0
Money lenders	15.1	3.2	15.7	10.0
Friends/relatives	17.2	11.5	18.2	12.7
All sources	46.5	42.9	47.0	43.7

Appendix Table4.1: Marketing of major agricultural products

Crops sold	Project Villages (Sales as % of total production)		Control Villages (Sales as % of total production)	
	1997/98	2003/04	1997/98	2003/04
Rice	33	41	30	36
Wheat	71	53	70	75
Pulses	68	71	57	61
Oilseeds	74	84	48	78
Potato	89	93	75	80
Onion	90	92	67	75
Vegetables	91	100	80	85
Jute	93	95	87	90
Sugar cane	95	99	98	100

Appendix Table 4.2: Marketed ratio and price variations by farm size (Rice only)

Features	Per cent of households selling rice		Per cent of output marketed		Price received (Tk/ton)	
	1997/98	2003/04	1997/98	2003/04	1997/98	2003/04
Farm size (ha)						
Up to 0.40	25	32	16	15	6025	6998
0.41 – 1.00	55	66	26	27	6000	7050
1.01-2.00	82	87	56	56	6175	7100
2.00 and above	96	94	72	78	5998	7350
Tenancy group						
Pure tenant	35	44	23	27	5950	7050
Tenant -owner	53	56	36	38	6178	7150
Owner-tenant	66	65	46	40	6150	7025
Pure owner	49	51	49	49	6000	7000

Appendix Table 4.3: Determinants of marketed supply of paddy: Regression results

Variables	1997/98			2003/04			
	Coefficient	't' value	Sig	Coefficient	't' value	Sig	
Constant	23.891	2.955	.005	-17.863	-1.912	.073	
PMVP	-0.049	-1.443	.213	.117	4.121	.003	
TOPP	1.989	16.535	.000	3.728	13.772	.002	
HSZ	-1.662	-6.311	.002	-1.210	-6.333	.000	
MVRA	0.051	3.432	.007	0.036	3.128	.030	
LOWN	1.665	2.712	.086	0.069	-1.837	.006	
EDHH	0.387	2.129	.087	0.553	2.885	.020	
DUMTNT	-4.516	-2.832	.012	-4.997	-3.225	.007	
DUMINF*	-	-	-	4.126	3.355	.032	
Adjusted R2	0.591			0.356			

*Access to electricity and good roads

Appendix Table 4.4: Input and output prices 1997/88 to 2003/04

	Project villages			Control Villages		
	1997/1998	2003/04	% change/year	1997/98	2003/04	% change/year
Outputs (Tk/maund)						
HYV rice	210	286	6.0	237	282	3.2
Wheat	294	411	6.7	329	-	-
Jute	325	374	2.5	369	346	-1.1
Sugar cane	55	50	-1.5	201	-	-
Oilseed	478	811	11.6	464	600	4.9
Pulses	369	555	8.4	753	800	1.0
Potato	133	185	6.5	133	-	-
Onion	432	444	0.46	364	-	-
Other spices	273	1045	47.1	287	303	0.9
Vegetables	191	255	5.6	285	296	0.6
Others	217	600	29.4	-	-	-
Inputs						
Urea (Tk/kg)	6.19	6.43	0.11	5.87	6.07	0.6
TSP (Tk/kg)	12.87	14.02	1.18	13.30	14.80	1.9
Wage (Tk/day)	52.0	69.0	5.4	53.46	59.63	1.9
Irrigation (Tk/ha)	4523	5088	2.1	6680	7633	2.4

Appendix Table 4.5: Price differences (Retail) between Dhaka and rural markets in Project village markets (Tk/unit)

Items	Unit	1997/98 Prices			2003/2004 Prices		
		Dhaka	Project villages	% difference	Dhaka	Project Village	% difference
Masuri (lentil)	Kg	37.53	33.5	11.7	55.02	50.00	10.0
Mustard oil	litre	58.58	50.00	15.6	71.56	62.00	13.2
Potato	Kg	7.55	6.00	25.1	10.75	9.50	13.0
Onion	Kg	17.82	18.00	1.0	22.75	16.00	42.0
Dry chilly	Kg	57.23	35.5	33.0	93.61	80.00	16.0
Kerosene	Liter	16.50	13.00	26.9	21.83	20.00	9.2
Egg	Hali	15.35	10.00	53.5	15.78	12.0	31.5
Milk	Liter	28.08	10.50	175.0	27.59	12.0	130.0

Source: For Dhaka prices, BBS (2005) and for Target villages, field surveys 1997/98 and 2003/04

Appendix Table 4.6: Perceived volume of trade expansion

Commodities	% of trade volume increase over Pre-Jamuna period		
	Maximum	Minimum	Average
Commodity flows:			
Rice	15	10	12.5
Vegetables	60	50	55
Fruits (Banana)	30	40	35
Fruits (Mango)	50	30	40
Fertilizer	20	10	15
Construction materials	50	30	40
Total	37.5	28.3	32.9
Other indicators:			
Vendors	5	10	7.5
Number of Fariahs	10	20	15
Number of shops	30	40	35
Truck fares	33	66	49.5
Trucking time	80	90	85
Number of trucks operating	75	65	70

Source: Discussions with traders, truckers, local wholesalers, toll points, ferry ghat points at Aricha and vendors in village markets.

