Essays on Development Economics

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Abstract

This dissertation is a collection of three independent papers in empirical development economics. The first chapter studies the effect of a family planning program in Bangladesh, which successfully reduced fertility, on households' asset accumulation. In developing countries parents expect their children to take care of them when they are old. Children also help parents to smooth consumption over their life cycle. They send remittances when parents are old and have relatively low income. The chapter presents a model where asset accumulation and children are substitutes, and finds that households exposed to a family planning program have lower fertility and more assets than those who were not exposed to the program.

Chapter 2 examines effect of the same program on female autonomy. Policy makers and planners often view family planning programs (FPP) as being conducive to female autonomy. They argue that when women have fewer children they can earn more income and enjoy more property rights, higher mobility and greater decision making power inside and outside the household. But this may not be true in all situations. Using household data from 142 villages in Bangladesh this paper shows that although a family planning program reduces women's fertility and thereby allows them to enjoy higher levels of private consumption through expanding their outside opportunities, it significantly reduces their decision making power within the household. A simple analytical model is presented to reconcile this empirical evidence.

Finally chapter 3 explores the macroeconomic usage of aid using panel data for a broad sample of aid-recipients. An increase in aid must go toward a reduction in the current account balance (in which case there is a real transfer of resources from donor to recipient and aid is said to be *absorbed*), an increase in capital outflows, or into international reserves. We find that short-run absorption is typically very low. While absorption increases in the long-run, it is still significantly less than complete and only a tiny fraction of the absorbed aid dollars go towards investment. It is likely that the remaining aid is lost through the capital account. Moreover, aid *spending*, defined in terms of the increase in government fiscal expenditures as a result of aid, is significantly greater than aid absorption, implying that aid systematically leads to an injection of domestic liquidity in recipient economies, with possible adverse consequences for macroeconomic management. The evidence marshaled here may help illuminate the rather weak link between aid and growth found in the literature.

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To my parents and Ashiq

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Contents

Chapter 1

Are Children Substitutes for Assets? Evidence from Rural Bangladesh

1.1 Introduction

In many developing countries the social norm entails children to look after their old parents. Children help parents to smooth consumption over their life cycle by sending remittances to their parents at the end of their lives when they have relatively low income. Thus savings by parents in old age come from two alternative sources – through children who support them in their old age and through asset accumulation. There is some degree of substitutability between the two and private household savings may decline with increases in the number of surviving children (Coale and Hoover, 1958).

There has been a large literature on fertility, old age security and private savings. Most of this literature tests whether or not the provision of some type of old age security leads couples to demand fewer children. Hohm (1975) finds that the existence of social security system and the benefit level are associated with lower fertility rates, controlling for income per capita and child

mortality. But critics have found other indices of modernization that, once introduced in these regressions, make the social security variable insignificant. They could not also find any relationship between the timing of the introduction of social security system in various countries and the year when fertility actually started to decline[1].

There is also some macro evidence in the same line of research. Boldrin, Nardi and Jones (2003) use two types of model to measure the impact of public pension schemes on fertility. Using the Barro and Becker (1989) model they find that this impact depends upon the cost of bearing children and the effect is always very small. The second model (Boldrin and Jones, 2002) predicts a decline in fertility with old age insurance plan and is corroborated by data.

Some other studies that try to measure the relationship among fertility and savings are Jensen (1990) and Raut (1990). Jensen (1990) finds a positive relationship between non-child support in the old-age and use of contraception in Indonesia. Raut (1992) also finds a negative partial correlation between fertility and wealth. But the direction of causality in these studies is unclear. Household fertility decisions depend on a variety of factors including wealth and old age security. And household savings decision can be influenced by fertility choices. Therefore to measure the impact of fertility on asset accumulation one needs to instrument fertility. One such instrument is a randomized program that has significant impact on household's fertility decision. Ridker (1980) claims that there has been one such experiment in the South Indian tea estates. Pension payments were provided to all women in 18 tea estates. He finds that fertility declined from 1971 to 1977 among the women workers in the treatment estates compared to those in the control estates. But the problem is that the decline in fertility could be due to women's empowerment caused by their increased old age income. A similar increase in male old age income might not produce the same results. Moreover the tea estates were not actually randomly chosen.

All these studies explore one implication of the interrelationship between fertility and savings: the impact of alternative ways of savings on fertility. But they don't say whether or not parents save more for themselves when they have fewer children, in the absence of these other means. There is basically a more than one way relationship among fertility, savings and old age insurance. One is that parents have fewer kids and save less in the presence of a well developed

[1] Some other similar cross section studies are National Academy (1971), Friedlander and Silver (1967), and Hohm (1975).

old age social security system. But in the absence of the social security system they may save more when they decide to have fewer children. While the first link is well explored in the literature there has been hardly any study examining the second one. This paper explores this second channel.

There have been numerous family planning programs in different countries of the world since 1950s. But the causal effects of family planning programs on fertility and other household decisions have not yet been effectively measured. This is because family planning decisions are related to other observed and unobserved determinants of fertility and the programs were often targeted to specific groups making evaluation difficult. In this paper I will use a family planning program introduced in a rural area of Bangladesh that was implemented in ways to facilitate scientific evaluation. This program had substantial effect on fertility of the treatment households and therefore will provide a good instrument for fertility. With this instrument in hand I would like to address the issue of whether or not parents save more when the cost of fertility drops exogenously and they have fewer children.

The program was implemented by the International Centre for Diarrhea Disease Research, Bangladesh (ICDDR,B), formerly the Cholera Research Laboratory in a rural area of Bangladesh called *Matlab*. This centre has launched several family planning programs since 1974, which reduced the average fertility rate in the program areas significantly compared to that in the control area. The program was implemented in 70 villages and used 72 villages in the same area as control. While the treatment and control villages were not randomly selected there is no evidence that they were systematically different before the program started.

Bangladesh has no social security plan for the elderly. Besides, there is no public or private health insurance scheme for them. And the credit market in the rural areas is mostly informal where the interest rates are exorbitant. Therefore parents depend on their children for old age consumption. In the presence of a successful family planning program these households will have fewer children and should therefore save more for their old age consumption as they would expect to receive smaller amount of transfer from their children compared to the households who do not have access to such a program. The program also allows one to check the fact that the change in households' asset level was not simply mechanical or just time effect but a result of households' conscious decision. It shows that those who were not affected by the FPP in

the program villages (cohort aged>50 when the program started) are not richer than their counterparts in the control villages.

The rest of the paper is organized as follows: section 1.2 discusses the family planning programs launched in *Matlab*. Section 1.3 describes a simple model of households where fertility and savings are jointly determined. It shows that savings and children are substitutes as far as old age consumption is concerned. Section 1.4 describes the data and empirical strategy. The next section presents the main results of the paper. Section 1.6 discusses the robustness of the estimates. Finally conclusions of the paper are presented in section 1.7.

1.2 The Family Planning Program in *Matlab*

1.2.1 Background

Matlab is a rural area of Bangladesh where socioeconomic conditions were not conducive to a decline in fertility. It is located about 55km southeast of the capital city of Bangladesh (figure 1). Two big rivers Padma and Meghna, their branches, streams and channels crisscross this regularly flooded area. Tropic of Cancer passes through it. There are no paved roads except the seven mile one connecting *Matlab Bazaar* with *Chandpur*. People travel on foot. During the monsoon all the footpaths go under water. Country boats are the only means of transportation at that time. In 1996 average population per village was about 1100. Population density was one of the highest in the world – more than 1500 per square mile. In each village households are grouped into *baris* (figure 2). '*Bari literally means a "homestead", but commonly refers to a group of households sharing the same courtyard.....Each bari or homestead may contain one or more joint or nuclear families*' (Fauveau, 1994). *Bari* is the economic and social unit in Matlab and in many parts of rural Bangladesh.

Matlab was a highly impoverished area when the ICDDR,B started its activities here. Over the period of 1974-76 it experienced a severe famine and crop failure. The fast increase in population resulted in diminishing returns to labor in agriculture. Real agricultural wage fell below the 1890s level and it had been accompanied by a decline in per capita calorie intake and increased landlessness. It was one of the most Cholera prone areas in Bangladesh and in 1963, 23 villages in the *Matlab thana* and its vicinity were taken under field trial by the Cholera Research

Lab (CRL). There have been five cholera vaccine trials until 1985-89. By 1974 about 263000 people of 233 villages were covered by the studies.

1.2.2 Family Planning and Maternal and Child Health Services in Matlab

Though initially all field studies were designed to test cholera vaccines, a major shift in research strategy occurred in 1975 with the launch of the CDP (Contraceptive Distribution Project). There have been several projects related to family planning, maternal and child health care since then.

The first non-government family planning program in *Matlab* started with the distribution of contraceptives to households. The ICDDR,B divided the area of Matlab *thana* into two groups. The program was launched in one group of 150 villages. The comparison group had 84 villages. 150 midwives were selected to distribute oral pills and condoms. These midwives had no medical training whatsoever. After the program was initiated contraceptive use increased from 1% to 18% among all eligible couples in the treatment villages. But it returned to initial level after the distribution stopped. Learning from the mistakes of CDP the ICDDR,B undertook an extensive family planning program in 70 villages in *Matlab* in 1977. There were 72 control villages under the program (figure 3). The treatment villages were drawn equally from the CDP and non-CDP villages and they were divided into four blocks – A, B, C and D. The control area was also divided into two blocks – E and F. Between the two blocks only E had the CDP. By 1978 each block in the treatment area had its own sub-centre clinic housed in the Union Council Community Centers. Each of these clinics provided family planning related services to a population of about 20,000. This time the ICDDR,B recruited young, married women, who had some level of education and used contraceptives themselves, as Community Health Workers (CHWs). They distributed a range of contraceptive methods (oral pills, condoms, injectables, spermicides). These CHWs were backed by female paramedics who had 18 months training in family planning and maternal-child health care. The sub-centre clinics had adequate drugs and equipment to treat common diseases and problems related to family planning. Besides the ICDDR,B's family planning program there were regular government family planning program in both treatment and control villages. The government had 10 union level health centers operating in *Matlab*.

In 1986 the ICDDR,B launched a third program which was an integrated maternal and child health and family planning program in the four treatment blocks. It provided maternity care, vitamin A supplementation, nutrition rehabilitation and control for respiratory infections and dysenteric diarrhea. But the program was not that effective. In 1989 the maternal mortality ratio and the induced child abortion were the same in treatment and control areas.

1. 3 Theoretical Framework

1.3.1 Model

The theoretical framework for this paper follows Schultz (2004). The theory of old age security motive for children treats the children as a means of inter-temporal transfer. Children are a mechanism through which parents receive income and support during retirement age when their income is relatively low. This means that children are an alternative form of monetary savings and for parents both serve the same end. Therefore, when households experience a fertility transition and have fewer children the marginal value of savings increases, all other things being equal. Parents should increase monetary savings in response to such an increase.

In this paper I will use a model where parents jointly decide how much to save, how many children to have and how much to spend on each children. Their decision will in turn reflect that as far as old age consumption is concerned, children and savings are substitutes. And this result follows from their optimization behavior. In the model the households live for two periods. Households have a utility function defined over consumption in their young and old age:

$$U = v(c^1_t) + \beta v(c^2_t) \qquad (I)$$

c^1_t and c^2_t are consumptions of generation t household in young and old age respectively. β is the time preference. The utility function is given by $v(c) = \frac{c^{1-\rho}}{1-\rho}$. Households maximize utility

subject to the following budget constraints:

$$c^1_t = (1 - a)\, w_t - n_t \theta_t - s_t \qquad (II)$$

$$c^2_t = (1 + r)s_t + a w_{t+1}(\theta_t)\, n_t \qquad (III)$$

Consumption in the first period depends on household's wage income w_t, the fraction of wage it transfers to parents a, how much it spends on each child θ_t, how many children it has n_t and its savings s_t. Here θ includes the expenditure on goods and services required to feed, clothe, shelter and educate a child, i.e., investment in child's human capital. In this sense Θ is a measure of the child's level of physical and human capital. Consumption in period 2 depends on the interest rate r earned on first period savings and the amount of transfer from children. Total transfer from children depends on the number of children n_t, the wage w_{t+1} and the fraction a. In the model a is assumed to be constant to keep things simple. Households maximize (I) subject to (II) and (III) and jointly decide s_t, n_t and θ_t. For any generation t household w_t is given because it depends on θ_{t-1}, which is a choice variable for their parents. We assume that w_{t+1} is an increasing function of θ_t, with $w_{t+1}'(\theta_t) > 0$ and $w_{t+1}''(\theta_t) < 0$. Suppose $w_{t+1}(\theta_t) = w_0 log(\theta_t)$ and $\mu = (\beta(1+r))^{1/\rho}$. Then the first order conditions of the household's optimization problem yield the following relationship where s_t and n_t are jointly determined.

$$s_t = \frac{\mu(1-a)w_t}{1+r+\mu} - \frac{n_t[\frac{\mu a w_0}{(1+r)} + a w_0 \log\frac{a w_0}{(1+r)}]}{1+r+\mu} \qquad \text{(IV)}$$

Equation (IV) clearly implies that monetary savings and children are substitutes as $ds_t/dn_t < 0$. Therefore if parents have fewer children in response to the family planning program they will save more for themselves in a society where children are viewed as one of the means to old age security.

Schultz (1969) recognizes three principal determinants of fertility – the family size goal, child mortality and uncertainty. How many children parents want depends on the relative costs and benefits of children in any particular society. The relevant factors affecting the cost of bearing children are opportunity cost of women's time spent in child rearing, value of child labor, family income, education, institution and contraception. Parents will have more children if it is expensive to acquire and evaluate information on alternative methods of contraception. Besides, if the contraceptives are also expensive parents may decide not to opt for it. Therefore, a family planning program that provides free and accurate information on alternative methods of contraception and also supplies contraceptives for free may reduce fertility and thereby increase savings. We can write n_t as a function of q_t and p, where q_t is the cost of contraception and p stands for all other determinants of fertility.

$n_t = n(q_t, p)$

And equation (IV) can be rewritten as

$$s_t = \frac{\mu(1-a)w_t}{1+r+\mu} - \frac{n(q,p)[\frac{\mu a w_0}{(1+r)} + a w_0 \log \frac{a w_0}{(1+r)}]}{1+r+\mu} \qquad \text{(V)}$$

From equation (V) we have $ds/dq = (ds/dn)/(dn/dq)$. $ds/dn < 0$ and $dn/dq > 0$ as parents have fewer children when a family planning program reduces the cost of contraception. Therefore, ds/dq < 0: a family planning program that reduces fertility results in higher savings.

The model has three testable predictions. First, family planning program should reduce the cost of abstinence and reduce fertility i.e. $dn/dq > 0$. Secondly, parents who experience this fertility transition will expect smaller remittances from their children. Total remittance from children is $aw_{t+1}(\theta_t)\, n_t$. When n_t declines, for given a and w_{t+1}, total transfer from children decreases. The third prediction is that parents will save more for themselves when they have fewer children, i.e., there is a negative relationship between fertility and savings.

However the model has some limitations. First of all, it does not allow for quantity-quality trade-off. Usually when parents have fewer children they spend more per child giving them more education which improves the quality of their lives. But in the model θ_t, i.e., expenditure per child is constant. It does not depend on the number of children parents have. This comes from the functional form assumed for $w_{t+1}(\theta_t)$. However with some other functional form it is possible to make expenditure per child depend on the number of children. This will not change the main results of the model but will make it complicated. Therefore, I prefer to leave things as they are.

Secondly, it assumes that the fraction of wage remitted by a child is constant across generations and for all children. But in reality remittance per child varies and it depends on a variety of factors such as education of the child, distance from home, income etc. A more educated child will earn a higher income which may increase remittance per child and also total remittance. But more educated children are also more likely to migrate to other places which may weaken the bond between parents and children and reduce the fraction of wage they send back to their parents. Therefore the second prediction of the model may still hold.

1.4 Data and Empirical Strategy

1.4.1 MHSS Data

This paper uses the Matlab Health and Socio-economic Survey (MHSS) data. The MHSS was carried out in 1996 in Matlab, funded by a Grant from the National Institute on Aging and was a collaborative effort of RAND, the Harvard School of Public Health, the University of Pennsylvania, the University of Colorado at Boulder, Brown University, Mitra and Associates and the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). The MHSS consists of four different surveys that have different samples.

In the Main or Primary Survey which is called the MHD, one third of all *baris* in the surveillance area were randomly selected. It contains detail information on 4364 households clustered in 2687 *baris* in the DSS (Demographic Surveillance System) area and 174 households clustered in 94 *baris* outside the surveillance area. From each *bari* one household was randomly selected as the primary household. A secondary household was then selected from *baris* with more than one household depending on its relationship to the primary household.

1.4.2 Program placement

One could see from figure 3 that the treatment and control villages are grouped into clusters. This figure therefore raises doubts about the experimental design of the program and hence the validity of any evaluation. But it has been repeatedly claimed by ICDDR,B and other social scientists working in Matlab that the socio-economic conditions were similar in both treatment and control villages.

"The study was designed to permit an independent evaluation of the effect of this augmented effort....."(Bhatia, 1982).

"An important feature of this program was the selection in 1978 of treatment and control areas within a homogeneous region of about 70 square miles. Although logistical and other considerations precluded the random allocation of programs to households, a careful selection of treatment and comparison areas provides a reasonable approximation to the desired experiment" (Foster and Roy, 1996)

There are other studies that also to refer the FPHSP as an ".....effective program for evaluation"(Menken, J. 1990).

The ICDDR,B operating area is about 184 square kilometers. It was a remote and extremely backward area in Bangladesh in 1977. The residents were mostly poor living on the edge of the poverty line. No data was collected on comparable economic variables for the treatment/control areas before the program was launched. But the 1974 census has some demographic statistics. Some important demographic measures are also available from yearly DSS surveys. All these surveys and census data indicate that the treatment and control villages had similar demographic features. The average age of the household head in all six blocks in Matlab was 48.5 years in 1977. Male headed households comprised 88%, 85%, 86%, 88%, 87% and 86% in the six blocks respectively in 1977. The average level of education of the household heads in the MHSS sample was between 6.27-5.55 years in 1977 in the six treatment-control blocks.

To check that the socio economic conditions were similar between the treatment and the control villages before the program was launched we can divide the area into two groups and have two treatment/control areas and check whether these two groups shared similar demographic features before 1977 or not. Each group consists of a control block (E or F) and the adjacent treatment blocks. Likewise, the first group has blocks A and B as the treatment area and the corresponding control block is E. The second group has blocks C and D as the treatment area and the corresponding control area is block F. In the first groups average age of household head in both treatment and control villages was 48 years in both 1977 and 1996. Similar figures are found for the second group. In both groups 87% of all households had a male head in 1977. Household heads in the treatment area of the first group had 6.53 years of education while those in the control area had 6.08 years. The corresponding figures for the second group were 5.88 and 5.07. The following section presents some more descriptive statistics which corroborate the claim that the program placement allows one to do scientific analysis even though the villages were not absolutely randomly selected.