Appendix Table 5.1: Occupation distribution of household working members, 1997/88 and 2003/04

Project Villages				[Percentage of earners]
	Primary occupation		Multiple occupation	
Occupation	1997/88	2003/04	1997/98	2003/04
Agriculture	**63.0**	**55.6**	**89.8**	**77.8**
Crop cultivation	40.3	42.9	51.7	44.2
Agricultural wage labor	26.5	10.7	33.7	32.7
Other agriculture	1.8	2.0	4.3	0.9
Non-agriculture	**37.0**	**44.4**	**46.6**	**56.0**
Trade and business	7.3	10.0	13.4	19.8
Services	10.1	12.3	13.4	16.6
Processing/industry	8.2	10.0	6.0	10.1
Construction labor	6.2	3.0	4.6	4.0
Transport operation	5.2	8.7	7.2	5.5
Total	**100.0**	**100.0**	**136.4**	**133.8**

Appendix Table 5.2: Occupation distribution of household working members, 1998 and 2004

Control Villages				[Percentage of earners]
	Primary occupation		Multiple occupation	
Occupation	1998	2004	1998	2004
Agriculture	**62.1**	**49.8**	**67.4**	**60.1**
Crop cultivation	40.9	42.0	43.1	44.9
Agricultural wage labor	19.5	6.2	22.8	12.8
Other agriculture	1.6	1.6	1.6	2.5
Non-agriculture	**37.9**	**50.2**	**46.5**	**58.3**
Trade and business	7.8	12.5	11.4	17.1
Services	9.0	13.8	9.6	13.4
Processing/industry	10.1	14.8	10.9	16.2
Construction labor	2.1	1.0	2.3	0.9
Transport operation	9.0	8.2	12.3	10.6
Total	**100.0**	**100.0**	**113.9**	**118.4**

Table 5.3: Structure of household income

Sources of income	Project Village					Control Village				
	Growth of income		Share of income (%)		Growth rate (%/Year)	Growth of income		Share of income (%)		Growth rate (%/Year)
	1997/98	2003/04	1997/98	2003/04	1997/98-2003/04	1997/98	2003/04	1997/98	2003/04	1997/98-2003/04
Agriculture	523	622	**42.5**	**44.1**	3.2	536	581	42.7	45.5	1.4
Rice farming	194	213	15.8	15.1	1.6	235	256	18.9	20.0	1.5
Non-rice crop	103	156	8.4	11.0	8.6	88	101	7.0	8.5	2.5
Non-crop agriculture	160	184	13.0	12.3	2.5	138	154	11.0	11.5	1.9
Agricultural wage	66	60	5.3	5.7	-1.5	75	70	5.5	5.5	-1.2
Non-agriculture	707	790	**57.5**	**55.9**	2.0	717	699	57.3	54.5	-0.4
Trade and business	258	261	20.8	19.1	1.2	210	191	16.8	14.9	-1.5
Services	192	200	17.0	15.7	2.5	107	130	8.5	10.1	3.6
Remittances	172	190	12.8	14.2	2.0	252	262	20.0	20.5	0.7
Other non-agriculture	85	139	6.9	6.9	10.0	148	116	11.8	-3.6	-3.6
Total income	1230	1412	100.0	100.0	2.5	1253	1280	100.0	100.0	0.4
Household size	5.45	5.30	-	-	-0.46	5.40	5.31			-0.28
Per capita income	225	266	-	-	3.0	232	241			0.64

Appendix Table 5.4: Change in the distribution of household income (Project Villages)

Ranking of households in per capita income scale	Share of per capita income (%)		Share of household income (%)	
	Pre-Jamuna period	Post-Jamuna period	Pre-Jamuna period	Post-Jamuna period
Bottom 40%	13.2	14.9	14.1	15.6
Middle 40%	34.1	36.2	33.8	36.1
Ninth decile	16.0	16.0	16.9	16.6
Top 10 per cent	36.6	33.0	34.2	30.6
Gini-Concentration co-efficient	0.448	0.434	0.449	0.410

Appendix Table 5.5: Change in the distribution of household income (Project Villages)

Ranking of households in per capita income scale	Share of agricultural income (%)		Share of non-agricultural income (%)	
	1999/00	2003/04	1999/00	2003/04
Bottom 40%	19.9	21.5	9.7	12.1
Middle 40%	36.5	38.7	31.8	35.8
Ninth decile	16.3	15.4	17.4	17.5
Top 10 per cent	27.4	25.4	41.1	34.6
Gini-Concentration co-efficient	0.339	0.324	0.490	0.467

Appendix Table 5.6: Contribution of different sources of widening income inequality, 1997/98 to 2003/04.