1.4.3 Descriptive Statistics

In 1977 when the FPHSP was launched the program villages had a total population of 89,000. For the control villages this number was 85, 000. In 1997 the treatment area had a

population of 108363 in 70 villages of which 49% were male and the control area had a population of 104661 in 72 villages of which 49.14% were male.

Table 1.1(a) shows that in 1978 under-five mortality (per thousand) was 22.5 in the treatment area and 22.1 in the control area. In 1974 the average family size in the treatment villages was 5.9 while in the control villages it was 5.8. The average age of household head was the same across treatment control villages. 87% of all household heads were male in both treatment and control villages. People were mostly illiterate in this area in 1974 - 65% in the treatment area and 68% in the control area. In 1977 the program village household heads had on average 6.1 years of schooling. The corresponding figure was 5.5 years in the non-program villages. And these differences between the treatment and the control villages in the pre-program period are not statistically significant. The mean age of the household head was 48.35 years in the treatment areas and 47.91 years in the control areas in 1977. 29% of the people in both areas were farmers. 12% were day laborers in the treatment areas and 13% were day laborer in the control areas. And these differences between are the treatment control villages are not statistically significant.

There have been some differences in the distribution of religion in the program and non-program villages. On average 89% of the people in all villages were Muslim. In the treatment villages 83% of the people were Muslim while in the control villages the share was 94%.

There have been some changes in the age distribution of the population as a result of fertility transition. In 1978 children aged less than 15 years were 43.4% of the total population in the MCH-FP area whereas they constituted 43.3% in the comparison area. In 1997 their share declined to 35.9% in the MCH-FP area and 40.1% in the comparison area (figure 4).

The supply of public facilities was very limited in this area. The use of sanitary latrine was 0% in 1974 which rose to only 20% in 1996. There was no electricity in 1974. 60% of the households used hurricane lamps then while in 1996 it increased to 90%. This means there was still almost no electricity in the villages of *Matlab* in 1996. Ownership of radios increased from 10% to 40% over the same period.

Since access to formal financial institutions is very limited in these rural areas, households hold assets mainly in the form of agricultural land. They also invest in housing. These two comprise the major part of household asset holding in *Matlab*. Besides they have jewelry. Some of them do have government bonds and savings accounts in formal banks and

some microfinance institutions. But their size is not significant. In this study I will use only the above types of assets.

1.4.4 Total Fertility Rate

Total fertility rate (TFR) was 6.6 in the treatment villages and 7 in the control villages in 1976. This difference in pre-program levels of TFR between the two areas is not statistically significant. After the initiation of the program TFR started to decline in the treatment villages significantly. TFR also declined in the control villages along with rest of the country but on average it always remained 33% higher than in the MCH-FP villages. TFR declined rapidly in the treatment area in the first ten years of the program. By 1986 it reduced to 4.3 in treatment area which is almost a 35% decline, whereas fertility in the control villages declined by only 21% over the same period. By 1996 TFR in the program villages declined to 2.7 while it was 3.5 in control villages (figure 5)[2].

In 1997 the age specific birth rate was lower for all ages in treatment area than in control area. The rate of pregnancy was 92.3 in treatment area and 111.2 in control area per 1000 women of child bearing age.

Table 1.1(b)(i) shows descriptive statistics on fertility in treatment and control villages for 1997. On average the number of pregnancies is 6.33 per household in the treatment villages and 7.21 in the control villages. The average numbers of live births are 5.9 and 6.67 respectively. The treatment households have on average 4.77 children alive and control households have 5.18 children alive. Table 1.1(b)(i) also shows that the differences in these indicators between the treatment and control group are statistically significant. Again the percentage of miscarriage and still birth is 6% in the treatment villages and 7% in the control villages. The corresponding figures for infant mortality are 24% and 27% respectively. There are no significant differences in these indicators between treatment and control villages. One could argue that the percentage of miscarriage and still birth and the maternal mortality ratio should be smaller in the treatment villages because they have a smaller number of births. But these events mainly occur during early pregnancies. So they should not be different unless the treatment villages had some

[2] Source: Health and Demographic Surveillance System in Matlab, Vol. 30, Registration of Demographic Events 1997.

effective maternal health care services. This means that the maternal and child health care program did not have any significant effect but the family planning program was quite successful in achieving its goals.

1.4.5 Empirical Strategy

The empirical strategy is simple. The socio economic conditions were similar across the villages in the treatment and control areas. Hence the reduced form effect of the family planning program on household asset can be measured by the difference in the average household asset in treatment and control areas.

We denote by Y_{ij} the value of asset owned by household i in village j and T_j the dummy which is equal to 1 if the village is in the program area and is equal to 0 if it is in the control area. Then effect of the family planning program on household asset is just:

$$E[Y_{ij}|\ T_j = 1] - E[Y_{ij}|\ T_j = 0]$$

In the household level regression the standard errors are corrected for correlation within villages. The household level regression uses only the primary households (households randomly selected from each bari) because they are the truly random unit. The secondary households were selected depending on its relation to the primary household. Since the family planning program may affect the structure of these relationships the sample selection of the secondary households may be affected by the preamble and I exclude them from the analysis.

Since fertility declined in the treatment villages more rapidly than in control villages and since the only cause of this reduction is the existence of a family planning program in the treatment villages, the reduced form estimates are very similar to those that would be obtained by using the family planning program as an instrument for households' fertility. The paper however, presents both the reduced form and the instrumental variable estimates. Household's asset is estimated as a function of surviving children to take care of the maternal and child care program into account. The number of surviving children is then instrumented by the placement of the family planning program. These estimates are the main results of this paper and can be directly interpreted as the effect of the fertility decisions on household's asset accumulation.

I construct household asset data by adding the value of different types of assets households have. Since all the values are in their monetary terms the aggregation is valid. Using

this asset data I then run the following regression. The underlying hypothesis is that in the treatment villages households do not have more assets than in the control villages.

(1.1) $$Y_{ij} = \beta_1 + \beta_2 * T_j + \varepsilon_{ij}$$

Equation (1.1) produces reduced from estimates and one would expect $\beta_2 > 0$. And it will give a consistent estimate of the effect of household's fertility decision on their savings decision.

Since there has been some difference in the distribution of religion I will control for it in my regression. Moreover, households may have different levels of asset at different age of the household heads. So I will also control for household head's age in the regression.

(1.2) $$Y_{ij} = \beta_1 + \beta_2 * T_j + \Sigma_{l=1}^{N} \alpha_l X_{ij} + \varepsilon_{ij}$$

Where, X_{ij} s are the control variables.

It has been repeatedly claimed that the microfinance institutions (MFIs) like Grameen, BRAC and others have succeeded in alleviating poverty to some extent in rural Bangladesh and have helped generating savings. Therefore the presence of microfinance institutions can also result in a difference in household assets across villages. BRAC, Grameen and some other institutions have microfinance programs in *Matlab*. If it so happens that only treatment villages have this service or only a few of the control villages have this service then average household asset in treatment villages could be higher irrespective of the family planning program as they will have better access to formal financial institutions. To check for this one can use a dummy for MFIs in the main regression equation if the household has any connection with any microfinance institution and run the following regression.

(1.3) $$Y_{ij} = \beta_1 + \beta_2 * T_j + \beta_3 T_i * M_i + \beta_4 M + \Sigma_{l=1}^{N} \alpha_l X_{ij} + \varepsilon_{ij}$$

Where, M is a dummy for being a member of any microfinance institution. β_3 measures the effect of a microfinance institution on household's asset in treatment villages compared to control villages. One would expect $\beta_3 \leq 0$ and $\beta_4 \leq 0$.

Households that have fewer children may spend more per children. Foster and Roy (1994) show that children in the treatment villages have more education than those in the control villages. These more educated children may have higher earnings and send more remittances to the parents. Thus households that were under the family planning program may have more assets than their counterparts in the control villages as a result of these bigger remittances. This will violate the exclusion restriction and make the IV estimates invalid. To check this channel I will run the following regression.

(1.4) $$Z_{ij} = \delta_1 + \delta_2 * T_j + \varepsilon_{ji}$$

Where Z_{ij} is the remittance per child received by household i in village j. The model presented in section 3 predicts that $\delta_2 \leq 0$.

Again the absence of maternal and child health care program in the control village may create a pecuniary shock for the control households and affect their asset. The resulting estimates may reflect these potential effects rather than the effect of reduced fertility. In this case the family planning program can not be used as an instrument for surviving children as it violates the exclusion restriction.

I will show that these factors are not operating in this specific case in Matlab and the reduced form estimates only capture the effect of reduced fertility.

1.5 Results

1.5.1 Effect of the Family Planning Program on Household's asset: Reduced Form Results

Table 1.2 shows effects of the family planning program on households' asset. Column 1 shows the result for regression equation (1.2) and columns 2-5 show results for regression equation (1.3). On average a household in the treatment village has Tk55000 (equivalent to US$840 in 1996) worth of more assets than a household in the control village. In 1996 the per capita income for Bangladesh was about US$370. So the difference in the level of assets between the treatment and the control villages is significantly big. Having any relationship with any microfinance institution reduces household's asset by about Tk30,000 compared to those who don't have any such involvement. This result is not surprising in the sense that microfinance institutions target mainly the poor people who do not possess any type of assets. Data shows no correlation (=0.02) between being a treatment household and having involvement with any MFI. And having involvement with a microfinance institution in the treatment villages reduces household's asset by about Tk60,000 compared to that in the control villages. This confirms the fact that households have children to get insurance. If they can get insurance through MFIs they save less when they have fewer children. Also there is no significant difference in the level of

assets between treatment and control households who has access to MFIs. But the difference in asset level between treatment and control households who do not have any connection with MFIs is Tk 64958 and this difference is statistically significant. And in both these groups- those who have access to MFI and those who don't, the treatment households have significantly smaller number of children. The difference in asset between treatment and control households remains almost the same after controlling for age, sex and religion of the household head. And the coefficients on household head's age are also significant. It is natural that assets increase with the age of the household head. Household's asset increases by Tk1750 with increases in household head's age. However the size of asset does not differ significantly between Hindu and Muslim households or between female and male headed households.

Table 1.3 shows results of regression equation (1.3) by household head's age. At all levels of age a household in the treatment area has more assets on average than a household in the control area except for the age group 70-95. This cohort has a smaller amount of assets in treatment villages than in the control villages. But this difference is not statistically significant. This also comprises a nice specification check for the model. The family planning program was launched 20 years ago. So it should not have any effect on the saving or fertility decision of this cohort. The pregnancy data also confirm this result. There is no significant difference in the number of children alive between treatment and control households of this cohort. The average number of surviving children in these households was 5.7 in both treatment and control groups. So we can leave this cohort outside our sample and run regression equation (1.3) again. The results are shown in columns 1-4 of table 1.4. The differences in the average level of asset increase a little bit and they are still significant. Figure 7 shows the average level of assets of treatment and control households by age. Figure 8 shows the average difference in the level of asset between treatment and control households by age. Almost all the differences are positive and statistically significant.

Columns 1 and 2 of table 1.5 show the results of regression equation (1.3) by sex of household head. Male headed households in the treatment villages have significantly higher amount of assets than their counterparts in the control villages. Female headed households also have higher assets in the treatment villages. It should also be noted that the difference in assets between treatment and control households is higher for female headed households. It may be because the difference in the number of surviving children between treatment-control households

is higher for female headed households than those for the male headed households. But data show no such statistically significant difference. Another explanation is that women are more parsimonious than men. For most of these households the husbands work outside the village. So the wife is in charge. For any given reduction in the number of children these female heads save more. Therefore for the same difference in the number of children the difference in assets between treatment and control villages is higher for female headed households compared to male headed households.

Columns 3 and 4 of table 1.5 show the results for regression equation (1.3) by religion. The reduced form estimates show that on average Hindu households save more than the Muslim households in the treatment villages compared to those in the control villages. But there is no significant difference in the number of surviving children between Hindu and Muslim households in the treatment-control villages (table 1.1(b)(ii)). Therefore, this larger difference in assets between treatment and control Hindu households compared to that of the Muslim households could be due to the small sample size of Hindu population or because the Hindu and the Muslims differ in their practice of inheritance.

In the results presented above households' assets include only the value of homestead land, jewelry, bonds, savings account and some other tangible assets like television, radio etc. It excludes any type of agricultural land households own. If I include the value of agricultural land owned by households the difference in asset level between treatment and control households increases. The results of equation (1.3) with agricultural land are shown in columns 5-8 of table 1.4. However, I will prefer to carry the analysis of assets differences in the rest of the paper excluding agricultural land because the value of land reported in the survey depends on the respondent's judgment which may not always reflect the true value of the land. However including agricultural land in household asset does not change the main results of this paper in any significant way.

1.5.2.1 Instrumental Variable estimates

Table 1.6 presents the IV estimates. On average for each additional surviving child households have Tk140000 worth of less assets. This result is in line with the reduced form estimates. The IV estimates are about 2.6 times higher than those of the reduced form estimates. And on average households in the treatment villages have 0.39 more surviving children than

households in the control villages. Table 1.6 also shows that, households' asset increases by Tk7500 with increases in household head's age. The effect of household head's religion on household asset is not significant. The MFIs have similar effects on households' asset as shown in section 1.5.1- any connection with an MFI reduces households' asset significantly. Also any connection with the MFI reduces households' asset by Tk90000 in the treatment villages than in the control villages. Besides, having fewer children doesn't result is more household level assets among households with any MFI connection. But it reduces the level of asset by Tk175465 in control villages compared to those in treatment villages when households don't have any connection with the MFIs. These results are consistent with those presented in section 1.5.1 and also with the model presented in section 1.3.

Columns 5-7 of table 1.3 show the IV estimates for different age groups. These regressions and the ones above are run only for the households whose head is below 70. This is because this cohort was not affected by the family planning program as they were above 50 when the program was launched.

Columns 5-8 of table 1.5 show the IV estimates by household head's sex and religion. Both male headed and Muslim households in the treatment villages have more assets than their counterparts in the control villages. The respective differences in assets are higher for Hindu households and female headed households. But they are not statistically significant. This could be due to the smaller sample size of Hindu and female headed households.

1.5.2.2 Maternal and Child Health Care Program

To make sure that the family planning program is a valid instrument for the number of surviving children we have to check for the confounding factors. One could argue that the MCH-FP program itself can cause a difference in the level of asset between the treatment and control groups. Since the treatment villages were also provided with maternal and child health care they are less susceptible to a shock caused by complications during pregnancy or labor. Therefore, the family planning program can no longer be used as a valid instrument for the number of surviving children. It violates the exclusion restriction that the program had no effect on household's decision to save except through its effect on their decision on how many children to have. ICDDR,B started maternal and child health care program in *Matlab* in 1986. According to an

ICDDR,B report (1994) the maternal mortality ratio[3] in the period of 1976-1989 was 5.1 in both treatment and control areas. One could argue that the MCH-FP program, though had no effect on maternal mortality, had some income effect. Having some level of medical care during pregnancy (for example a tetanus shot) may have some positive health effect and save the expense of going to a hospital at a later time. The women in the control villages had to bear the extra medical expenses as they didn't have access to the MCH-HP program. So the program indirectly helped the treatment households to save more. But the fact is that in a rural area of Bangladesh like *Matlab*, it is highly unlikely for women to seek expensive medical care when they are sick. Usually when women are sick they don't seek medical attention if it is not something serious. And when it is serious they just suffer and die as the social norm does not place a high value on their lives. Therefore, one can infer that the program did not have any direct effect on the households' decision to save through generating any precautionary shock in the control areas.

1.5.2.3 Transfer from Children

The results for regression equation (1.4) are presented in table 1.7. On average households in the treatment villages receive Tk408 less in transfer per child. Also transfer from all children is Tk 2146 less per household in treatment villages than in control villages. The second result follows from the fact that the treatment households on average have fewer children than control households. From table 1.7 it is clear that the higher asset level of the households in the treatment villages cannot be attributed to higher remittances from their better educated children. Though the negative transfer per child does not follow the prediction of the model it is not in conflict with the main result of this paper.

All the above results support the prediction of the model presented in section 1.3 that parents substitute assets for children. When they decide to have fewer children influenced by an extensive family planning program they increase their asset accumulation. But these estimation techniques are legitimate only under the assumption that the program placement was more or less random. The next section elaborates on this crucial assumption.

[3] Maternal mortality ratio is the risk of dying during pregnancy or the postpartum period, once pregnant. It is usually measured per thousand live births.

1.6 Robustness Check

1.6.1 Program Placement

One plausible objection against the above estimates may come from figure 3. Though in all of the publications that used data from *Matlab* repeatedly claim that the program was placed in a way to facilitate scientific evaluation figure 1.3 shows that the treatment villages are actually clustered in the middle of the *Matlab thana* and the control villages are bunched into two groups at the tails of the treatment villages.

We can check the claim that the area of *Matlab* was homogenous before the family planning program was launched in two ways. One is to select a group of treatment and control villages along the border of the two control areas and check whether or not the same difference in asset level persists for each group. Another is to do a propensity score matching. Table 1.8 shows the results for the first approach. I do this exercise for two treatment and control areas. The first group has 53 treatment-control villages with an observation of 1294 households. The treatment villages are selected from blocks A and B. On average households in the treatment villages of this group have Tk75000 worth of more assets than households in the control villages. The second group has 66 treatment-control villages with an observation of 782 households. The treatment households belong to blocks C and D. On average households in the treatment villages in group 2 have Tk69000 worth of more assets than the control households in the same group. These results confirm that even if the villages were not randomly picked as treatment and control villages they were homogenous and therefore the program design approximates a truly random experiment.

The second approach is to do a propensity score matching. It matches treatment and control villages with the same propensity score (probability to be treated). The propensity score for each household is estimated based on some pre-program level characteristics of the villages – average level of education and age of household heads, proportion of Muslim population in the village and proportion of male headed-households in the village. All the households that have the same propensity score comprise a cell. Then treatment and control households in each cell are compared. The difference in households' asset in each cell is simply given by:

$$E[Y_{ij} \mid X;\ T=1] - E[Y_{ij} \mid X;\ T=0]$$

The final estimate is found by taking a weighted average of the differences in assets over all the cells. The weights used are the fraction of treated households in cells. Therefore, the regression matching result is just:

$$E_X\{E[Y_{ij}|\ X_j;\ T=1]-E[Y_{ij}|\ X_j;T=0]\} = \int\{E[Y_{ij}\mid x,T=1]-E[Y_{ij}\mid x,T=0]\}P(x=X\mid T=1)dx$$

The results for matching regression are presented in table 1.9. The propensity scores are calculated for the control variables – average age of household heads in the village, average level of education and the distribution of religion in the village. Furthermore, in order to address the problem of selection bias at the village level I include the distance of the villages from the treatment-control borders in calculating the propensity scores. This takes care of any demographic differences among the villages across the treatment control borders. The villages near the borders must have similar socioeconomic conditions and therefore any difference in the level of asset between the treatment-control groups must be a result of the family planning program. The results in table-1.9 are presented only for households affected by the family planning program – for household heads who were aged below 55 in 1977. Column 3 shows the results for the entire treatment control area. The matching coefficient for all the households is 61701 which is consistent with the reduced form results. The coefficients become a little bigger when only adjacent villages are compared. They are also bigger when matching is done separately for the two treatment control groups described in the first approach. In all these matching regressions the differences in household's asset between treatment-control villages are statistically significant. These results also confirm the fact that the socio economic conditions across the treatment and control villages were similar and the program placement served the purpose of an experimental design.

1.7 Conclusion

Economists have long treated children as means for consumption smoothing for parents in their old age. But there has been little empirical study to support the hypothesis. There are several interesting ways of testing this hypothesis. One is to see whether parents demand fewer children when there is an alternative source of old age security like the social security system. Another is to look for evidence whether parents save more when they have fewer children. The studies available so far explore the first channel and are therefore limited to the context of

developed countries. The other channel of testing the old age security motive for children has remained unexplored. In this paper I attempt to investigate this second channel using data from a remote area of Bangladesh known as *Matlab*. Family planning programs, introduced in Matlab about 29 years ago, reduced the fertility rate in the treatment villages significantly. The results presented in this paper show that in 1996, twenty years after the program was launched, households in the treatment villages had more assets compared to those in the control villages. On average they have Tk 55000 worth of more assets. This result varies with age, sex and religion of the household head. But the average differences in assets between treatment and control households are always significant across age, sex and religion. These differences are also big in the sense that they are equivalent to almost one and a half years' of per capita income of Bangladesh.

The paper also illustrates that the differences in assets between treatment and control households cannot be explained by any other channel except the old age security motive for children. It shows that the difference is households' level of asset is not merely a mechanical process in the sense that they have more to save because they have fewer children. When households have access to microfinance institutions they save less for themselves. There is no significant difference in the households' asset level between treatment and control villages when they have access to MFIs. But the difference is very high and significant when they don't have that access. These facts imply that children are treated as a form of old age insurance. The paper also shows that there was no significant difference in the level of household assets between the cohorts who were not affected by the FPP in the treatment villages and their counterparts in the control villages.

One shortcoming of the model presented in this paper is that it treats the share of income transferred to parents and investment in children as exogenous parameters and are assumed constant. However, evidence from Matlab shows that households in the treatment villages receive less transfer per child than households in the control villages and children in the treatment villages are more educated than those in the control villages. These facts could be explained in a model where these two parameters are interrelated and transfer to parents is endogenous. More educated children are more likely to migrate to cities and once they migrate they feel less obligated to send money back home. And parents incorporate these facts when they make investment decisions in children. This reinforces the main results. The model can

incorporate this issue if I make transfer to parents as a function of education, distance and environment and investment in children as a function of expected transfer. This will not change the main results of the model but will make it more complicated. But even in its simple form the model makes some important predictions that are supported by robust empirical evidence. And the evidence has important policy implications. The FPP has been proved to be useful beyond its original potentials. The paper shows that it can generate capital in the form of increased household assets.

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Table 1.1(a): Characteristics of Treatment and Control groups

Characteristics	Treatment	Control	All
Mean age of the HH head (years)	48.47 (13.40)	48.97 (13.71)	48.73 (13.56)
Average household asset (Tk)	133048 (7139.612)	91372 (4917.058)	111440 (4379)
Religion: Muslim	84.62	95.61	90.34
Hindu	15.38	4.39	9.66
HH heads level of schooling (years)	6.00 (3.43)	5.43 (3.21)	5.72 (3.34)
Sex of HH head (%):			
Male	86.56	86.59	86.57
Female	13.44	13.41	13.43
Spouse's level of education	6.85 (3.11)	6.49 (2.88)	6.53 (3.02)
Family size*	5.9	5.8	5.9
Under five mortality*	22.1	22.5	22.3
Occupation (%)			
Agriculture	28.03	24.31	26.09
Laborer	11.76	13.34	12.57
No of observation	1176	1268	2444

Standard errors are in the parentheses.
Source: MHSS data
* These statistics are obtained from DSS 1976

Table 1.1(b): Fertility in treatment and control villages across different groups.

i) Across Treatment/Control groups

Group	Sons alive	Daughters alive	Child alive	Son proportion	Live birth	Pregnancy
Control group						
Mean	2.73	2.45	5.18	0.52	6.67	7.21
Standard error	(1.74)	(1.71)	(2.50)	(0.25)	(3.39)	(3.66)
Treatment group						
Mean	2.43	2.34	4.77	0.51	5.90	6.33
Standard error	(1.59)	(1.66)	(2.47)	(0.253)	(3.2)	(3.47)
Difference						
Mean	0.29	0.104	0.39	0.009	0.761	0.858
Standard error	(0.058)	(0.073)	(0.093)	(0.009)	(0.132)	(0.142)

Sample includes only primary households.
There are 1273 control households and 1183 treatment households.

ii) Across different religious groups

Religion	Sons	Daughters	Children	Pregnancy
Hindus				
Mean	3.01	3.07	6.09	6.61
Standard error	(2.12)	(2.49)	(3.86)	(4.05)
Muslims				
Mean	3.25	3.07	6.32	6.80
Standard error	(2.09)	(2.05)	(3.28)	(3.54)
Difference				
Mean	0.24	-0.007	0.23	0.19
Standard error	(0.147)	(0.162)	(0.25)	(0.25)

The sample includes only primary households.
There are 2213 Muslim households and 243 Hindu households.

Table 1.2: Reduced form results - Differences in assets between treatment and control groups (in Taka)

Explanatory variables	(1)	(2)	(3)	(4)	(5)
Treat	55165.09** (24286.21)	55109.66** (24278.23)	55188.93** (24323.72)	57538.82** (24959.34)	57414.66** (24938.3)
Household head's age		1756.38*** (496.35)			1754.502*** (496.4811)
Household head's religion				19030.69 (17780.05)	18666.53 (17512.99)
Household head's sex		5563.61 (12217.33)	11014 (12159.9)	11565.84 (12086.62)	6110.733 (12133.51)
Micro	-32401.1*** (8636.21)	-27892.87** (8599.82)	-33274.8*** (8832.53)	-33294.26* (8932.37)	-27917.72** (8712.956)
Micro*Treat	-63477.66** (23289.11)	-60408.35 (23059.88)	-63121.07** (23332.34)	-63996.29** (23459.55)	-61269.72** (23189.25)
No of Ob.	2456	2456	2456	2456	2456

The dependent variable is household assets in Tk.
Standard errors are in the parentheses.
Standard errors are corrected for cluster effects within villages.
**Significant at the level of 5%.
***Significant at the level of 1%.

Table 1.3: Reduced form and IV results
Difference in household level asset between treatment and control groups by age

	Reduced form Estimates				IV Estimates		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Explanatory variable	For age=<30	For 30 <age<=45	For 45< age<=70	For 70 <age<=95	For age=<30	For 30 <age<=45	For 45< age<=70
Treatment	67750.33 (75754.6)	48054.89* (24853.8)	75572.1** (30444.96)	-54302.63 (87251.02)	-308772.3 (815967.1)	-132464.8 (88933.2)	-167818.2** (81007.08)
Micro	-38815.98* (23528.8)	-1909.117 (11349.58)	-46324.27*** (11684.81)	-70212.16 (95802.08)	-94648.79 (247176.2)	-22441.16 (33018.8)	-65638.78** (39568.77)
Micro* Treat	-74343.67 (78215.12)	-63795.37** (23429.94)	-71997.36** (32007.72)	46630.13 (103527.7)	-356535.3 (980434.9)	-72313.98 (56528.29)	-115573.4** (84058.85)
Number of observation	160	937	1213	146	160	937	1213

Dependent variable is household assets measured in Taka. Sample includes only primary households. The regressions do not include any other control variable. Columns 1-4 present the reduced form estimates while columns 5-7 present the IV estimates.
Standard errors in the parenthesis
**Significant at 5% level.
*Significant at the level of 10%.

Table 1.4: Reduced form results
Difference in household assets between treatment and control groups without age cohort 71-95

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat	63986.22** (24540.73)	63850.37* (24332.83)	65785.99* (25143.91)	65723.04* (24961.81)	85232.2** (27663.19)	85010.3** (27337.05)	90805.4** (29132.1)	90625** (28774.51)
Household head's age		1965.454*** (599.0495)		1969.058* (607.90)		3224.8*** (670.03)		3226.8*** (669.12)
HH head's religion			14195.74 (19237.49)	14770.92 (19021.62)			44270.2** (22039.7)	44496.6** (21642.82)
Sex		-851.8066 (13592.8)	4497.631 (12939.83)	-356.1248 (13500.11)		11719.47 (17326.66)	21958.71 (16625.8)	13199.45 (17242.83)
Micro	-27211.51** (7561.91)	-21792.04* (7842.72)	-27351.71** (7676.147)	-21899.26* (8237.159)	-48956.33* (12783.79)	-41697.27** (12588.34)	-50856*** (13047)	-41954*** (12946.32)
Micro*Treat	-70452.38** (23480.94)	-70550.84** (23250.02)	-70993.** (23588.38)	-71123.68* (23385.63)	-85709.6** (29865.5)	-84621.98** (29435.86)	-86978** (30154.7)	-86566*** (29781.97)
Ob.	2310	2310	2310	2310	2310	2310	2310	2310

Dependent variable is household assets in Taka. Household asset comprises of jewelry, bond, homestead and savings. In columns 5-8 household asset includes agricultural land.
Standard errors are in the parentheses.
*Significant at the level of 10%
**Significant at the level of 5%.
*** Significant at the level of 1%.

Table 1.5: Reduced form and IV results
Difference in household asset between treatment and control groups by sex and religion of the household head (in Taka)

	Reduced Form Estimates				IV Estimates			
Explanatory variable	Female headed HH (1)	Male headed HH (2)	Muslim HH (3)	Hindu HH (4)	Female headed HH (5)	Male headed HH (6)	Muslim HH (7)	Hindu HH (8)
Treatment	67574.49*	62003.83*	63227.04*	89215.74*	-285102.2	-137278.7**	-147253.9**	-274307.4
	(36026.19)	(24579.72)	(25705.48)	(31712.44)	(416939.6)	(58722.24)	(66529.17)	(544835.1)
Micro	-54275.19*	-27669.05**	-31286.72***	24004.06	250304.7	-86339.84**	-67838.62**	-331800.5
	(14822.53)	(8174.559)	(7296.416)	(22196.67)	(541243.8)	(28966.68)	(24215.18)	(556117.6)
Micro*Treat	-64227.94	-67410.93**	-69353.1**	-102163.2	-413469.5	-74221.69**	-97255.23*	153465.7
	(39125.19)	(23737.96)	(25027.89)	(37506.96)	(690295.2)	(40541.97)	(51895.99)	(368728.3)
No. of observation	303	2007	2079	231	303	2007	2079	231

Dependent variable is household asset.
Standard errors are in the parenthesis. They are clustered into villages.
*Significant at the level of 10%.
**Significant at the level of 5%.

Table 1.6: IV estimates.
Difference in households' asset between treatment and control groups (in Taka)

Explanatory variables	(1)	(2)	(3)	(4)
Children alive	-149065.9** (63633.39)	-147451.4** (59854.81)	-154441.3** (66310.55)	-153366.4** (62369.57)
Household head's age		10231.37** (3571.44)		10568.11** (3690.72)
HH head's religion			17939.41 (39399.78)	19917.49 (38532.02)
Micro	-72224.96** (24468.62)	-45750.7** (20319.08)	-73844.4** (25364.9)	-46677.38** (21099.48)
Micro* Treat	-89207.02* (46973.28)	-86739.7** (40378.12)	-90761.82* (48725.73)	-88384.73** (41895.98)
No of Observation	2310	2310	2310	2310

The dependent variable is household's asset in Tk and does not include agricultural land. Results in columns 1-4 leave cohort of age> 70 out of the sample as they were not affected by the program (there is no first stage for this excluded group).
Standard errors are in the parentheses.
Standard errors are corrected for cluster effects within villages.
**Significant at the level of 5%.
*Significant al the level of 10%

Table 1.7: Reduced form results
Difference in transfer form children between treatment and control groups (in Taka)

Explanatory variable	Transfer from children	
	All children	Per children
	(1)	(2)
Treat	-2146	-408
	(1026.79)**	(187.15)**
No of observation	2404	2404

1. Dependent variable in column 2 is total transfer received by household from all children and in column 3 is transfer received per child. The sample is restricted to households exposed to the program, i.e. those who were less than 70 in 1996.
2. Standard errors in the parenthesis.
**Significant at the level if 5%

Table 1.8: Reduced form results for two groups
Difference in household assets between treatment and control groups (in Taka)

Explanatory variable	(1)	(2)
Treat	75159.29* (39396.42)	69227.65* (37422.01)
Micro	-41992.3* (9508.36)	-24900* (14969.71)
Micro*Treat	-82560.93** (37097.8)	-73807.77* (43784.11)
No of treatment-control villages	53	66
No. of observation	1294	782

Dependent variable is household assets. The sample is restricted to households exposed to the program and household head age<70.
Standard errors in the parenthesis.
*Significant at 10% level.
** Significant at 5% level.

Table 1.9: Regression Matching Results: ATT*
(Household's asset is measured in Taka)

	Difference in assets between treatment control households		
Area	Group I Blocks A, B and E	Group II Blocks C, D and F	All Blocks
Within 1.5 mile of boarder	98557 (30198.35)	237000 (69504.61)	136000 (32200.75)
Within 3 mile of boarder	76982 (33084.54)	146000 (35375.05)	81812 (22101.45)
Within 4.5 mile of boarder	80412 (27349.75)	86496 (33766.23)	69401 (17668.64)
All villages	83970 (21156)	**	61701 (15994.65)
No of observation	1294	782	2147

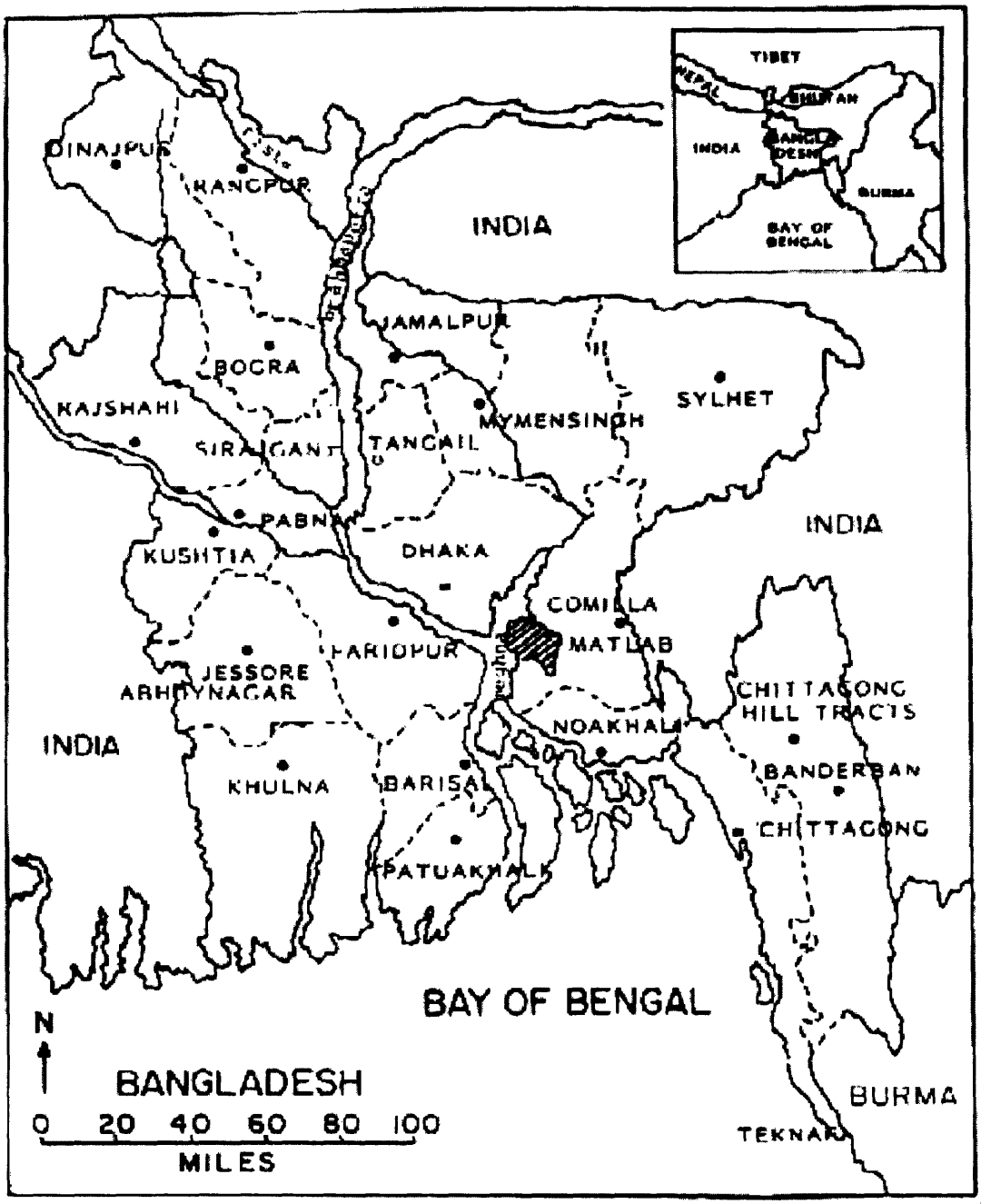
** There is no control village beyond 3 miles of the boarder for this group.
*ATT = Average treatment effect on the treated

Table 1.10: Bangladesh: Some Indicators

Indicator/Year	1977	1999	2000	2002
Fertility rate, total (births per woman)	6.3	..	3.13	2.95
GDP growth (annual %)		4.87	5.94	4.42
GNI per capita, Atlas method (current US$)		370	380	380
Mortality rate, infant (per 1,000 live births)		..	54	48
Mortality rate, under-5 (per 1,000)		..	82	73
Population growth (annual %)	2.43	1.74	1.73	1.74
Population, total	79390,000	1.29E+08	1.31E+08	1.36E+08