Sources of income	% of income from the source		Concentration of income from source		Contribution of the source to gini	
	1997/98	2003/04	1997/98	2003/04	1997/98	2003/04
Agriculture	0.589	0.441	0.316	0.328	0.184	0.145
Rice farming	0.280	0.151	0.450	0.345	0.126	0.052
Non-rice crop	0.086	0.110	0.388	0.508	0.033	0.056
Non-crop agriculture	0.116	0.123	0.247	0.333	0.029	0.041

Agricultural wage	0.107	0.057	-0.020	-0.082	-0.002	-0.005
Non-agriculture	0.411	0.559	0.515	0.478	0.212	0.267
Trade and business	0.131	0.191	0.485	0.506	0.063	0.096
Services	0.151	0.158	0.592	0.484	0.090	0.076
Remittances	0.055	0.142	0.802	0.558	0.044	0.079
Services and remittance	0.206	0.299	0.647	0.519	0.133	0.155
Other non-agriculture	0.074	0.069	0.203	0.214	0.015	0.015
Total	1.00	1.00	0.398	0.411	0.398	0.411

Appendix Table 6.1: Normative food basket and prices of different food items

Food item	Normative requirement (gm/person/day)		Calorie intake norms		Rural price (Tk/kg)			
	FAO norm	NNC norm	FAO	NNC	1997/98	1997/98	1999/00	2003/04
Rice	397	390	1386	1362	9.19	11.21	11.59	13.18
Other cereals	40	100	139	347	7.20	10.50	11.23	14.51
Tuber and vegetables	177	225	63	83	4.01	6.73	7.11	8.73
Pulses	40	30	153	115	15.37	26.22	27.15	30.97
Oils and fats	20	20	180	180	29.50	35.89	38.69	50.74
Spices	10	10	10	10	14.48	23.64	25.20	31.84
Sugar and gur	20	10	80	40	9.58	15.41	16.65	21.02
Fruits	20	50	6	15	13.79	28.21	28.78	31.13
Fish	48		51	48	28.02	44.12	47.16	59.11
Meat and eggs	12	45	14	40	40.79	61.95	66.29	83.37
Milk	58	34	38	20	10.00	14.56	15.38	18.81
Total	842	30	2120	2260				

Source: For 1997/98, 1999/00 and 203/04 from Hossain et.al (forthcoming) and author's own estimation for 1997/98.

Appendix Table 6.2: Estimates of poverty line income (Taka/person/year), 1997/98 to 2003/04

Reference year of survey	Moderate poverty line		Extreme poverty line*	
	FAO norm	NNC norm	FAO norm	NNC norm
1997/98	4609	5198	2830	3066
1997/98	6,740	7,277	1,9080	4,560
1999/00	7023	7649	4009	4385
2003/04	8332	9495	4677	5125

Note: Estimated on the basis of modified food basket of the full intake of rice, other cereals, tuber and vegetables' and 50 per cent intake of pulses, oils, spices and sugar, and zero consumption of fruits, fish and livestock production. It is assumed that the consumption of the last group of food items that the extreme poor rarely make may come from marginal self production or from common property resources.

Source: For 1997/98, 1999/00 and 203/04 from Hossain et.al (forthcoming) and author's own estimation for 1997/98.

Appendix Table 6.3a: Income Poverty using FAO norm

Poverty	Project villages			Control villages		
	Pre-Jamuna	Post-Jamuna	Change (% per year)	Pre-Jamuna	Post-Jamuna	Change (%)
Head count index (%)	48.79	41.80	- 1.75	42.66	38.36	- 2.51
Extreme poor	20.64	13.85	-8.21	15.60	13.70	- 3.04
Moderate poor	28.15	27.95	-0.17	27.06	24.66	-2.22
Poverty gap	18.54	11.65	-6.20	13.50	11.50	-2.90
Squared poverty gap	12.19	7.61	-10.00	8.82	7.57	-0.14

Appendix Table 6.3b: Income Poverty 1997/98 to 2003/04 using NNC norm

Poverty	Project villages			Control villages		
	Pre-Jaumna	Post-Jamuna	Change per year (%)	Pre-Jamuna	Post-Jamuna	Change per year (%)
Head count index (%)	52.28	46.16	-2.92	47.25	45.20	-1.10
Extreme poor	23.59	17.95	-5.98	18.35	17.35	-1.36
Moderate poor	28.69	28.21	-0.42	28.90	27.85	-0.91
Poverty gap	12.48	9.49	-3.99	9.86	9.38	-0.81
Squared poverty gap	14.84	11.29	-4.00	11.69	11.19	-0.71

Appendix Table 6.4: Rural Poverty in Bangladesh 1997/98 to 2003/04

Poverty measure	1999	2003/04
Head count index (%)	45.6	40.1
Extreme poverty	24.5	18.2
Poverty gap (%)	11.1	4.0
Squared poverty gap (%)	10.9	3.8

Source: Ministry of Finance (2006)

Appendix Table 6.5: Perception about economic conditions

Economic condition	Project Village		Control Village	
	1997/98	2003/04	1997/98	2003/04
Improved	44.87	51.47	51.38	38.36
No change	35.90	24.40	24.77	44.75
Deteriorated	19.23	24.13	23.58	16.89
Net change	8.97	27.34	27.80	21.47

Appendix Table 6.6: Changes in economic conditions by land ownership and education

Characteristics	Pre-Jamuna period			Post-Jamuna period		
	Improved	Unchanged	Deteriorated	Improved	Unchanged	Deteriorated
Land owned						
Only homestead	35.0	30.4	34.6	39.5	37.5	26.6
Up to 0.2ha	43.8	25.6	30.6	40.0	35.9	24.1
0.20 to 0.40	47.2	25.4	27.5	40.7	35.0	24.4
0.40 to 1.0	55.1	18.3	26.6	39.0	36.2	24.9
1.0 to 2.0	64.4	16.2	19.4	55.0	25.1	19.9
2.0 and above	58.6	15.2	26.3	41.6	38.2	20.2
Main sources of income						
Wage labor	34.0	32.5	33.5	32.8	40.3	26.9
Farming	46.4	22.3	31.3	40.8	34.7	24.5
Services	50.0	24.7	25.3	44.1	32.4	23.5
Trade and business	57.6	17.5	24.9	42.4	34.8	22.8
Education of household head						
No formal education	39.7	26.9	33.5	36.8	36.8	25.6
Attended primary school	45.2	22.0	32.8	38.5	38.5	23.5
Attended secondary school	53.2	**23.4**	23.4	31.4	31.4	24.8