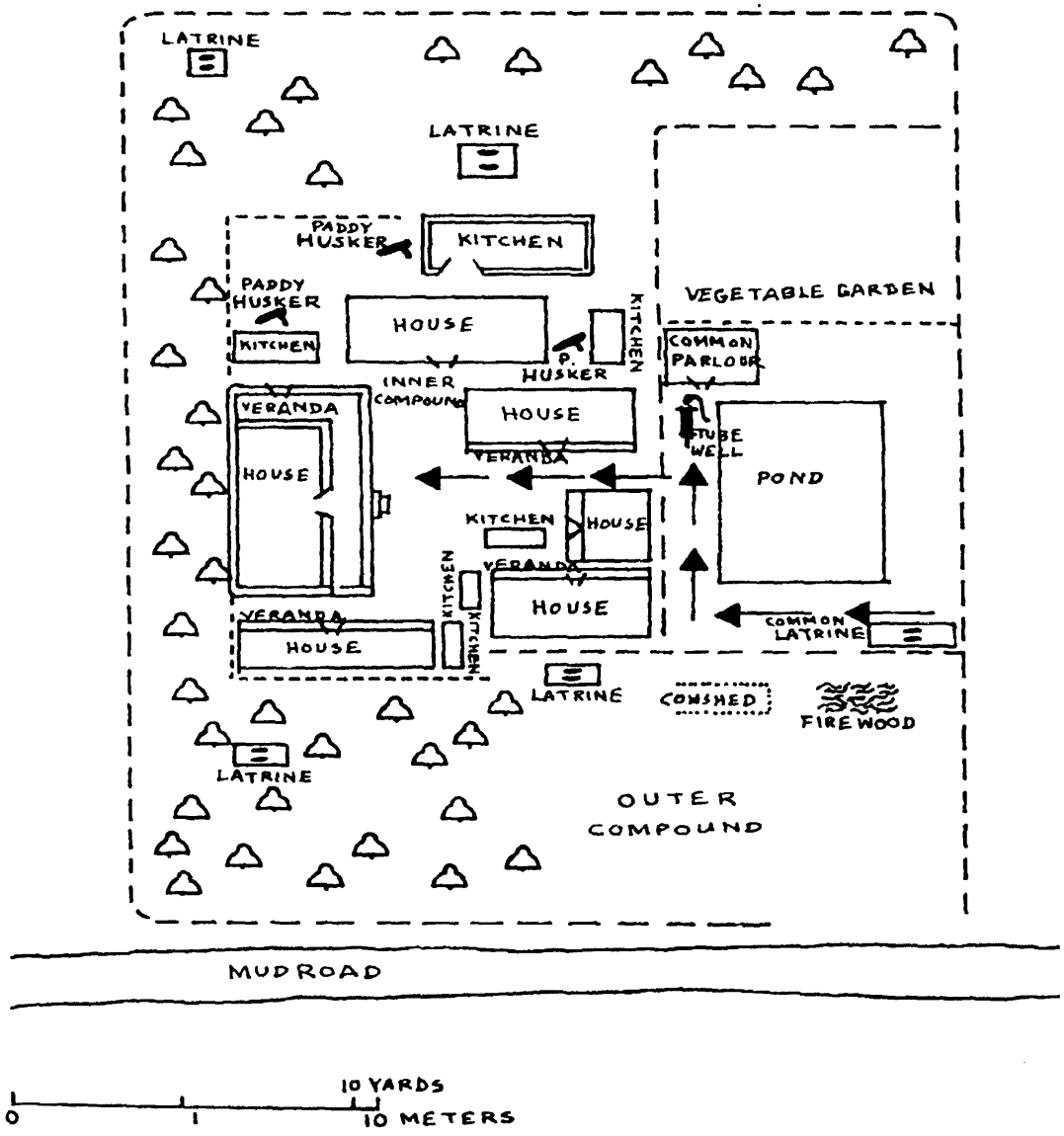
Source: World Bank, World Development Indicators.

FIGURE 1
MAP OF BANGLADESH SHOWING THE MATLAB AREA



SOURCE: Mostafa G, K.M.A. Shaikh, J.K. van Ginneken and A.M. Sarder, 1998."Demographic Surveillance System-Matlab. Registration of Demographic Events", vol 28; International Centre for Diarrhoeal Disease Research, Bangladesh, Scientific Report No. 82.

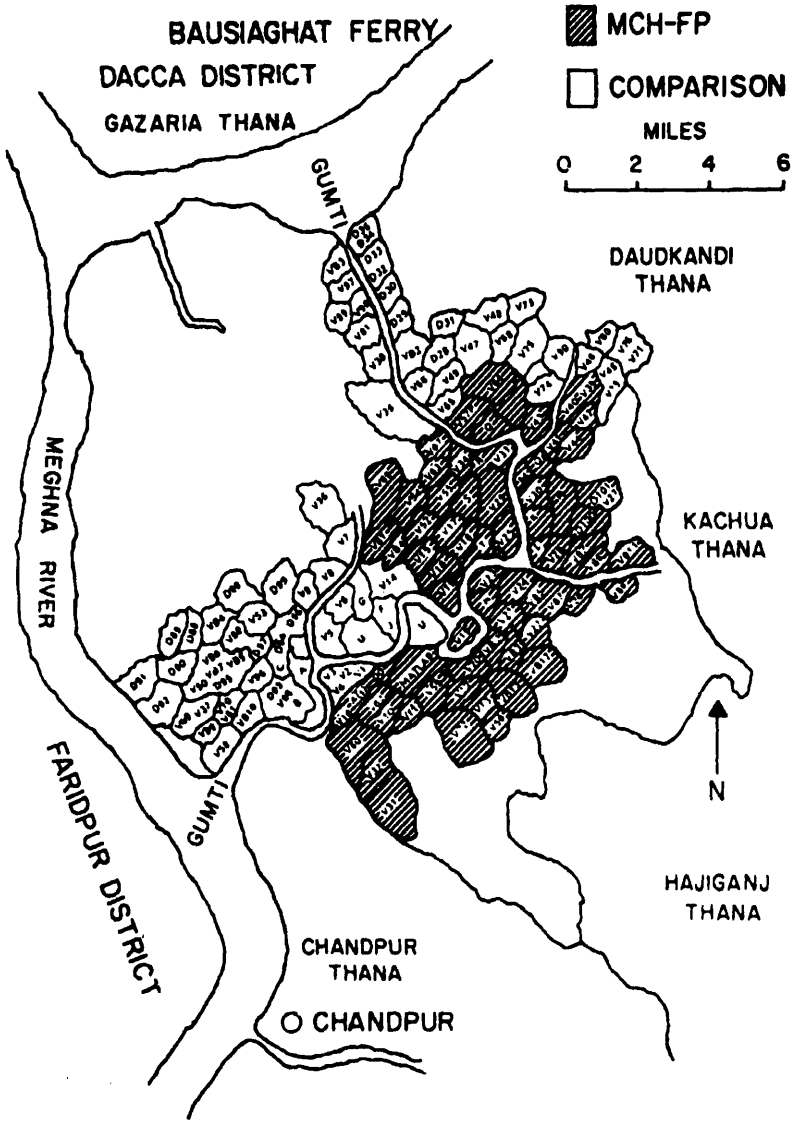
FIGURE 2
PLAN OF A COMMON BARI IN MATLAB



SOURCE: Rahman, M. "Tradition, Development, And the Individual. A Study of Conflicts and Supports to Family Planning in Rural Bangladesh." Edited by Penny Kane and Lado Ruzicka; *Asian Population Change Series No. 1*, Department Of Demography, Australian National University, Canberra, 1986.

FIGURE 3

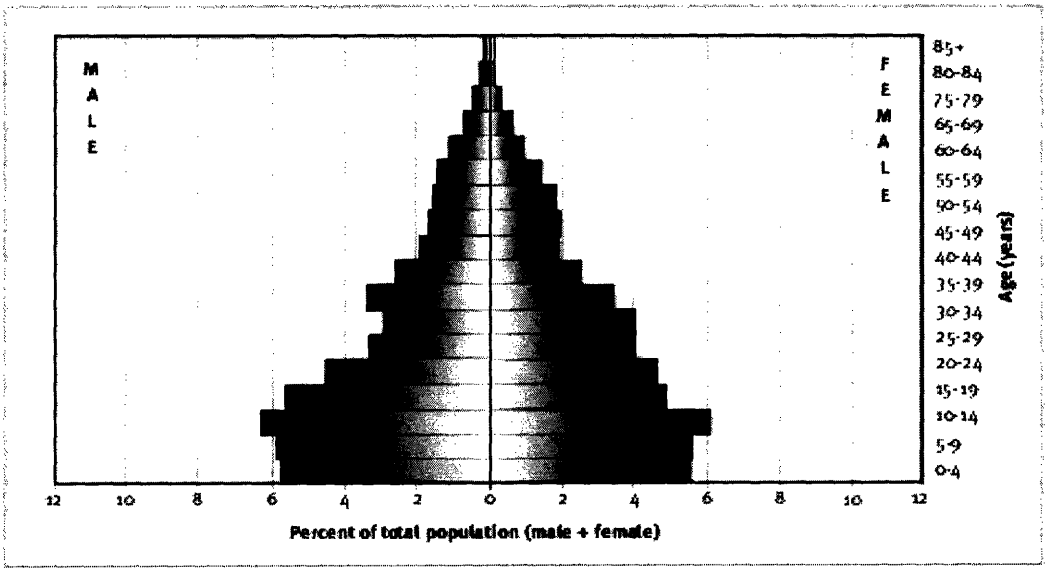
MATLAB AREA SHOWING VILLAGES OF DEMOGRAPHIC SURVEILLANCE SYSTEM



SOURCE: Mostafa G, K.M.A. Shaikh, J.K. van Ginneken and A.M. Sarder, 1998. "Demographic Surveillance System-Matlab. Registration of Demographic Events", vol 28; International Centre for Diarrhoeal Disease Research, Bangladesh, Scientific Report No. 82.

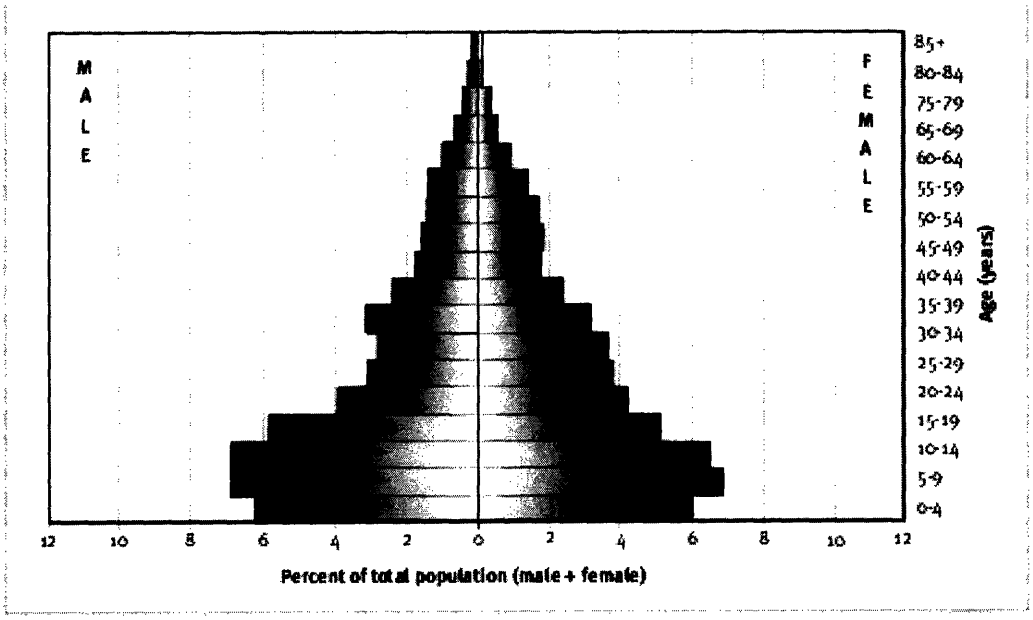
The south west part of the control area is block E, the are to the north is block F. the south-east corner of the treatment area comprises of blocks A and B where as the north part has blocks C and D.

Figure 4.1: Population pyramid for person–years observed in the treatment area of the Matlab DSS site, Bangladesh, 1998.



Source: Internet.

Figure 4.2: Population pyramid for person–years observed in the comparison area of the Matlab DSS site, Bangaldesh.



Source: Internet

Figure 5: Total Fertiltiy Rates in Matlab comparison and MCH-FP areas, 1976-2002
Children per woman

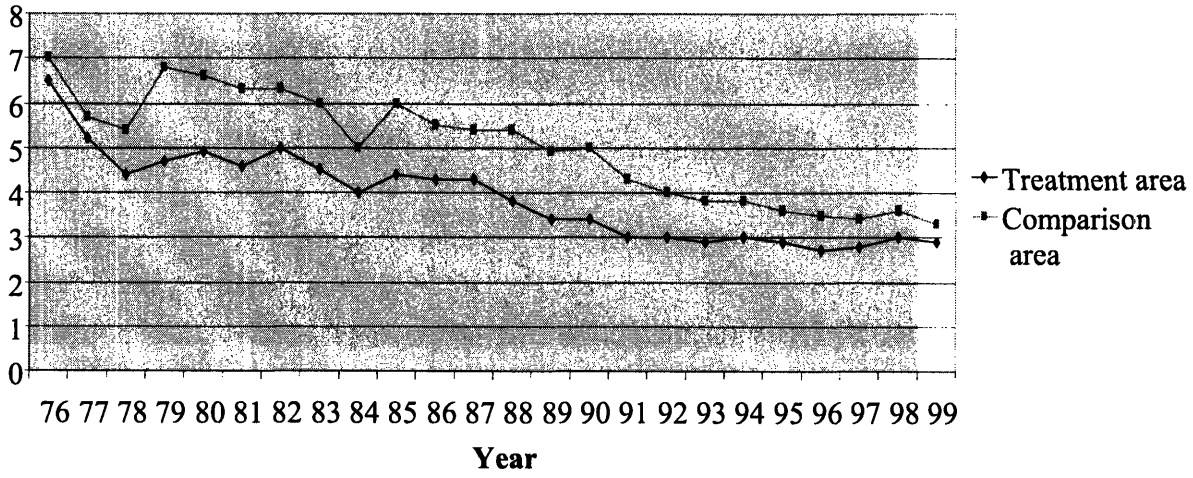


Figure 6: Distribution of Asset between Treatment and Control Groups

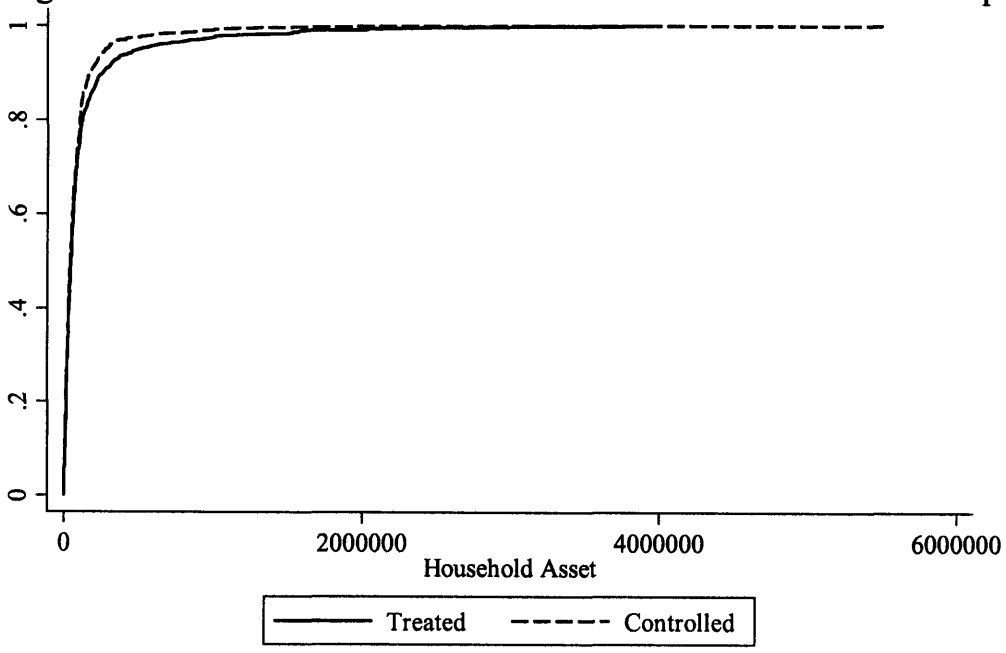


Figure 7: Distribution of Asset by Age and Treatment

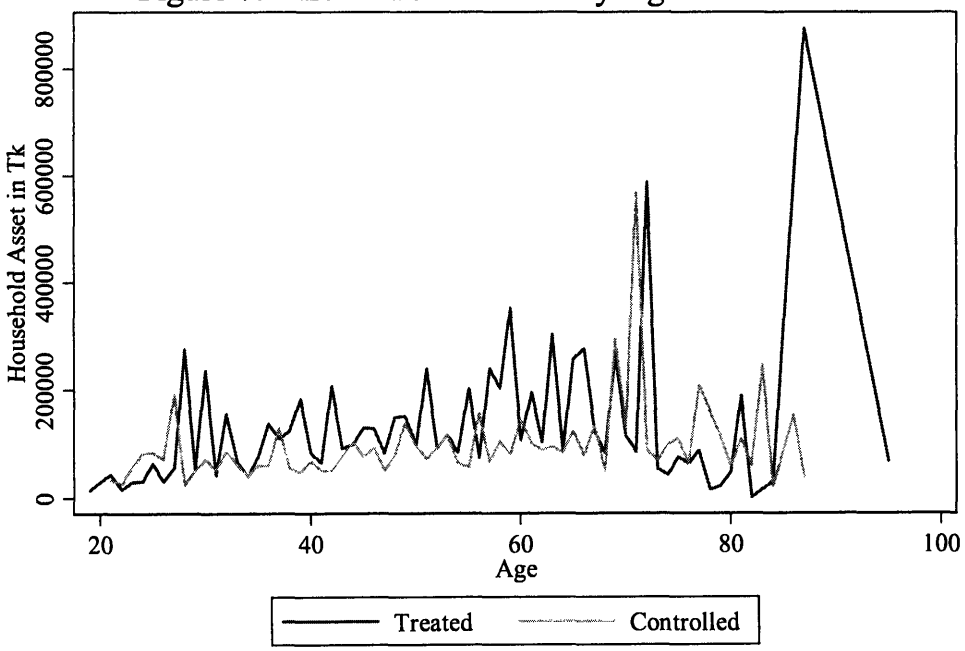
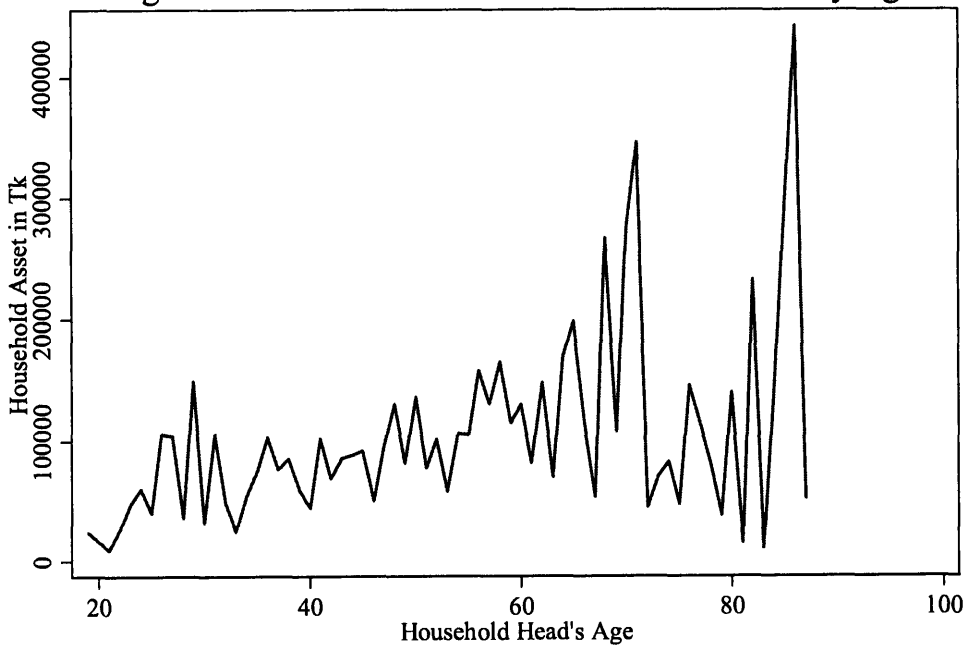


Figure 8: Effect of the FPP on Household's Asset by Age



Chapter 2

Family Planning Program and the Trade off in Female Autonomy: Evidence from Rural Bangladesh

2.1 Introduction

It is often argued that there is a positive relationship between lower fertility and female autonomy. The logic goes as follows. Women who have fewer children can work more, earn more income and enjoy higher control over resources, greater mobility and enhanced decision making power inside and outside the household. Therefore a Family Planning Program (FPP) that reduces the cost of contraception and hence reduces fertility will be conducive to female autonomy. But this may not be true in all situations. This paper uses data from an experimental FPP introduced in a rural area of Bangladesh called Matlab and finds that although the program reduces fertility and increases women's mobility, property rights and makes them less sexually segregated, it reduces their decision making power within the household. It also presents a simple analytical model to explain these findings.

There has been a large literature on empowerment. Generally speaking, empowerment is a process by which those who are denied the ability to make choices regarding their lives improve such ability. For women in a developing country, who generally play a subservient role to men in almost all spheres of life, empowerment means primarily more bargaining power

within the households and greater flexibility outside. The empowered women will have enhanced decision making power, greater mobility, secured property rights, increased participation in life both inside and outside the household, etc.

While the effects of education and credit program on women's empowerment are much explored, little has been done in determining the relationship between female autonomy and family planning program. There are two ways to analyze the relationship between female empowerment and FPP. One is to see how female autonomy affects fertility and the other is to examine how the reduced fertility affects female autonomy. The existing literature assumes a positive relationship in both directions (Eswaran 2000, Rasul 2001). Eswaran (2000) uses the family planning program data in *Matlab* and finds that female autonomy helps to reduce fertility. But the paper does not investigate the reverse channel. In this paper I will explore this second avenue.

There are numerous channels through which a family planning program can affect women's status. The first one is through a reduction in fertility. Since child bearing is primarily a mother's job in most of the underdeveloped and developing world, a reduction in fertility will release a huge amount of time and energy that the mother spends in bearing and rearing a child. She can then utilize these time and energy to some other productive activities which will increase her income/wealth and empower her. This will change her status within the family and change her private consumption and welfare. The question is in what direction? The existing literature assumes that the direction of this change is positive. Studies have also found that in rural Bangladesh earned income helps more to increase female autonomy than unearned income (Anderson and Eswaran, 2005). In their study Anderson and Eswaran use sickness of a family member in recent past as an instrument for earned income. When a family member becomes sick the woman has to give up the time she works outside and take care of that person instead. But when a family member becomes sick the woman's outside options may change which can affect her autonomy within the household. Therefore the recent sickness of a family member is not a good instrument for woman's earned income – it violates the exclusion restriction, and the conclusions drawn from this study may not be very instructive.

In fact the relationship between female autonomy and reduced fertility may not be as straightforward as it appears. In this paper I will present a model where under some particular circumstances the FPP can reduce women's decision making power within the family. For

example their control over the allocation of common household resources declines. It also shows that the FPP improves their private consumption as expected in the literature.

Other channels through which a FPP can affect female autonomy are through education and improved heath. The children of the women who were first exposed to the program will have fewer siblings because of the family planning program. The parents will have more money to spend on each child. Therefore, they would be well-nourished and more educated (Foster and Roy, 1996). This will give them an upper hand in the empowerment process.

The paper analyzes the effects of an experimental FPP on female autonomy in four main dimensions – decision making within the household, property rights, mobility and sexual segregation. This Family Planning Program was implemented by the International Centre for Diarrhea Disease Research, Bangladesh (ICDDR,B), formerly Cholera Research Laboratory. This centre has launched several family planning programs in Matlab area since 1974, which reduced the average fertility rate in the program areas compared to that in the control area by 33%. The program was implemented in 70 villages and used 72 villages in the same area as control. While the treatment and control villages were not randomly selected there is no evidence that they were systematically different before the program was launched. Therefore a comparison between the levels of various dimensions of empowerment of the treated women and that of the control women will give a consistent estimate of the effect of the family planning program on women's empowerment.

The results found in this study present evidence of a trade off in female autonomy posed by the family planning program. It shows that even though the FPP helps women to enjoy more property rights, greater mobility and a lower level of sexual segregation it reduces their command over common household resources significantly. The program women have lower decision making power within the household, compared to their counterpart in the control villages. These results are in contradiction with the traditional view in literature – where a family panning program has only positive effects on women's empowerment.

The rest of the paper is structured as follows. The next section describes the family planning program introduced in *Matlab*. Section 3 presents a simple model that shows that an FPP can pose a trade off in female autonomy. Section 4 describes the data and illustrates the estimation strategy followed for the study. Section 5 presents the results. Robustness of the results is discussed in section 6. Finally, section 7 presents the concluding notes.

2.2 The Family Planning Program in Matlab

1.2.1 Background

Matlab is a rural area of Bangladesh where the socioeconomic conditions were years behind the modern era when ICDDR,B started its projects. Though it is located only about 55km southeast of the capital city Dhaka (figure 2.1) it had hardly any connection with the capital. Two big rivers Padma and Meghna, their branches, streams and channels crisscross this regularly flooded area and almost seclude it from the rest of the country. There are no paved roads except the seven mile one connecting *Matlab Bazaar* with *Chandpur*. People travel on foot. During the monsoon all the footpaths go under water. Country boats are the only means of transportation at that time. Though there have been some improvements in health care system the villages are still poor and isolated from the rest of the country. In 1996 average population per village was about 1100. Population density was one of the highest in the world – more than 1500 per square mile. In each village households are grouped into *bari*s (figure 2.2). '*Bari literally means a "homestead", but commonly refers to a group of households sharing the same courtyard.....Each bari or homestead may contain one or more joint or nuclear families*' (Fauveau, 1994). *Bari* is the economic and social unit in Matlab and in many parts of rural Bangladesh.

Matlab was a highly impoverished area when the ICDDR,B started its activities here. Over the period of 1974-76 Matlab experienced a severe famine and crop failure. The fast increase in population resulted in diminishing returns to labor in agriculture. Real agricultural wage fell below the 1890s level and it had been accompanied by a decline in per capita calorie intake and increased landlessness. It was also one of the most Cholera prone areas in Bangladesh. In 1963, 23 villages in the *Matlab thana* and its vicinity were taken under field trial by the Cholera Research Lab (CRL) and there have been five cholera vaccine trials until 1985-89.

1.2.2 Family Planning and Maternal and Child Health Services in Matlab

Though initially all field studies were designed to test cholera vaccines, a major shift in research strategy occurred in 1975 with the launch of the CDP (Contraceptive Distribution Project). There have been several projects related to family planning, maternal and child health care since then.

The first non-government family planning program in *Matlab* started with the distribution of contraceptives to households. The ICDDR,B divided the area of Matlab *thana* into two groups. The program was launched in one group of 150 villages. The comparison group had 84 villages. 150 midwives were selected to distribute oral pills and condoms. These midwives had no medical training whatsoever. After the program was initiated contraceptive use increased from 1% to 18% among all eligible couples in the treatment villages. But it returned to initial level after the distribution stopped. Learning from the mistakes of the CDP the ICDDR,B undertook an extensive family planning program in 70 villages of *Matlab* in 1977. There were 72 control villages under the program (figure 2.3). The treatment villages were drawn equally from the CDP and non-CDP villages. They were divided into four blocks – A, B, C and D. The control area was also divided into two blocks – E and F. Between the two blocks only E had the CDP. By 1978 each block in the treatment area had its own sub-centre clinic housed in the Union Council Community Centers. Each of these clinics provided family planning related services to a population of about 20,000. This time the ICDDR,B recruited young, married women, who had some level of education and used contraceptives themselves, as Community Health Workers (CHWs). They distributed a range of contraceptive methods (oral pills, condoms, injectables, spermicides). These CHWs were backed by female paramedics who had 18 months training in family planning and maternal-child health care. The sub-centre clinics had adequate drugs and equipment to treat common diseases and problems related to family planning. In addition to the ICDDR,B's family planning program, there were regular government family planning program in both treatment and control villages. The government had 10 union level health centers operating in *Matlab*.

In 1986 the ICDDR,B launched a third program which was an integrated maternal and child health and family planning (MCH-FP) program in the four treatment blocks. It provided maternity care, vitamin A supplementation, nutrition rehabilitation and control for respiratory

infections and dysenteric diarrhea. But the program was not that effective. In 1989 the maternal mortality ratio and the induced child abortion were the same in treatment and control areas.

Since the FFP program concentrated on women, at some level it would be interesting to investigate its effects on different aspects of their lives such as empowerment other than fertility. That is indeed the objective of this paper.

2.3 Theoretical Framework

The theoretical framework for this model follows Schultz. Schultz (1969) recognizes three principal determinants of fertility – the family size goal, child mortality and uncertainty. How many children parents want depends on the relative costs and benefits of children in any particular society. The relevant factors affecting the cost of bearing children are opportunity cost of women's time spent in child rearing, value of child labor, family income, education, institution and cost of contraception. Parents will have more children if it is expensive to acquire and evaluate information on alternative methods of contraception. Besides, if the contraceptives are also expensive parents may decide not to opt for it. Therefore, a family planning program that provides free and accurate information on alternative methods of contraception and also supplies contraceptives for free will reduce fertility. We can write n, the number of children that household has, as a function of q and p, where q is the cost of contraception and p stands for all other determinants of fertility.

$n = n(q, p)$ and $\partial n / \partial q > 0$

Now, since in developing countries the mother is responsible of taking care of children, a reduction in fertility releases some extra time for her. She can then utilize her free time in activities that improve her welfare. The model presented below shows that a family planning program, by lowering the cost of contraception, reduces fertility and the reduced fertility improves woman's private consumption and at the same time reduces her decision making power within the household.

The model is fairly simple. The household consists of two persons, husband (m) and wife (f). The husband's utility is denoted by U^m and the wife's utility is denoted by U^f. Each person's utility depends on consumption of a private good c, the number of household decisions d each makes, the number of children they have and the average quality of children. Among

these children and their quality are public goods. The total number of decisions that the household needs to make is fixed. The wife is responsible for taking care of the children. The amount of time spent per child is assumed to be fixed. Therefore the lower the number of children the more free time the wife has. Both the husband and wife contribute a fixed fraction α of their income to the quality of children, i.e., toward the children's health and education and hence keep $(1-\alpha)$ of his/her income for own consumption. Since in rural Bangladesh the husband has more bargaining power, the husband makes all the choices. The husband decides the number of children and the distribution of household decisions between them. When the number of children declines the wife can work more hours at the market wage and can have a higher private consumption. The husband only needs to assure a minimum level of utility from private goods for the wife. Therefore he can take away some of her decision making power and still leave her as well of as she would have been if she didn't work. He can then make some more household decisions and increase his utility.

The husband's optimization problem is as follows

$$\underset{d_m,n}{Max}\ U^m(c_m,d_m,n,\theta)$$

s.t. $U^f\ (c_f,d_f) \geq \overline{U}^f$

$$c_m = w\beta(1-\alpha)$$

$$c_f = w\beta(1-\alpha) * f(1-tn) + \bar{c}_f$$

$$x = \alpha w\beta / n + (\alpha w\beta / n) * f(1-tn)$$

$$d_m + d_f = 1$$

$$\theta = f(t,x)$$

$$n = n(q,p)$$

$$U_c\ ,U_d,U_n,U_\theta > 0$$

where c_m = Husband's private consumption

c_f = Wife's private consumption

d_m = Number of decisions taken by the husband

d_f = Number of decisions taken by the wife

t = Average amount of time spent per child

x = Average amount of money spent per child

$\overline{U}^f$ = Wife's reservation level of utility. This is the wife's level of utility from private consumption and decision making when she can't go out in her free time.

Assuming that an interior solution to this utility maximization problem exists, the optimal number of children will be a function of the model parameters, q, p, w, β, α. An exogenous change in any of these parameters will change the optimal number of children for the household. Therefore, a family planning program that reduces the cost of contraception q, will reduce the number of children the household wants to have.

Since the number of hours the wife works outside depends on the number of children, $f(1-n)$, and it increases as the number of children decreases, the wife's private consumption will increase as result of the family planning program.

$$\partial c_f / \partial q = \partial c_f / \partial n) * (\partial n / \partial q) < 0$$

Since the husband cares only about his utility in equilibrium he will always set $U^f = \overline{U}^f$. This implies

$$\frac{\Delta c_f}{\Delta d_f} = -\frac{\partial U^f / \partial d_f}{\partial U^f / \partial c_f} < 0.$$

When the number of children declines $\Delta c_f > 0$. Hence we must have $\Delta d_f < 0$. The husband will reduce the number the decision the wife makes to leave her just indifferent (or reduce her decision making power by $\Delta d_f - \varepsilon$ to provide her with some incentive to work).

Therefore we will have $\partial d_f / \partial q = (\partial d_f / \partial n)(\partial n / \partial q) > 0$. The family planning program will reduce the decision making power of the women. Since the number of decisions the household makes in total is fixed this will increase the number of decisions made by the husband and will obviously increase his level of utility.

Furthermore, because total amount of money spent on children is bigger (when the wife earns an income) or the same as before (when she does not) the average spending per child increases when fertility declines. Therefore, households with fewer children will tend to have higher levels of human capital per child. $\partial x / \partial q = (\partial x / \partial n) * (\partial n / \partial q) < 0$. The family planning program will improve the human capital of the children in households affected by the program. These children, when they grow up, will have higher income potential. Hence women from this generation will have higher private consumption when they have fewer children.

To summarize, the model has a number testable predictions. First, given that the family planning program reduces the cost of contraception fertility will decline. Second, this decline in fertility will improve women's opportunities to work and increase their private consumption. Third, this higher private consumption will enable the husbands to curtail some of the wives' decision making power within the household. As result the model predicts that the FPP will reduce the women's decision making power inside the household. Finally the model predicts that the children of the mothers who were first exposed to the program will have higher private consumption compared to the counterpart in the control villages not only because they have fewer children but also because they have more human capital.

However the model has some limitations. It treats the amount of time spent per child as fixed. Since the average quality of children is a function of both the average amount of time and average amount of money spent per child, the husband may want the wife to increase the average amount of time spent per child when fertility declined. But as long as this increase in average time spent per child does not eat up all her spare time her private consumption will increase and the predictions of the model will follow. However if it happens that the husband wants the wife to spent all her spare time in rearing children then the wife will not have any extra time to go out and her private consumption and decision making power will remain unchanged. Which of these two outcomes is favorable for the husband depends on how child quality is related to the average amount time and money spent on children and how child quality itself affects husband's utility and is not the goal of this paper to determine. But as long as the optimal time spent per child is not a corner solution, i.e., $t < 1/n$, the women with lower fertility will experience an increase in their private consumption and a decline in their decision making power.

2.4 Data & Methodology

2.4.1 MHSS Data

The Matlab Health and Socio-economic Survey (MHSS) was carried out in 1996 in Matlab[4]. It consists of four different surveys that have different samples. In the Main or Primary

[4] It was funded by a Grant from the National Institute on Aging and was a collaborative effort of RAND, the Harvard School of Public Health, the University of Pennsylvania, the University of Colorado at Boulder, Brown

Survey which is called the MHD, one third of all *baris* in the surveillance area were randomly selected. It contains detail information on 25207 individuals residing in 4364 households clustered in 2687 baris in the DSS (Demographic Surveillance System) area and 174 households clustered in 94 baris outside the surveillance area. From each *bari* one household was randomly selected as the primary household. A secondary household was then selected from *baris* with more than one household depending on its relationship to the primary household.

2.4.2 Program Placement

One could see from figure 2.3 that the treatment and control villages are grouped into clusters. This figure therefore raises doubts about the experimental design of the program and hence the validity of any evaluation. But it has been repeatedly claimed by ICDDR,B and other social scientists working in *Matlab* that the socio-economic conditions were similar in both treatment and control villages.

"The study was designed to permit an independent evaluation of the effect of this augmented effort....."(Bhatia, 1982).

"An important feature of this program was the selection in 1978 of treatment and control areas within a homogeneous region of about 70 square miles. Although logistical and other considerations precluded the random allocation of programs to households, a careful selection of treatment and comparison areas provides a reasonable approximation to the desired experiment" (Foster and Roy, 1996)

There are other studies that also refer to the FPHSP as an "....effective program for evaluation"(Menken, J. 1990).

The ICDDR,B operating area is about 184 square kilometers. It was a remote and extremely backward area in Bangladesh in 1977. The residents were mostly poor living on the edge of the poverty line. No data was collected on comparable economic variables for the treatment/control areas before the program was launched. But the 1974 census has some demographic statistics. Some important demographic measures are also available from yearly DSS surveys. All these surveys and census data indicate that the treatment and control villages

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University, Mitra and Associates and the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

had similar demographic features. The average age of the household head in all six blocks in Matlab was 48.5 years in 1977. Male headed households comprised 88%, 85%, 86%, 88%, 87% and 86% in the six blocks respectively in 1977. The average level of education of the household heads in the MHSS sample was between 6.27-5.55 years in 1977 in the six treatment-control blocks.