Secondary passed	56.2	**21.9**	21.9	32.6	32.6	24.6
College and universality	66.7	**22.2**	11.0	29.1	29.1	17.2

Appendix Table 6.7: Perceptions and economic change (% of respondents)

Reasons	Improvements		Deterioration		
	First reason	Multiple response	First reason	Multiple response	
Jamuna Bridge	15.2	35.2			
Hard work	18.0	43.0	-	-	
Employment in services/job loss	15.0	23.0	-	6.2	
Business	14.0	21.0	-	-	
Improved agricultural technology	14.0	30.0	-	-	
Extra/less earning member	10.0	22.0	19.0	37.0	
Migration of member	9.0	11.0	-	-	
Extra rented in land	7.8	17.0	-	-	
Family size reduced/increased	-	49.0	16.0	44.0	
Natural calamity	-	-	8.7	15.0	
Health expenditure	-	-	15.0	24.0	
Livestock and poultry	-	8.4	-	-	
Land reduced	-	-	8.1	20.0	
Marriage related expenses	-	-	5.3	8.5	
Litigation expenses	-	-	3.1	6.0	
Educational expenses	-	-	-	4.3	
Unfavorable prices	-	-	-	3.8	
Judicious expenses	-	-	11.0	-	
Total	100.0				

Table 6.8a: Non-income indicators of poverty, 1999/00 to 2003/04 (% of households)

Indicators	Project Villages		Control Villages	
	1997/98	2003/04	1997/98	2003/04
Hunger				
Whether three meals a day	16.1	3.3	6.4	5.0
Housing				
Poor quality* house	13.1	8.2	10.1	8.2
Jhupri**	16.6	7.7	9.2	4.6
Clothing				
No winter cloth	3.5	3.1		1.8
One winter cloth	34.3	22.6	18.3	22.8
Education				
Primary (6-10)***	3.8	6.5	2.8	4.5
Secondary (10-15)***	7.5	12.9	6.9	8.1

* Earthen floor and one room, ** Earthen floor, straw roof and one room,*** Children not attending schools

Table 6.8b: Non-income indicators by land ownership groups

Socio-economic characteristics of household	Households with hungry members (%)		Households with poor quality housing (%)	
	1999/00	2003/04	1999/00	2003/04
Homestead only	28.2	6.9	18.1	12.5
	(16.2)	(8.2)	(23.5)	(18.0)
Up to 0.2	26.0	2.6	22.0	11.8
	(3.8)	(9.5)	(0.0)	(3.2)
0.2 to 0.4	9.5	2.4	9.5	4.8
	(1.9)	(0.0)	(9.4)	(7.5)
0.4 to 1.0	1.3	0.0	6.6	1.4
	(2.2)	(2.2)	(2.2)	(6.5)
1.0 to 2.0	0.0	0.0	6.1	5.9
	(0.0)	(0.0)	(0.0)	(6.7)
2.0 and above	0.0	0.0	0.0	0.0
	(0.0)	(0.0)	(0.0)	(0.0)
Total	16.1	3.3	13.1	8.2
	(6.4)	(5.0)	(10.1)	(8.2)

Note: Figures in parentheses apply for Control Villages

Table 7.1 :Determinants of Household Income: All households

Variables	2003/04				1999/00			
	Mean values	Co-efficient	't' value	Significance	Mean	Co-efficient	't' value	Significance
Mean Income	1414.325				1230.698			
Irrigated land	.3338	554.043	10.859	.000	.3415	663.334	12.789	.000
Rainfed land	.1262	288.675	3.349	.001	.1716	133.466	1.494	.136
Rented land (ha)	0.2652	297.2562	2.6591	.003	.1361	610.589	3.338	.001
Total Agric.worker	1.13	117.562	3.300	.001	1.07	67.519	1.744	.082
Total non-agric. worker	.71	313.475	8.314	.000	.77	378.752	10.188	.000
Education of worker	3.9823	7.902	1.076	.283	4.0790	14.384	1.728	.085
Agric.capiatl ($)	187.196	.733	5.547	.000	175.4950	.684	3.914	.000
Non-Agric.capital ($)	165.48	.423	9.210	.000	198.4310	.155	3.572	.000
Other infrastructure* (dum)	.8996	56.997	0.883	.378	.5799	12.090	.203	.839
Migrants (abroad) (No.)	.02	1895.723	11.656	.000	.03	336.647	2.168	.031
Migrants(home) (No)	.26	-41.303	-1.270	.204	.24	73.170	1.707	.088
NGO membership	.36	186.400	3.392	.001	.31	140.841	2.248	.025
Jamuna (dum)	.6404	57.088	1.202	.230	.6327	-25.391	-.332	.740
Adjusted R^2 F-Statistics	0.801 2044.800				0.748 135.218			

* Access to good roads and electricity

Table 7.2: Determinants of household Income: Land owning households

| Variables | 2003/04 | | | | 1999/00 | | | |
	Mean	Co-efficient	't' value	Significance	Mean	Co-efficient	't' value	Significance
Mean Income	1359				1069.569			
Irrigated land	.7130	498.565	7.976	.000	.6621	585.323	11.205	.000
Rainfed land	.2411	196.805	2.170	.031	.3080	161.530	1.575	.116
Rented land (ha)	0.129	663.456	1.956	0.04	.1218	522.203	3.648	.000
Total Agric.worker	1.29	122.826	1.970	.050	1.27	32.796	.583	.560
Total non-agric. worker	.65	356.055	5.230	.000	.70	434.071	7.281	.000
Education of worker	5.6028	2.816	.222	.825	5.4804	12.864	1.057	.291
Agric.capiatl ($)	275.3111	.790	4.142	.000	255.4386	.501	2.244	.026
Non-Agric.capital ($)	277.3947	.387	6.816	.000	308.4856	.110	2.201	.029
Other infrastructure* (dum)	.8913	96.347	.803	.423	.5638	-11.674	-.125	.901
Migrants (abroad) (No.)	.04	2282.906	9.943	.000	.04	515.271	2.226	.027
Migrants(home) (No)	.36	13.887	.285	.676	.38	105.460	2.078	.059
NGO membership	.24	108.153	1.043	.298	.24	184.223	1.787	.075
Jamuna (dum)	.6519	48.335	.320	.603	.5839	-29.348	-.497	.567
Adjusted R^2 F-statisitcs	0.844 125.768				0.804 95.028			

*Access to electricity and good roads

Appendix Table: 7.3: Determinant of Household Income: Functionally Landless Households

Variables	2003/04				1999/00			
	Mean	Co-efficient	't' value	Significance	Mean	Co-efficient	't' value	Significance
Mean Income	920.6921				649.2492			
Irrigated land	.0196	513.166	.710	.478	.0121	650.605	.541	.589
Rainfed land	.0309	3530.762	3.383	.001	.0315	-178.120	-.160	.873
Rented land (ha)	0.3252	485.9631	3.568	.0356	.1508	68.125	.425	.671
Total Agric.worker	1.00	73.156	1.777	.076	.87	108.773	1.872	.062
Total non-agric. worker	.76	254.026	5.929	.000	.84	352.636	7.202	.000
Education of worker	2.6391	4.824	.520	.603	2.6389	7.532	.639	.524
Agric.capiatl ($)	114.1636	.529	2.776	.006	93.346	1.134	3.648	.000
Non-Agric.capital ($)	72.7291	.629	4.630	.000	85.3404	.584	4.080	.000
Other infrastructure* (dum)	.9009	4.009	.055	.956	.5966	32.224	.434	.665
Migrants (abroad) (No.)	.01	1103.875	3.871	.000	.02	-28.050	-.137	.891
Migrants(home) (No)	.19	-27.732	-.536	.592	.10	-186.531	-1.728	.085
NGO membership	.46	211.818	13.579	.000	.39	63.783	.854	.394
Jamuna (dum)	.6607	119.894	1.938	.054	.6828	53.116	.724	.469
Adjusted R^2	0.662				0.568			

*Access to electricity and good roads

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ATTACHMENT 1
JAMUNA BRIDGE IMPACT STUDY:
BENCHMARK SURVEY 2004

ID	L	IS	NG	Area

Converted

QUESTIONNAIRE

RESPONDENT IDENTIFICATION *
Name of Household Head: ……………………………………………………………………
Name of Respondent: …………………………………………………………………
Relation with Household Head: ………………………………………………………...
Name of Father of Respondent: ………………………………………………………...
Address: …………………………………………………………………………………
Village: ………………………………… Union: ……………………………………
Thana: ………………………………. District: …………………………………

WORKED RECORD

	Interviewed	Edited by	Verified by	Computerized by	Validated by
Name					
Date					

* If the household is not found, show reasons in details

MODULE ONE
Infrastructural Situation of the Village (Discuss with Villagers)

1.1 Distances of Village

From where	Distance (k.m.)	Road Description (Code)*	Way of communication (Code)**	Time (hr.)	Fare (tk.)
Dhaka					
District					
Thana					
Highway					
Feeder Road					
Local Market					
Hospital/Clinic					
Post Office					
High School					
College					
Bank					

* Kacha Road =1, Brick soling =2, Paved Feeder Road =3
** On Foot =1, Rickshaw/Van/Cycle =2, Bus/Tempu =3, Boat =4, Others=5

1.2 Wage rate in Village (Busy Season)

Sectors	Without Lunch			With Lunch		
	Hour	Current Rate (Taka)	Five years Ago	Hour	Current Rate (Taka)	Five years Ago
Agriculture:						
Male						
Female						
Child*						
Non-Agriculture:						
Male						
Female						
Child**						

* Five years ago, that is, before the opening of Jamuna Bridge in 1998
** Under 15 years old

1.3 Current price (taka) of different commodities in the local market:

Commodity	Unit	Maximum	Minimum	Average
Agricultural Items				
Urea				
TSP				
Diesel				
Agricultural Product				
Coarse Rice				
Fine Rice				
Wheat/Flower				
Vegetables				
Lentil				

1.4 Price of Land in the village (per decimal, taka)

Type of land	Price (per decimal, taka)	
	Near Road	Far from Road
Agricultural land: Single crop		
Agricultural land: Double Crop		
Agricultural land: Triple crop		
Homestead land		
Commercial land		

1.5 Local industrial and other activities after opening of Jamuna Bridge

	Number		Use of Product/ Buy and sale	
	Now	Before	Now	Before
1. Cold Storage				
2. Market: Wholesale Retail				
3. NGO				
4. Industry: Small Medium Large				
5. Agricultural Processing				
6. Others (Office etc.)				