To check that the socio economic conditions were similar between the treatment and the control villages before the program was launched we can divide the area into two groups and have two treatment/control areas and check whether these two groups shared similar demographic features before 1977 or not. Each group consists of a control block (E or F) and the adjacent treatment blocks. Likewise, the first group has blocks A and B as the treatment area and the corresponding control block is E. The second group has blocks C and D as the treatment area and the corresponding control block is F. In the first group average age of household head in both treatment and control villages was 48 years in both 1977 and 1996. Similar figures are found for the second group. In both groups 87% of all households had a male head in 1977. Household heads in the treatment area of the first group had 6.53 years of education while those in the control area had 6.08 years in 1977. The corresponding figures for the second group were 5.88 and 5.07. The following section presents some more descriptive statistics which corroborate the claim that the program placement allows one to do scientific analysis even though the villages were not randomly selected.

2.4.3 Descriptive Statistics

In 1977 when the FPHSP was launched the program villages had a total population of 89,000. For the control villages this number was 85, 000. In 1997 the treatment area had a population of 108363 in 70 villages of which 49% were male and the control area had a population of 104661 in 72 villages of which 49.14% were male.

Table 2.1 shows that under-five mortality (per thousand) was 22.5 in the treatment area and 22.1 in the control area in 1978. In 1974 the average family size in the treatment villages was 5.9 while in the control villages it was 5.8. The mean age of the household head was 48.35 years in the treatment areas and 47.91 years in the control areas in 1977. 87% of all household heads were male in both treatment and control villages. In 1977 the household heads in program

villages had on average 6.1 years of schooling. The corresponding figure was 5.5 years in the non-program villages. People were mostly illiterate in this area in 1974- 65% in the treatment area and 68% in the control area. 29% of the people in both areas were farmers. 12% were day laborers in the treatment areas and 13% were day laborer in the control areas. And these differences between the treatment and the control villages are not statistically significant.

There have been some differences in the distribution of religion in the program and non-program villages. On average 89% of the people in all villages were Muslim. In the treatment villages 83% of the people were Muslim while in the control villages the share was 94%.

There have been some changes in the age distribution of the population as a result of fertility transition. In 1978 children below the age of 15 were 43.4% of the total population in the MCH-FP area whereas they constituted 43.3% in the comparison area. In 1997 their share declined to 35.9% in the MCH-FP area and 40.1% in the comparison area (figure 2.4).

2.4.4 Women and Empowerment in *Matlab*

The MHD sample data has information on 15289 individuals living in the primary households. Of those 50% are female. Of these women only 4557 women were in their childbearing age in the period of 1976-1996. The survey collected empowerment data for 3736 women, one from each primary household. Of these women 1812 lived in the treatment villages and 1924 in the control villages. In both treatment and control villages 12% of the women were unmarried, 72% were married, 15% were widows and the rest were either divorced or separated. In treatment and control villages the average age at marriage was 16.91 and 16.42 respectively. The figures were slightly lower in both areas in 1976 before the program started. The average number of marriage (1.2 per person) is also the same in both areas. The mean age was 39. The average ages of the 1st generation of women (who were in their child bearing age when the program was introduced) and of the 2nd generation of women (who were not in their child bearing age when the program was introduced) are also the same across treatment control areas. The average years of schooling in 1996 were 5.6 and 5.18 in treatment and control villages respectively. In the treatment villages 83% of the women were Muslims and in the control villages their share was 95%.

In the treatment village 4.62% of the women were in some kind of profession and earning money– teaching, medicine, government service, paramedics, NGOs etc in 1996. In the control villages the respective share was only 2.28%. There was no big difference in the value of dowry at marriage between the treatment and control villages in 1996. On average it was Tk8500 in treatment villages and Tk7500 in control villages. And the average amount of dowry was lower for the 2nd generation of women in both treatment and control areas. This is not surprising given the facts that the second generation of women is more educated and the family laws are now enforced more strictly than before.

There are various ways in which one can quantify empowerment. According to Kabeer (1999) there are three interrelated dimensions of empowerment. The first is the access to resources – material, human and social. The second is the ability to make decision, negotiate and manipulate. The third is the ability to improve well-being. According to Hashemi and Schuler (1993) quantifying women's empowerment involves six interrelated dimensions. These are: sense of self and vision of the future, mobility, economic security, decision making power in the household, participation in the non family groups and interaction in the public sphere. The MHD contains details information on various aspects of the lives of women living across the treatment-control villages. In order to test the predictions of the model specified in section 2.3, I have created four principal dimensions of empowerment for these women. These are:

1. Purdah (covering head, a measure of sexual segregation)
2. Property rights
3. Mobility and
4. Decision making.

Measures of Empowerment:

Among the above four dimensions the first three are measures of private consumption. When women are less sexually segregated they have more flexibility inside and outside the house and their opportunity set for earning an income outside home expands. Greater mobility also helps to expand her opportunity set. Furthermore an improvement in property rights on one hand may increase her asset holdings and savings and on the other hand can ensure that she can convert her improved outside options into higher private consumption. The various individual components of these four dimensions of empowerment are discussed below.

Purdah: To take account of their position with respect to the practice of 'purdah' they were asked the following three questions:

1. Do you cover your head when going outside?
2. Do you cover your head inside the *bari*?
3. Do you cover your head inside *bari* in the presence of outsider?

The responses were then assigned a number for each answer: 1 for 'never' and 0 for 'sometimes' or 'always'. A movement from 0 to 1 implies that she is less sexually segregated. Table -2.3 shows the summary statistics for the above three measures of 'purdah'. 82.15% of these women cover head when they go outside. Almost 71% covers head inside the *bari*. And 72.7% covers head in the presence of outside men inside the *bari*.

Property rights: The measurement of property rights is based on the responses to the following questions:

1. Do you own any productive assets?
2. Do you have any cash savings?
3. Is your husband aware of the savings?
4. Have you inherited any property from your parents?
5. Was asset ever taken against your wishes?
6. Was savings ever taken against your wishes?

The responses are again assigned a number for each answer: 0 for 'no' and 1 for 'yes' for the first four questions and the opposite for the last two. Here '1' represents a better condition and '0' represents a grim condition. As table 2.3 shows, only 15% of them own any type of assets, 11% have cash savings, only 9% of the husbands know about their wives' savings, 35% have inherited any property from their parents and for those who have assets or savings 3% of the time it was taken against their wish.

Mobility: Mobility is measured on the basis of the responses to the following questions:

1. Do you have a job?
2. Do you visit parents' house?
3. Do you need permission to visit parents?
4. Are you allowed to travel by public transportation?

5. Are you allowed to travel by rickshaw?
6. Do you need permission to go to cinema?
7. Are you allowed to go to hat (the weekly bazaar)?
8. Can you go to hospital if needed?
9. Do you need permission to go to a hospital if needed?

A number is assigned for each of the responses: 1 for 'yes' and 0 for 'no' for all questions except number 3, 6 and 9. For these three questions the order is reversed. Table 2.3 shows that 89% of the women can visit their parents and 72% of them need permission for a visit. 83% are allowed to travel by rickshaw (a private local transport) and only 72% are allowed to use any public transport. 20% need permission to go to a cinema and 29% are allowed to go to hat. 58% can go to a hospital if they are sick and 85% of them do not need any permission to go there.

Decision making within household: The measurement of decision making relies on the following questions:

1 Whether a woman needs permission to purchase kerosene, ice-cream for children or to make any personal purchases. 0 is assigned if she needs permission from husband or other family members and 1 if she doesn't.

2 Who decides purchase of cloths, betel leaf and nuts, daily bazaar? '1' is assigned if the answer is 'self' and '0' if the answer is 'husband or other family members'.

Table 2.3 shows that almost 50% of the women need permission to purchase kerosene, ice-cream for children and personal stuff. And only 21% to 30% of them have authority to purchase cloths, sari, daily bazaar and betel leaf.

2.4.5 Empirical Strategy

The methodology used in this paper is fairly simple. I compare women from the treatment villages with those from the control villages. If the socioeconomic conditions were similar across the treatment and control villages before the program was launched this comparison will produce consistent estimates of the effects of the family planning program on women's empowerment[5].

[5] I will discuss this issue in detail in section 2.6.

Let Z be an indicator for assignment to a treatment group and Y_{ij} be an outcome for individual i living in village j. The coefficient α_1 in equation (2.1), measures the effect of living in a treatment village on an outcome Y. α_1 is known as the Intent to Treat (ITT) effect. It produces the average affect of an attempted policy on the target population and in this paper is the estimate I am interested in.

(2.1) $$Y_{ij} = \alpha_1 Z + \beta_1 X_{ij} + \varepsilon_1$$

where X_{ij} are characteristics of woman living in household i in village j when the program was launched. X is independent of Z because of the assumption of random assignment of the program. And therefore can be excluded from the regression equation. But to make the estimates more precise and to take care of any other sources that may affect the outcome variable I will add a few exogenous variables to the model. For example whether or not one has to cover her head depends on religion. It is primarily a Muslim custom in rural Bangladesh to abide by the rules of 'purdah'. Again older women are more inclined to this custom. As people grow old they become more attached to religion. To take account of this I control for religion and age in the regression for 'purdah'. Again when women are young they may not have any cash savings or assets. Also one usually inherits property from parents only when they pass away. So property rights may also depend on age. Besides, according to Hindu inheritance law girls don't get any property from their parents. So I have to control for age and religion in the regression for 'property rights' too. The decision making power often is in the hand of the elderly of the household. This is the way things work in most households in rural Bangladesh. So the regression for 'decision making' is controlled for age. Therefore, the regression equation that I will run for each of the variable representing female empowerment is as follows.

(2.2) $$Y_{ij} = \alpha_1 Z + \beta_1 S_{ij} + \beta_2 D_{ij} + \varepsilon_2$$

Where S_{ij} is the age of women in household i living in village j and D_{ij} is a dummy for religion of that person. $D = 1$ if she is Muslim and $D = 0$ if she is Hindu. According to the model presented in section 3, one would expect $\alpha_1 > 0$ in all regression equations for 'purdah', property rights and mobility and $\alpha_1 < 0$ in the regression equations for decision making.

The sample consists of all women living in a primary household. The secondary households were selected on the basis of its link to the primary household. Therefore

observations only from the primary households are truly random. All the regressions are run for three groups of women.

1. Those who were already in their childbearing age when the program started: the cohort of women who were older then 15 in 1977. I call them the 1st generation.
2. Those who were not in their childbearing age: the cohort aged below 15 in 1977. They are referred to as the 2ndgeneration.
3. All the women who were in childbearing age between 1976 and 1996.

Following the model one would expect both the 1st and the 2nd generation of women to be better off compared to the respective control women when it comes to 'purdah', property rights and mobility but they will have a lower level of decision making power compared to the control women.

I run regression (2.2) for all the outcome dummy variables described in section 2.4.4. But to understand the overall impact of the FFP on women's empowerment I construct summary measures for the effect of the program on empowerment – 'purdah', property rights, mobility and decision making from the individual regression coefficients. The summary measures are standardized program effects weighted by the standard errors of the control group. Let σ_k^2 be the variance of outcome Y_k in the control villages. Then the mean effect α for a set of K outcomes that fall under any of the four dimensions of empowerment is created based on the ITT estimates and the control group standard deviations as follows.

(2.3) $$\alpha = \frac{1}{K}\sum_{k=1}^{K}\frac{\alpha_k}{\sigma_k^2}$$

The co-variances of α_k are calculated from the seemingly unrelated regression equation system (2.4).

(2.4) $$Y = (I_K \times (Z \;\; X))\Pi + \Sigma \qquad \text{where } Y = (Y_1', Y_2', \ldots\ldots Y_K')'$$

Where I_k is a K by K identity matrix and Z and X are defined as in (2.2). Estimates for each outcome are identical to those obtained using equation (2.2). I calculate a point estimate, standard error, and p-value for α, based on the parameters α_k, jointly estimated as elements of Π in equation (2.4). The intention of creating summary measures is to draw our attention to a small number of statistical estimates. This will help us to see whether the predictions of the model are supported by data and will make drawing inferences on the FPP and female autonomy

relationship easier. For example, the individual treatment effects for all decision making outcomes may not be uniform and go in different directions, making it difficult to draw any conclusion regarding the predictions of the model. But the mean effect on decision making will give us an average effect of the program on these individual outcome variables and help us see if the aggregate effect is consistent with the model or not. The SUR helps us in another way. In case none of the average effects are statistically significant it helps us to test the hypothesis that all the individual treatment effects are simultaneously non-positive (for 'purdah', property rights and mobility) or non-negative (for decision making). A rejection of this null hypothesis will imply that even if the summary estimates are not statistically significant for any of the measures, some of the individual measures are.

2.5 Results

The primary results are for the individual outcome variables and the results for summary measures of empowerment are presented in tables 2.4 – 2.7. The individual effects of the FPP on women's empowerment are not statistically significant most of the time but the standardized mean effects are.

2.5.1 Effect on Purdah

In rural Bangladesh the social system insists upon strict segregation of the sexes and control of assets and wealth are put in the hands of males. The women have little control over the choices they make and their lives as a whole. After the FPP if it is observed that a women who used to practice purdah has shied away from it that would clearly indicate that she has greater freedom to exercise her choice. And hence one can say that she has been empowered.

The family planning program can affect the practice of 'purdah' in several ways. First women who have fewer children have extra time to work outside. This will increase their earned income and will give her more control over her life. The second channel is through education. More educated women are less likely to give way to this social tradition of female seclusion. As Foster and Roy (1996) show, the children in the treatment villages on average have significantly more years of education than those in the control villages. Therefore we would expect a positive

change in the practice of 'purdah' among both the 1st and the 2nd generations of women and the effect would be stronger for the 2nd generation of women.

Table 1.4 shows the results of regression equation (2.2) for 'purdah'. I run the regression for three groups of women – the 1st generation women, the 2nd generation women and all women. In the table, columns (1), (2) and (3) show that fewer women in the treatment villages are covering their heads when they go out. And the results are statistically significant for all three groups. The coefficient is slightly larger for the 2nd generation than that for the 1st generation as expected. This means that the FPP affected the younger generation's practice of 'purdah' more than that of the older generation. There is no significant difference in the proportion of women who cover their head inside the *bari* across the treatment-control villages. However the proportion of the 2nd generation women who covers their head before males not within their kinship groups is smaller compared to the corresponding control group. It seems that the FPP affected the practice of 'purdah' mainly through education. On average a woman born after 1976 has 0.6 years of more education than their counterparts in the control villages. But there were no significant differences in the level of education between the 1st generation treatment-control women.

Column (1), (2) and (3) of table 2.4 also show the standardized mean effect of the FPP on 'purdah'. The family planning program affected the aggregate practice of 'purdah' only among the young women as shown is column 1. These women are less likely to cover their head inside or outside of *bari* by 0.087 standard deviation. These results are consistent with the hypothesis that the 2nd generation of women exposed to the FPP are better educated and are less likely to be sexually segregated.

1.5.2 Effect on Property Rights

The rural women in Bangladesh have almost no property rights. The social structure allocates the control of resources to males. Since their primary job is to perform household duties, mainly attending the personal needs of their husbands and children and in-laws, most women have no income and savings. They also don't get share in parents' property, not because the law is against it but because of the male dominance in society. And in many cases the women are not even aware of their property rights. The FPP can improve women's property rights in two ways. First of all when women have fewer children they have time to work outside or inside the

house and earn extra income. Therefore it helps them to own assets or have savings. This reflects increased private consumption in terms of the model presented in section 2.3. Second, the 2nd generation of women, since they are more educated, is more likely to be aware of their property rights. It is more difficult to take her assets against her will[6]. Therefore, we would expect both the 1st and 2nd generations of women in the treatment villages to have higher property rights and higher private consumption compared to those in the treatment villages. But whether or not the 2nd generation of women would have a higher property rights than the 1st generation is not clear. They will be more likely to own assets. And the incidence of confiscation of property or cash will be less likely for them. But at the same time since they are below age 35, they are less likely to inherit any property as it is bestowed only after the death of the parents.

The results of regression equation (2.2) for property rights are presented in table 2.5. The sample consists of women who were over 20 and below 65. Women over 65 were not affected by the family planning program in any way. And those below 20 are less likely to own any property or cash savings. Columns (1), (2) and (3) of table 2.5 show that women in the treatment villages have more assets than those in the control villages. But the estimate is statistically significant only for the 2nd generation of women. However the treatment women don't have more cash savings than the control women. Neither are the husbands more aware of the wives' savings in the treatment villages. This is consistent in the sense that there may be a possibility that if the husband knows about cash savings he will take it away. So the savings are in the form of assets rather than cash. There is also no significant improvement in the treatment women's status in terms of likelihood of their assets/cash savings being taken against their will.

Table 2.5 also shows the results for aggregate measures of property rights. Though the individual effects on the measures of property rights are not all statistically significant this table shows that the FPP substantially improved (by 0.063 standard deviation) the property rights for the 1st generation of women altogether. The mean standardized effect on property rights is also significant for all women in their child bearing age. The FPP improved their property rights by 0.06 standard deviation. However the program had no significant effect on the property rights of the 2nd generation of women. Even though the aggregate standardized effect on this group is not

[6] Often when women don't know how to read they can be easily deceived to give away their property. They can sign or finger print papers without knowing the contents. This is a common incident in rural areas and one of the ways how brothers and relatives deprive women from their inheritance and get away with it.

significant it rejects the one tail joint test that all the six individual effects are non-positive with probability 0.91.

2.5.3 Effect on Mobility

Most women's lives in rural Bangladesh evolve and end within the boundaries of the *baris*. The male dominated overly protective society watches and monitors women's movements with great caution and in an obnoxious manner. Women need permission to go outside the *baris*. And sometimes they are not allowed to visit their parents' house without any major occasions. In most households women so not work outside. For a village woman going to the '*hat*' is a mater of disgrace for her family. A lot of these clichés change when women have fewer children and have time to earn income for the family and for themselves. First of all, their mobility increases when they can go outside to work. Second, the earned income may give her more control over her own life and improve her mobility. Third, the FFP increased the level of education among the boys and girls of the 2nd generation. So the 2nd generation of women may have greater mobility because they are more educated and have more educated husbands as a result of assortative matching compared to their counterparts in the control villages. Finally, the FPP hires female CHW form the treatment villages. Their job requires them to go outside the boundaries of their own *baris* and travel across villages. The villager who resisted their course of action at the beginning accepted them after sometime. These CHWs also gained considerable respect among the villagers for the services they provide. Thus they helped change the villagers' perception of women working outside their home. This may ease the restrictions on women's mobility for both the 1st and 2nd generations of women

Table 2.6 presents the results of regression equation (2.2) for the various individual components of mobility. As columns (1), (2) and (3) show, the regression coefficients are significant for all three groups only for the hospital variable. More women in the treatment villages can go to hospital if necessary compared to those in the control villages. But they need permission to go to a hospital just like the women in the control villages. They don't have higher mobility in terms of going to the *hat* or cinema or using public transportation. In fact more treatment women need permission to visit their parents but the difference is not statistically significant for any groups of women. The standardized mean effects are presented in the second

to last row of table 2.6. It shows that even though many of the individual effects are not statistically significant the standardized mean effects are for all three groups. On average the FPP has increased mobility of the 1st and 2nd generations of treated women by 0.081 standard deviations and 0.078 standard deviations respectively. The corresponding figure for all women is 0.077. These results are consistent with the claims made at the beginning of this section.