1.6 Describe cropping pattern in this village. If there is any change in this pattern during last five years, then write it in brief. Describe the cropping pattern before and after Jamuna Bridge and its impact on Crops.

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MODULE TWO
Infrastructural Condition of Household

2.1 Materials of main house. Roof …… Wall …… Floor ……
   (Soil =1, Tin =2, Pave =3, Bamboo/cane =4, straw/jute straw =5, Tally=6)

2.2 Current price of house Taka …………….

2.3 Development of homestead and house for last five years …….
   (Has developed =1, No development =2, Remain same =3)

2.4 Has electricity in the household? ………
   (Yes=1, No=2)

2.5 If yes, year of electrification ………

2.6 Has there been any change in economic condition of your household during
   last five years? ………..
   (Significant improvement =1, moderate improvement =2, unchanged =3, deteriorated =4)

2.7 If improvement occured, reasons are:
   a. ………………………………….
   b. ………………………………….
   c. ………………………………….

2.8 If deteriorated, reasons are:
   a. ………………………………….
   b. ………………………………….
   c. ………………………………….

2.9 Is there any member of household living outside on temporary basis? …….
   (Yes =1, No =2)
   Outside the district …….. nos.   Outside the country ……….nos.
   What is the purposes? Outside the district ……..   Outside the country
   ……….

2.10 How much money they (members who live temporary basis) usually send in
   a year?
   Outside the district …….. (taka) Outside the country …….(taka) Total …….

2.11 Last year, did you have any leased in /leased out land? Yes =1, No =2

2.12 Condition of leased in /leased out land: (percent of land)
   a. Share cropping (Share of Crops)
   b. Seasonal lease
   c. Yearly lease
   d. Khaikhalashi lease
   e. Daishuddhi lease
   f. Total percent

2.13 Is there any change in land leasing system during the last couple of years? If
   yes, describe type and reasons.

2.14 if yes, discuss the effect of change:
    a. on land owner

…………………………………………………………………………………

…...

    b. on farmer

…………………………………………………………………………………

…...

2.15 How much you had to spend to purchase agricultural materials during last boro seasons? (Taka/Acre)

Sources	Unit	Current		Five years ago		
1. Seed						
2. Plant						
3. Urea						
4. TSP						
5. SSP						
6. MP						
7. Irrigation						
8. Other agri. tool rent						
9. Draft animal						
10. Insecticide						
11. Agri. Labour Rent Self Total						

MODULE THREE
3.1 Information on members of household

Name	Relation with HHH	Gender Female =1 Male=2	Age (years)	Marital Status	Age at marriage	Education (Class/Grade)	Main Occupation			Secondary occupation			Health condition	Diseases last month	Yearly expenses for health	Vaccination (if under 5) yes=1 No=2	Winter cloth yes=1 No=2	Yearly expenses for education
							Code	Months in year	Days in month	Code	Months in year	Days in month						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Total household members: ……

Relation with Household head		Marital Status	Health Condition
01 = Household head	09 = Relative from mother side	Unmarried =1	Invalid =1
02 =Wife/husband	10 = Relatives from father side 11 =	Married =2	Suffer from diseases frequently =2
03 = Own child	Relatives from brother/sister side	Widow/ =3	Suffer from diseases but not frequently =3
04 = Step child	12 = Relatives from wife side	Divorced =4	No sufferings from diseases =4
05 = Sister/brother	13 = husband of daughter	Separated =5	
06 = Parents	14 = House master		** Put 88 if student
07 = Wife of son/nephew	15 = Sheltered		** Put 99 if not go to school
08 = Nephew/ niece			** Put 00 school going aged

MODULE FOUR

4.1 Information on land of household

Plot #	Land (in decimal)	Sources of land	Site of land	Scope of irrigation	Uses of land	Boro 2003		Aus 2003		Amon 2003	
						Crop code	Production (40 kg)	Crop code	Production (40 kg)	Crop code	Production (40 kg)
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											

Sources of land	Site of land	Scope of Irrigation	Use of land
Inheritance=1 Purchase =2 By marriage =3 Captured=4 Khash (Govt.) land =5 Rented in=6 Leased out =7 Lease in =8	High land=1 Medium land=2 Low land=3 Very much low land=4	No irrigation facility=1 Local irrigation=2 Pump=3 BWDB=4 Cannel=5 DTW=6 STW=7 Have irrigation facility but not given=8	Homestead=1 Jungle=2 Other fruits garden=3 Pond=4 Cultivated=5 Rented out=6 Lased out=7 Other arrangment=8 Rented in=9 Rented in other arrangement=10 Mortgage in=11 Jungle/grave yard=12