2.5.4 Effect on Decision Making within the Household

The model in section 2.3 suggests that women in the treatment villages will have lower decision making power within the household for a certain range of fertility. This prediction of the model is in clear contradiction with the traditional view. Just as in the cases of 'purdah', property rights and mobility, the traditional paradigm would expect that the treated women to have more decision making power within the households compared to those in the control villages. The women in the treated villages are more educated, have greater property rights, own more assets and are less sexually segregated than those in the control villages. All these factors are likely to give her more decision making power within the households under the conventional model. But the empirical results support the hypothesis of the model presented in this paper and not of the traditional paradigm

Table 2.7 presents the results for regression equation (2.2) for the individual components of decision making and the mean effects. All the coefficients are negative for all three groups of women. This implies that the women in the treatment villages have less decision making power when it comes to common resource allocation within the household. More women in the treatment villages need permission to buy kerosene, ice-cream for children and personal items for themselves. A smaller fraction of them has any decision making power over the purchase of children's clothing, sari, daily bazaar and betel-leaf compared to the control group. Though all of these individual coefficients are not statistically significant for any of the groups of women the standardized mean effects are. The penultimate row of table 2.7 shows the standardized mean effect of the FPP on decision making. It shows that the FPP reduces the program women's overall decision making power, by 0.136 standard deviation among the 2nd generation, by 0.11 standard deviation among the 1st generation and by 0.12 standard deviation among all of them compared to those of the control women.

All the above estimates support the predictions of the model. However, the consistency of all these estimates critically depends on the assumption that the treatment and control women were identical in all respects before the program was launched. This discussion is pursued in the next section.

2.6. Robustness of the Estimates

2.6.1 Program Placement

One objection against the above estimates may come from figure 2.3. Though all of the publications that used data from *Matlab* repeatedly claim that the program was placed in a way to facilitate scientific evaluation (Bhatia 1982, Foster and Roy 1996), figure 2.3 shows that the treatment villages are actually clustered in the middle of the *Matlab thana* and the control villages are bunched into two groups at the tails of the treatment villages.

We can check the claim that the area of *Matlab* was homogenous in three ways. One is to see the effect of the FPP on the women who were not affected by the program. The women who were already past their child bearing age in 1977, when the program was introduced should not have any difference in their levels of empowerment across the treatment control villages. But the sample size for this group is too small to find the standardized mean effect of the FPP on their measures of empowerment. Therefore I can't explore this channel. The second approach is to select a group of treatment and control villages along the border of the two control areas and check whether or not the same difference in the level of empowerment persists for each group. Another is to do a propensity score matching.

The results for the second approach are presented in Tables I-IV in Appendix I. I do this exercise for two groups of treatment-control areas. The first group has observations on 1812 women living in 54 treatment-control villages. The treatment villages are selected from blocks A and B and the corresponding control villages are drawn from block E. The second group has 88 treatment-control villages with an observation of 1619 women. The treatment households belong to blocks C and D and the control villages to block F. Table (I) suggests that the family planning program reduced the sexual segregation among the treatment women in both groups compared to the control women. The 2nd generations of women in both these groups are less likely to cover their heads outside the *bari*. The coefficients for the other two measures of 'purdah' are positive

but not statistically significant. The mean standardized effect is also positive for both groups but it is statistically significant only for group II. Table (II) shows the results for property rights for groups (I) and (II). The first generations in both groups have higher property rights. None of the individual effects are statistically significant and the mean standardized effects are positive and statistically significant only for group (I). However, it rejects the null hypotheses that all the individual effects are non-positive at 90% for group (II). Table (III) presents the results for mobility. As columns (3) and (6) show, a statistically significant larger fraction of the program women in groups (I) and (II) can go to the hat and hospital if they are sick. A fewer of them need permission to go to cinema and more of them can use public transport compared to the control women but these differences are not statistically significant. However, the mean effect of the FPP on mobility is statistically significant and is also consistent with those presented in section 2.5. Both groups have higher average mobility in the program villages than that in the control villages. Finally table (IV) presents the results for decision making. In both groups (I) and (II) program women have less decision making power than their counterpart in control villages. These results are consistent with those presented in section 2.5 and confirm that even if the villages were not randomly picked as treatment and control villages they were homogenous before the program was launched and therefore the program design approximates a truly random experiment.

The second approach to check for the consistency of the results is to do a propensity score matching. It matches treatment and control villages with the same propensity score (probability to be treated). The propensity score for each household is estimated based on some pre-program level characteristics of the villages such as – average age, proportion of Muslim population and the distance of the village from the treatment/control border. All the women that have the same propensity score comprise a cell. Then treatment and control women in each cell are compared. The difference in level of empowerment in each cell is simply given by:

$$E[Y_{ij} \mid X;\ T=1] - E[Y_{ij} \mid X;\ T=0]$$

The final estimate is found by taking a weighted average of the differences in different measures of empowerment over all the cells. The weights used are the fraction of treated women in cells. Therefore, the regression matching result is just:

$$E_X\{E[Y_{ij} \mid X_j;\ T=1] - E[Y_{ij} \mid X_j;\ T=0]\} = \int \{E[Y_{ij} \mid x, T=1] - E[Y_{ij} \mid x, T=0]\} P(x = X \mid T=1) dx$$

For this study the propensity scores are calculated using the following control variables – the pre-program average age of women in the village, average village level of education and the distribution of religion in the village. Furthermore, in order to address the problem of selection bias at the village level I will include the distance of the villages from the treatment-control borders in calculating the propensity scores. This takes care of any demographic differences among the villages across the treatment control borders. The villages near the borders must have similar socioeconomic conditions and therefore any difference in the level of empowerment must be a result of the family planning program. Table 2.8 presents the results of propensity score matching. Columns (1) (2) (3) and (4) show the regression matching estimates for women living within 1.5 mile, 3 miles, 4.5 miles and beyond the treatment-control borders. The average treatment effects on the treated are significantly different from 0 for many of the variables and are not statistically significant for others. But they are all consistent with the ITT estimates presented in tables 2.4 -2.7. And they also remain qualitatively same as we include more villages in our estimates. The treated women are less sexually segregated, can enjoy higher property rights and greater mobility and at the same time they have lower decision making power within the household. The standardized mean effects for propensity score matching are also similar for those who live near the border and for those who live far away from it except for the case of 'purdah' and are similar to those presented in section 2.5. The FPP improved women's status in terms of purdah by .09 standard deviations. Similarly it improved mobility by 0.07 standard deviations, women's property rights by 0.046 standard deviation but it lowered their decision making power by 0.1 standard deviation. These results also corroborate the fact that the socio economic conditions across the treatment and control villages were fairly similar before the program was introduced and the program placement did not constraint the analysis and conclusions presented in this paper in any significant way.

2.7 Conclusion

Economists and policy makers have long recognized the inevitability of women's participation in the development process. Though there are diverse opinions on how to increase and improve their participation one unanimous opinion is that women should be empowered. There are many ways to empower women such as access to better education, access to credit,

reduced fertility, change in social perspective regarding women's place in it and so on. But there has been hardly any methodological research about the impacts or effectiveness of these variables on female empowerment. It is also difficult to say whether any single intervention can have any significant impact. This paper studies the impact of a FPP in a remote area of Bangladesh that successfully reduced fertility on the status of women. The conventional paradigm views FPP as conducive to female autonomy. But the results brought out in this paper apprehend the conventional view to some extent. It finds that a FPP can improve women's status outside the household and increase their flexibility. But at the same time it can reduce their autonomy within the household. The results show that the treated women have greater mobility, improved property higher property rights and are less sexually segregated compared to the control women. At the same time these same women have less decision making power within the household compared to control women. It reduces their control over common household resources. Hence the FPP poses a trade off among different aspects of female autonomy.

These results are interesting not only because it sheds new light on the popular view regarding the effects of FPP on empowerment. The evidence presented here does not only apprehend the popular concept but also explain an intrinsic feature of household functioning in a developing country like Bangladesh. But to my knowledge this is the first study that attempts to measure this relationship in a structured way.

The paper also shows that the resulting changes in women's status cannot be explained by any ways other than the FPP. Therefore one can conclude that in addition to reducing fertility the FPP can be an effective intervention to empower women and improve their autonomy outside the household. But policy makers should be careful about the trade off it brings in. The FPP improves female autonomy outside the household at a cost of reducing it within the household. This change in the dynamics of decision making power within the household may have adverse effects on the next generation as it affects the allocation of resources within the household.

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Table 2.1: Characteristics of Treatment and Control groups

Characteristics	Treatment	Control	All
Mean age of the HH head (years)	48.47 (13.40)	48.97 (13.71)	48.73 (13.56)
Religion:			
Muslim	84.62	95.61	90.34
Hindu	15.38	4.39	9.66
HH head's level of schooling (years)	6.00 (3.43)	5.43 (3.21)	5.72 (3.34)
Sex of HH head (%):			
Male	86.56	86.59	86.57
Female	13.44	13.41	13.43
HH head's level of education	6.00 (3.4)	5.45 (3.2)	5.73 (3.3)
Family size*	5.9	5.8	5.9
Under five mortality*	22.1	22.5	22.3
Occupation (%)			
Agriculture	28.03	24.31	26.09
Laborer	11.76	13.34	12.57
No of households	1176	1268	2444

Standard errors are in the parentheses.
Source: MHSS data
* These statistics are obtained from DSS 1976

Table 2.2: Characteristics of women in Matlab

	All women		All women below 35	
	Treatment	Control	Treatment	Control
Marital status (%)				
Unmarried	11.92	11.43	26.16	26.38
Married	72.02	71.47	71.05	70.98
Separated	0.61	0.73	0.85	0.84
Divorced	0.72	0.68	0.97	0.72
Widow	14.74	15.70	0.97	1.08
Labor force participation	4.62%	2.28%	3.39%	1.92%
Age	39.40 (15.47)	39.85 (15.76)	25.84 (5.95)	25.23 (5.95)
Religion (Muslim)	83%	95%	83%	95%
Education	5.6 (2.7)	5.1 (2.5)	6.22 (2.7)	5.66 (2.56)
No if children	6.56 (3.49)	7.34 (3.59)	5.75 (3.6)	6.48 (3.83)
Age at marriage	15.87 (5.1)	15.32 (3.9)	16.98 (4.07)	16.83 (4.1)
No of ob.	1812	1924	828	833

Standard errors are in the parentheses.

Table 2.3: Mean of Empowerment Variables.

	For age<35	For age>=35	For all women	For HH<3 miles of border	For HH >3 miles of border
Panel A: Purdah					
Cover head when outside bari	0.29	0.07	0.17	.18	.15
Cover head inside bari	0.40	0.17	0.28	.29	.27
Cover head inside bari for outside men	0.38	0.16	0.27	.27	.25
No. of Observations	**1629**	**1788**	**3417**	**1686**	**1511**
Panel B: Property Rights					
Have asset	.14	.16	0.15	.15	.15
Have cash savings	.15	.08	0.11	.14	.08
Husband knows about savings	.12	.07	0.09	.12	.06
Inherited property from parents	.36	.32	0.35	.35	.34
Money taken against wish	.96	.97	0.96	.96	.97
Asset taken against wish	.97	.98	0.97	.97	.98
No. of Observations	**1147**	**1684**	**2831**	**1418**	**1353**
Panel C: Mobility					
Need permission to visit parents	.19	.31	0.27	.23	.26
Can visit parents	.96	.86	0.89	.9	.9
Can use public transport	.75	.72	0.72	.77	.69
Can travel by rickshaw	.85	.83	0.83	.86	.82
Can go to cinema	.35	.12	0.20	.24	.19
Can go to hat	.34	.26	0.29	.3	.27
Can go to hospital if sick	.6	.58	0.58	.61	.55
Need permission to go to hospital	.86	.85	0.85	.85	.86
No. of Observations	**1148**	**1629**	**2777**	**1384**	**1238**
Panel D: Decision Making					
Needs permission to purchase kerosene	0.4	0.56	0.48	.46	.49
Needs permission to make personal purchases	0.43	0.57	0.49	.47	.5
Needs permission to buy ice-cream	0.48	0.6	0.53	.52	.54
Can decide to buy cloth	0.17	0.27	0.21	.18	.24
Can decide purchase of sari	0.18	0.27	0.21	.18	.24
Can purchase daily bazaar	0.18	0.29	0.23	.19	.26
Can decide on purchase of betel-leaf	0.2	0.38	0.29	.25	.32
No of observations	**900**	**956**	**1856**	**875**	**845**

Table 2.4: Effects on 'Purdah'

	For age<35	For age >=35	For all
Dependent Variable	ITT (1)	ITT (2)	ITT (3)
Cover head when outside bari	.05* (.023)	.045** (.015)	.039** (.015)
Cover head inside bari	.018 (.029)	.01 (.02)	.008 (.025
Cover head inside bari for outside men	.052* (.028)	-.017 (.02)	.006 (.019)
Mean effect	0.087* (0.05)	0.068 (0.056)	0.047 (0.042)
No of observation	1629	1788	3417

ITT = Intent to treat effect on the treated. ** Significant at the level of 5%. * Significant at the level of 10%. Standard errors, corrected for heteroscedasticity, are in the parentheses. A positive coefficient means that treatment women are less likely to cover their head.

Table 2.5: Effects on Property Rights

	For age <35	For age>=35	For all
Dependent Variable	ITT (1)	ITT (2)	ITT (3)
Have asset	.052** (.025)	.034 (.022)	.043** (.02)
Have cash savings	.039 (.029)	.034 (.022)	.037* (.02)
Husband knows about savings	.023 (.024)	.028 (.019)	.027 (.018)
Inherited property from parents	.042 (.041)	.027 (.033)	.018 (.041)
Money taken against wish	-.011 (.014)	-.001 (.008)	-.005 (.008)
Asset taken against wish	-.009 (.014)	-.005 (.006)	-.007 (.007)
Mean effect	0.051 (0.035)	0.063** (0.03)	0.06** (0.025)
No. of observation	1147	1684	2831

ITT = Intent to treat effect on the treated. Standard errors, corrected for heteroscedasticity, are in the parentheses. Respondents below age 20 are excluded from the sample. **Significant at the level of 5%. * Significant at the level of 10%.

Table 2.6: Effects on Mobility

	For age <35	For age>=35	For all
	ITT	ITT	ITT
Dependent Variable	(1)	(2)	(3)
Work outside	0.024**	0.019**	0.024**
	(0.01)	(0.008)	(0.007)
Need permission to visit parents	-.019	-.002	-.008
	(.027)	(.027)	(.023)
Can visit parents	.009	.027	.021
	(.012)	(.022)	(.014)
Can use public transport	.028	.043	.03
	(.04)	(.034)	(.03)
Can travel by rickshaw	.034	.05	.043*
	(.035)	(.024)	(.024)
Can go to cinema	.037	.018	.025
	(.04)	(.02)	(.023)
Can go to hat	.02	.05	.0445
	(.05)	(.038)	(.038)
Can go to hospital if sick	.08	.103	.094**
	(.04)	(.03)	(.03)
Need permission to go to hospital	.021	-.008	.005
	(.039)	(.035)	(.035)
Mean effect	0.074*	0.089**	0.084**
	(0.04)	(0.03)	(0.03)
No of observation	1148	1629	2773

ITT = Intent to treat effect on the treated.
Standard errors, corrected for heteroscedasticity, are in the parentheses.
**Significant at the level of 5%. * Significant at the level of 10%

Table 2.7: Effects on Decision Making within Household

	For age<35	For age>=35	For all
	ITT	ITT	ITT
Dependent Variable	(1)	(2)	(3)
Needs permission to purchase kerosene	-.07 (.03)	-.0289 (.048)	-.048 (.038)
Needs permission to make personal purchases	-.079 (.039)	-.018 (.047)	-.047 (.038)
Needs permission to buy ice-cream	-.078 (.043)	-.047 (.045)	-.058 (.037)
Can decide to buy cloth	-.0455 (.032)	-.068* (.04)	-.056* (.03)
Can decide purchase of sari	-.037 (.032)	-.066 (.04)	-.052 (.03)
Can purchase daily bazaar	-.052 (.032)	-.078* (.04)	-.0648** (.03)
Can decide on purchase of betel-leaf	-.069** (.03)	-.086* (.044)	-.078** (.03)
Mean effect	-0.136* (0.061)	-0.11* (0.07)	-0.12* (0.06)
No of observation	900	956	1856

ITT = Intent to treat effect on the treated.
Standard errors, corrected for heteroscedasticity, are in the parentheses.
**Significant at the level of 5%. * Significant at the level of 10%.