MODULE FIVE
Information on Assets

Assets	Current		1998	
	Numbers	Price	Numbers	Price
a. Animal Assets				
Cow				
Calf				
Bullock/cow (Draft)				
Buffalo				
Goats/sheep				
Duck/Chicken				
b. Transport				
Cycle				
Motor Cycle				
Boat				
Engine Boat				
Rickshaw/Van				
Push Cart				
Bullock Cart				
c. Others				
Handloom				
Fishing Net				
Pulling Net				
Pottery				
d. Modern Instrument				
Power Tiller				
Shallow Machine				
Thresher				
Spray Machine				
Rice Machine				
Capital for Business				

MODULE SIX
Information on production and income (Last year or last three seasons)

a. Agriculture

Sources of production / income	Unit Mond/Kg/Nos/Lts	Total (in taka)	Sell in market (taka)
Crops type			
Total Paddy (Local+ Rice)			
Wheat			
Maize /other cereals			
Cash crop			
Jute			
Sugarcane			
Tobacco			
Total fruits:			
Mango			
Banana			
Papaya			
Pineapple			
Total vegetables			
Potato			
Gourd			
Tomato			
Cucumber			
Carrot			
Bean			
Khira			
Bitter Gourd			
Other vegetable			
Total Lentil			
Moshuri			
Kheshari			
Sola			
Mug			
Others			
Total Spices:			
Ginger			
Chilly			
Onion			
Garlic			
Other			
Total oil seed			
Sharisha			
Tishi			
Others			
Non crop agricultural:			
Total Fish			
Pond/Cannel			
River			

Dry Fish				
Total livestock/product:				
Milk				
Meat				
Egg				
Forest:				
Bamboo				
Wood				
Fire wood				
Others				

b. Income from agricultural labour

Source	Engaged member	Highest education	Months in year	Days in month	Average hours in a day	Approx. income (taka)
Daily labour						
Permanent labour						
Contract labour						

c. Non-agricultural production/income

Source	Engaged member	Highest education	Months in year	Days in month	Average hours in a day	Approx. income (taka)
Cottage						
Self business /shop /workshop						
Transport Operator						
Rickshaw puller						
Van/Tempu						
Engine boat						
Boat						
Cow-Car						
Construction/repairing contractor						
House construction /repairing						
Road Construction /repairing						
Non-agricultural Labour						
Industrial labour						
Workshop labour						
Transport labour						
House construction /repairing labour						
Road Construction /repairing labour						
Other labour (earthen)						
Income from occupation						
Teaching /Imam /Doctor etc.						
Govt. or Non Govt. Job						

Others job						
Rent						
House /Shop rent		95				
Pump/ Shallow/ Deep tubewell/ Tractor						
Land						
Others						
Remittance						
Getting Loan						
Return of loan						
Gift from relatives						
Relief /VGD						
Land sale						
Other assets sale						

MODULE SEVEN

7.1 Investment made during last one year

Source	
Residence:	
House construction	
House maintenance	
Agriculture:	
Gola/goal construction/maintenance	
Purchase of Rice depot/goal-ghar	
Land development	
Purchase/repairing of Agri. Machineries	
Purchase of Plants	
Purchase of Land	
Pond construction/development	
Purchase of Cow/Bullock/ buffalos	
Purchase of duck/chicken	
Purchase of transport/machineries	
Repairing of transport/machineries	
Trade/Business	

7.2 Loss of capital

Source	amount	Sale price	Reason of deficit
Land sale (decimal)			
Jewelry item sale			
Sale of used machineries			
Sale of vehicle			
Others assets sale			

(1=Medical, 2=education, 3=going abroad, 4=Marriage, 5=trade & business, 6=Economic crisis 7=others)

7.3 How much have you spent to accommodate your household needs during last year? ……
taka.

7.4 Please mention the sources of these expenses.

Source	% of total expenses	% in Five years ago	Comment about changes
Rice/wheat Vegetables Milk/egg/meat Spices/oil/salt Education Medication Cloths/shoes Fertilizer/seed/water Hire of labour Hire of Machine/cows Others			
Total	100%	100%	

MODULE EIGHT
Food security questions

8.1 How many days have you had your meal last week? (please put tick mark)

Food	One time	Two times	Three times
Rice and fried fish			
Rice/vegetables/Vorta			
Rice/dal			
Bread			
Vegetables			
Egg			
Fish			
Meat			
Milk			
Fruits			

8.2 Have your capability to face the lean seasons during the last five years increased? ………
  (increased =1, decreased =2, constant =3)

8.3 Give supportive arguments behind the above position
      1. ………………………
      2. ………………………
      3. ………………………

8.4 Information of crops except rice (last couple of years)

	Last year					Five years ago				
	Total land (dec.)	Production	Use production (%)			Total land (dec.)	Production	Use production (%)		
			Consumption	Sale	Damage			Consumption	Sale	Damage
Vegetables (except potato)										
Potato										
Onion										
Spices										
Oil										
Fruits										

8.5 What are the changes occurred in producing and marketing the above crops?

Crops	Unit	Where & how it is sold		Income of family from product (increased=1, decreased=2, constant=3
		Current	Five yrs ago	
Vegetables (except potato)				
Potato				
Onion				
Spices				
Oil				
Fruits				
Fish				
Meat				
Milk type				
Egg				

8.6 What changes would you notice in production, marketing and other aspects of these crops over the years?

8.7 Does this household own any business?

If yes, give details (e.g. fertilizer, paddy business etc)

Type of business/ mention name	Invested Capital		Additional capital invested last year	
	Source	Quantity (taka)	Source	Quantity (taka)
1.				
2.				
3.				

(Source: Bank=1, NGO=2, Mohagon=3, self savins=4, Land sale=5, Land lease=6, Cow sale=7, other asset sale=8, remittance=9, ….=10)

8.8 Mention trends and reasons of your business during last couple of years.

8.9 If any family disasters last 5-6 years, give reasons.
   Any disaster or accident in your family. Yes=1, No=2

8.10 if yes,

Type of disaster	Approx. damage	How faced*
1. Earning member death 2. Earning member lay 3. House destroyed by Flood/cyclone 4. Robbery 5. Death of Bullock 6. Case on Assets 7. Death of female member/insult 8. Others		

(* 1. Land sale, 2. Domestic animal sale, 3. Tree sale, 4. Land lease, 5. Other assets lease, 6. Self savings, 7. Gift from relatives, 8. Loan, 9. product sale, 10. Help relief, 11. Others)

8.11 Mention the changes that occur due to construction of Jamuna Bridge in your locality.

    a. Agricultural sector   1………………… 2……………….. 3……………………
    b. Industrial sector   1………………… 2……………….. 3……………………
    c. Business sector   1………………… 2……………….. 3……………………
    d. Communication sector 1………………… 2……………….. 3……………………
    e. Price of commodities   1………………… 2……………….. 3……………………
    f. Others   1………………… 2……………….. 3……………………

8.12 What is the effect of construction of Jamuna Bridge on your family? …….
        No changes=1, Improve=2, deteriorated =3

8.13 If improve, mention three main reasons:

1. …………………………………………………………………………………………..
2. …………………………………………………………………………………………..
3. …………………………………………………………………………………………..

8.14 If deteriorated, mention three main reasons:

1. …………………………………………………………………………………………..
2. …………………………………………………………………………………………..
3. …………………………………………………………………………………………..

8.15 In traditional way, we can divide families of village in three categories, such as, rich, middle, poor. In which category you may identify your family? ……….
(Rich=1, middle=2, poor=3)

ATTACHMENT 2

REPLIES TO COMMENTS FROM PARTICIPANTS IN VIDEO CONFERENCE HELD ON 11 DECEMBER 2006 AT BRAC UNIVERSITY

A. From ADB:

Q. Is there any enumerator bias? How could that be solved?

Ans: It is possible that there is enumerator bias since the same enumerators were not used for two surveys. In fact, that bias should not pose a serious problems since same households were interviewed with the same structured questionnaires and data set were edited and complied by same groups of people.

Q. How accurate are income figures from recall method?

Ans: Income figures are not based on recall methods. Total income is estimated as total production of goods and services produced by the household in the preceding season. The reported output had been cross checked with the amount of land, labor and capital that the household was endowed with.

Q. Is the compared income figures nominal or constant?

Ans: To turn the figures real, we have used income figures in US $ for respective periods. This should take into account of the inflationary psychosis, if any. Of course, we could also use CPI index to deflate the figures. But available empirical studies also use income figures in US $ for a comparison across periods.

Q. Is the dummy for infrastructure used in regression practicable?

Ans: Yes, it is. We have used 1 for the access to the bridge and 0 for no access. We have also taken into account all factors that go to influence income of households. The dummy variable thus provides us with the net contribution of the bridge, leaving others constant.

B. From Koyabashi, JBIC and others

Q. Please clarify 'target' and 'control' villages. How close are they to be compared?

Ans: Target or project villages are those that are assumed to be affected by the operation of the JMBP. For example, a village in northern part of the country. On the other hand, control villages are those that remain unaffected by the operation of JMBP. In terms of agro-ecological and socio-economic parameters, the villages are very close.

Q. What is the basis of the sample selection?

Ans: The International Rice Research Institute (IRRI) has a basket of sample of 62 villages in Bangladesh drawn randomly and keeping in view the agro-ecological conditions. WE have used that sample basket to draw the sample for our study. For example, from the list of villages in northern districts (to be affected by JMBP), we have randomly selected five

villages. Likewise, from the list of villages in the eastern part, we have selected two villages randomly. Of course, in selecting villages from eastern part, we tried to choose them from as close to Jamuna river as possible since that would ensure closeness of villages.

Q. Why domestic migration has negative impact on household income?

Ans: It could be due to the fact that, generally, domestic migrants migrate with families and stop sending money to the household. Non-migrant members provide money to households for various expenses and hence the negative relationship.

Q. How to land on hypothesis from the logic model? That is, how could we discern the logical outcome of events?

Ans: In the revised version, we have tried to reach the hypotheses from the logical layout. IN other words, the logical consequences emerged out as plausible hypotheses for the study.

Q. Why lower school attendance in project villages?

Ans: Perhaps, it is because the opening of the bridge boosted income earning opportunities so fast that households went to maximize income even by using child labor. It may so happen that with increased income and better household conditions, the school attendance rate might go up in future.

Q. Why cropping intensity/yield is lower in control villages?

Ans: Cropping intensity is a function of many variables. One of the important element is extension and market opportunities. Both have increased in project villages.

Comments on potential areas of studies with which the author has no disagreement:

  (a) In depth studies on marketing margin and transaction costs
  (b) Follow up studies
  (c) Studies on the impact on environment, sustainability.