Table 2.8: Results for Propensity Score Matching

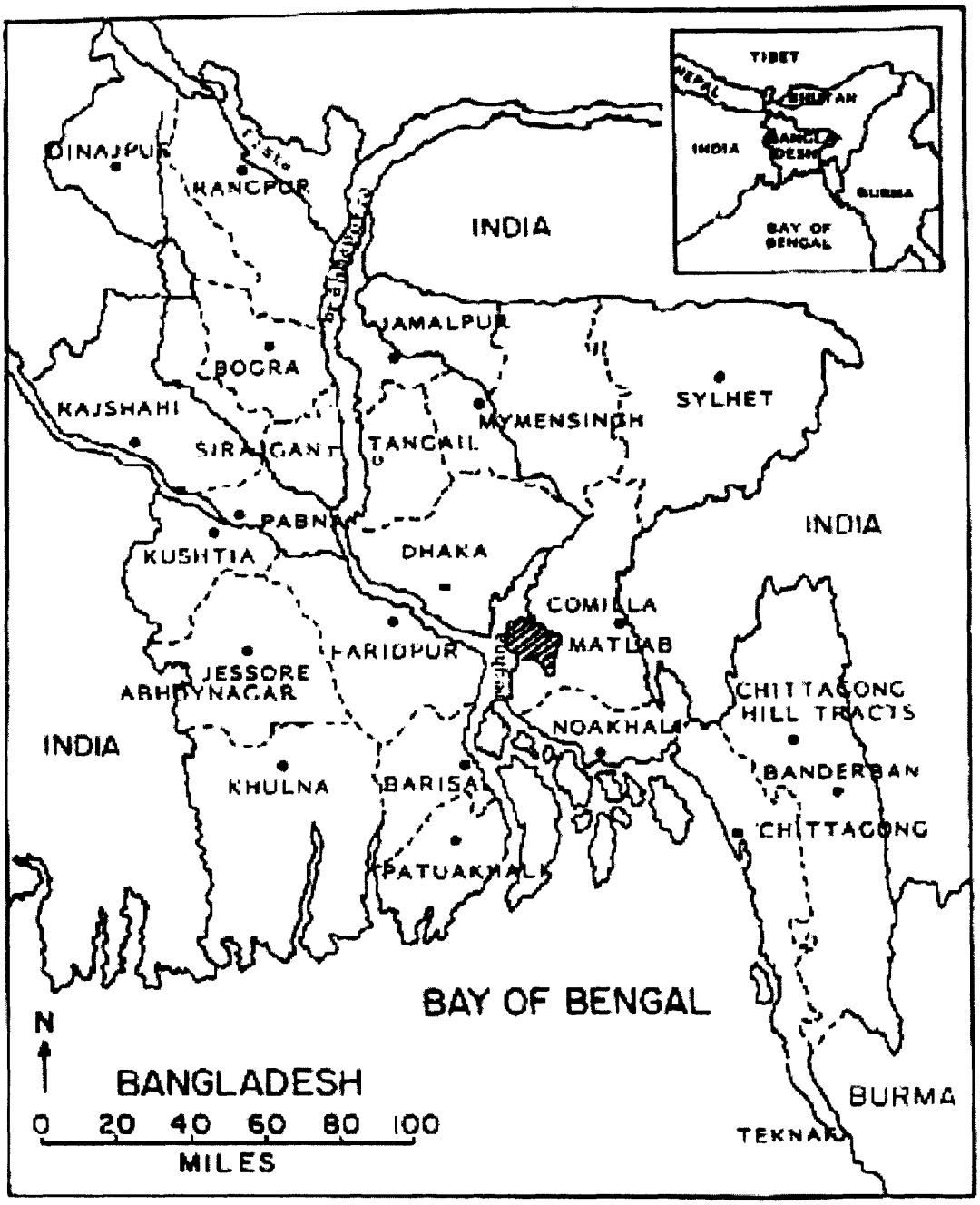
	Hh<1.5 Miles of Border	Hh<3 Miles from Border	Hh<4.5 Miles from Border	All
Dependent Variable	(1)	(2)	(3)	(4)
Purdah				
Cover head when outside bari	0.03	0.057**	0.059**	0.059**
	(0.03)	(0.02)	(0.015)	(0.014)
Cover head inside bari	-0.02	0.04*	0.022	0.034*
	(0.06)	(0.023)	(0.02)	(0.019)
Cover head inside bari for outside men	-0.02	0.034	0.002	0.022
	(0.04)	(0.022)	(0.02)	(0.019)
Mean effect	-0.027	0.1*	0.08**	0.09**
	(0.07)	(0.03)	(0.02)	(0.029)
No of observation	**735**	**1811**	**2521**	**3199**
Property Rights				
Have asset	-0.01	-0.005	0.009	.02
	(0.05)	(0.03)	(0.02)	(0.018)
Have cash savings	0.04	-0.005	-0.007	0.007
	(0.04)	(0.017)	(0.018)	(0.016)
Husband knows about savings	0.07**	0.003	-0.006	0.008
	(0.02)	(0.017)	(0.014)	(0.015)
Inherited property from parents	-0.05	-.011	-0.012	0.018
	(0.069)	(0.031)	(0.021)	(0.024)
Money taken against wish	0.06*	.027**	0.016*	0.017
	(0.033)	(0.011)	(0.009)	(0.011)
Asset taken against wish	0.02	0.011	0.007	0.007
	(0.03)	(0.01)	(0.008)	(0.008)
Mean effect	0.102*	0.019	0.009	0.046**
	(0.056)	(0.023)	(0.02)	(0.022)
No. of observation	**601**	**1418**	**2111**	**2771**
Mobility				
Work outside	0.06**	0.03**	0.018*	0.02
	(0.01)	(0.012)	(0.009)	(0.09)
Need permission to visit parents	0.08**	0.071**	0.044**	0.036*
	(0.037)	(0.23)	(0.02)	(0.01)
Can visit parents	0.009	0.02	0.016	0.019
	(0.032)	(0.023)	(0.015)	(0.017)
Can use public transport	-0.06	-0.028	-0.018	-0.01
	(0.045)	(0.032)	(0.02)	(0.02)

Table 2.8(cont.): Results for Propensity Score Matching (All Households)

	Hh<1.5 Miles of Border	Hh<3 Miles from Border	Hh<4.5 Miles from Border	All
	(1)	(2)	(3)	(4)
Can travel by rickshaw	-0.04	-.007	0.003	0.023
	(0.036)	(0.022)	(0.02)	(0.018)
Can go to cinema	-0.04	0.026	0.012	0.02
	(0.061)	(0.027)	(0.02)	(0.02)
Can go to hat	0.015	0.059*	0.047*	0.043**
	(0.06)	(003)	(0.024)	(0.21)
Can go to hospital if sick	0.15**	0.064**	0.077**	0.09**
	(0.066)	(0.031)	(0.026)	(0.24)
Need permission to go to hospital	-0.06**	0.03	0.027	0.01
	(0.02)	(0.018)	(0.018)	(0.014)
Mean effect	0.09*	0.015**	0.069**	0.07**
	(0.048)	(0.007)	(0.02)	(0.002)
No of observation	**642**	**1384**	**2213**	**2622**
Decision Making				
Needs permission to purchase kerosene	-0.06	-0.03	-0.48*	-0.04
	(0.06)	(0.03)	(0.029)	(0.37)
Needs permission to make per. purchases	-0.068	-0.036	-0.053	-0.046
	(0.07)	(0.036)	(0.03)	(0.032)
Needs permission to buy ice-cream	-0.03	-0.066**	-0.09**	-0.075**
	(0.06)	(0.027)	(0.029)	(0.037)
Can decide to buy cloth	-0.11	-0.12**	-0.055*	-0.044
	(0.08)	(0.052)	(0.036)	(0.028)
Can decide purchase of sari	-0.1	-0.13**	-0.06	-0.049*
	(0.09)	(0.04)	(0.07)	(0.031)
Can purchase daily bazaar	-0.11	-0.169**	-0.083**	-0.069**
	(0.085)	(0.026)	(0.036)	(0.024)
Can decide on purchase of betel-leaf	-0.11	-0.14**	-0.096**	-0.08**
	(0.1)	(0.044)	(0.033)	(0.026)
Mean effect	-0.2**	-0.07**	-0.116**	-0.1**
	(0.06)	(0.027)	(0.023)	(0.026)
No of observation	**422**	**968**	**1461**	**1896**

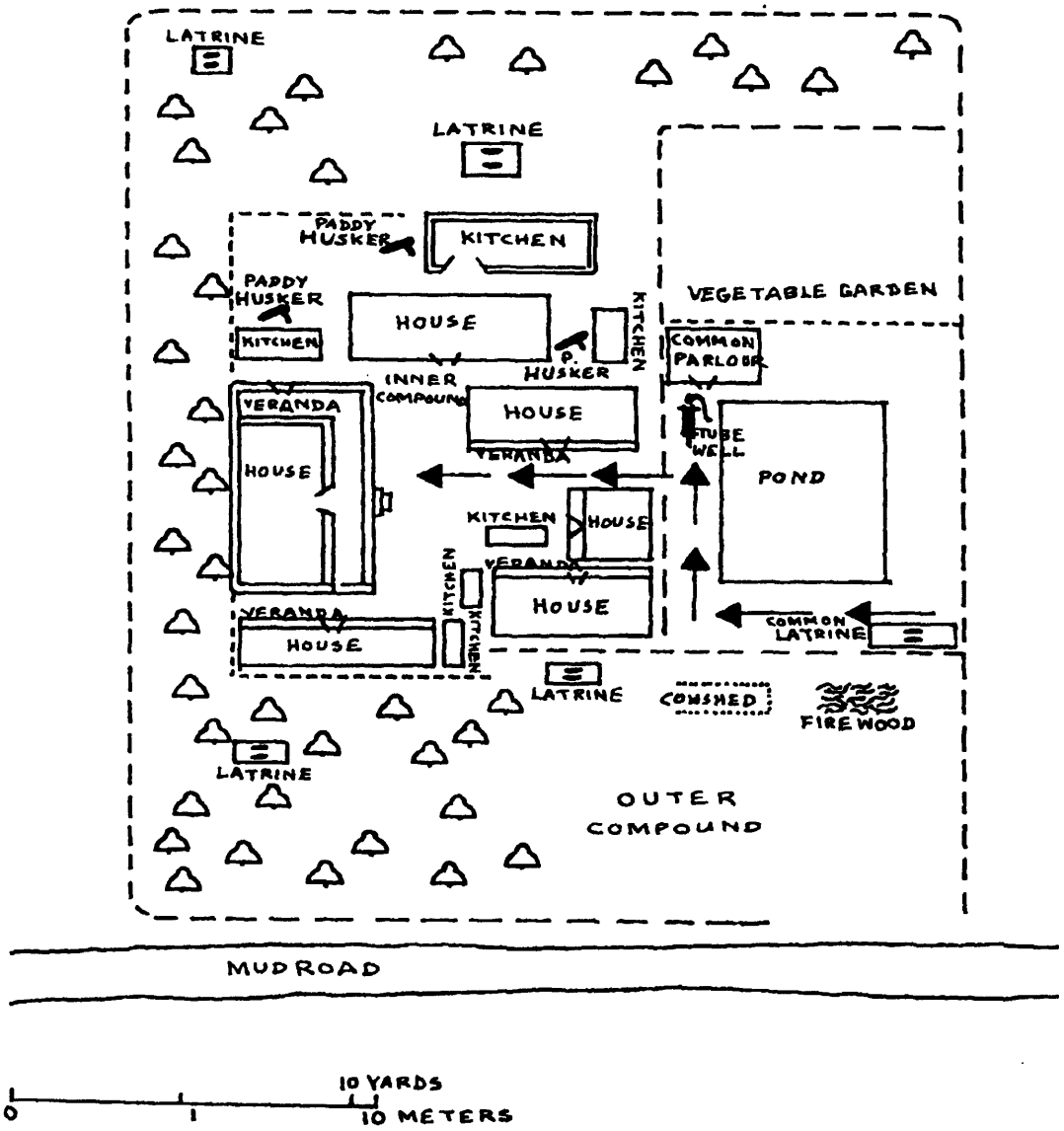
Standard errors, corrected for heteroscedasticity, are in the parentheses.
**Significant at the level of 5%. * Significant at the level of 10%.

FIGURE 2.1: MAP OF BANGLADESH SHOWING THE MATLAB AREA



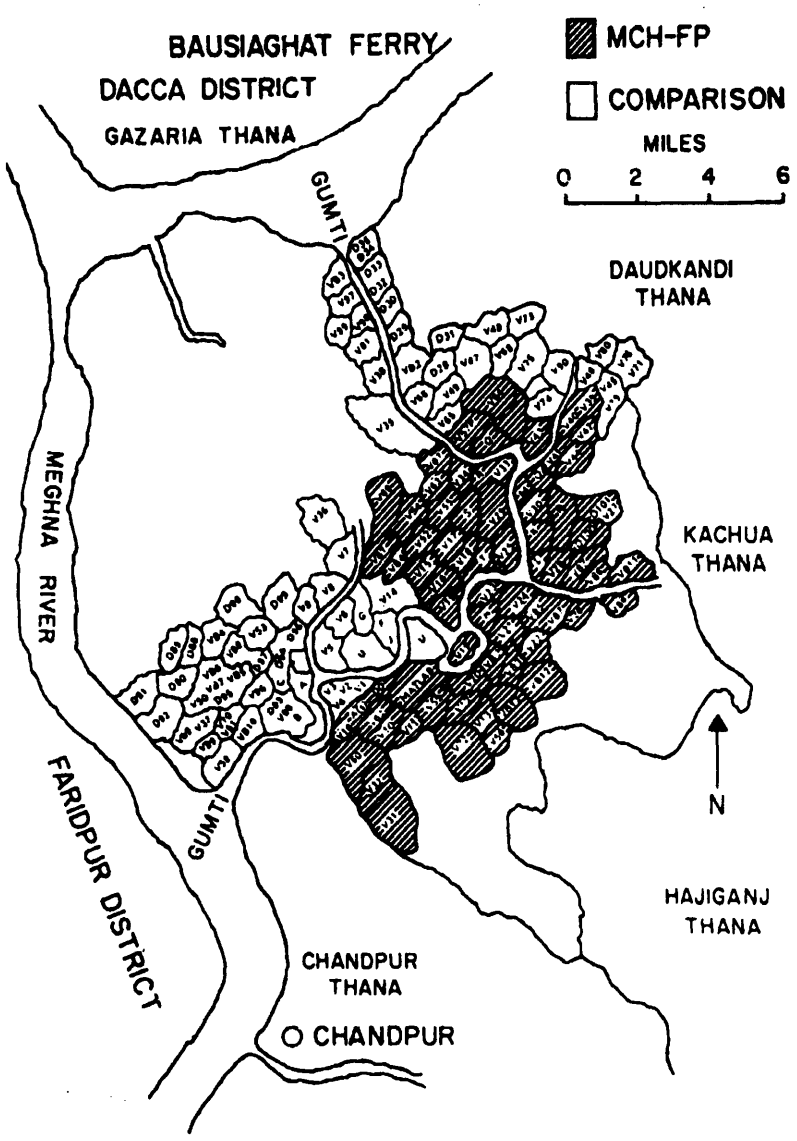
SOURCE: Mostafa G, K.M.A. Shaikh, J.K. van Ginneken and A.M. Sarder, 1998."Demographic Surveillance System-Matlab. Registration of Demographic Events", vol 28; International Centre for Diarrhoeal Disease Research, Bangladesh, Scientific Report No. 82.

FIGURE 2.2: PLAN OF A COMMON BARI IN MATLAB



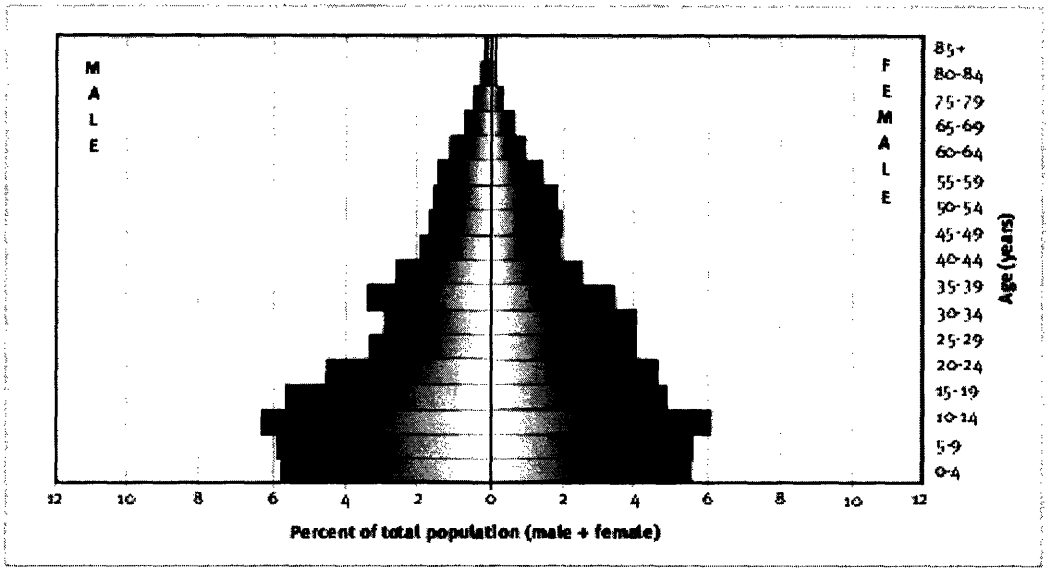
SOURCE: Rahman, M. "Tradition, Development, And the Individual. A Study of Conflicts and Supports to Family Planning in Rural Bangladesh." Edited by Penny Kane and Lado Ruzicka; *Asian Population Change Series No. 1*, Department Of Demography, Australian National University, Canberra, 1986.

FIGURE 2.3: MATLAB AREA SHOWING VILLAGES OF DEMOGRAPHIC SURVEILLANCE SYSTEM



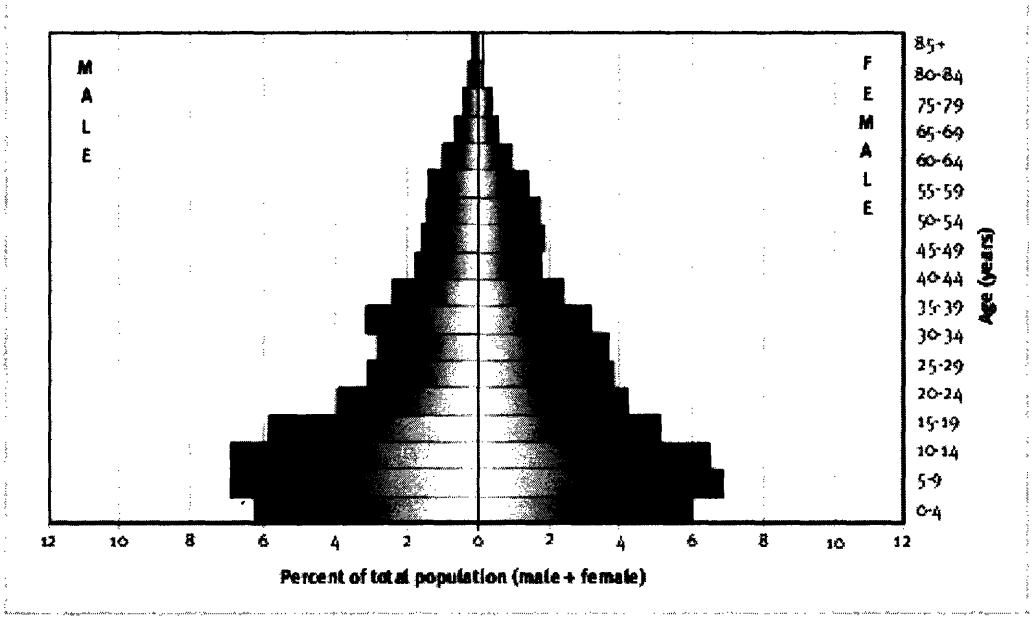
SOURCE: Mostafa G, K.M.A. Shaikh, J.K. van Ginneken and A.M. Sarder, 1998. "Demographic Surveillance System-Matlab. Registration of Demographic Events", vol 28; International Centre for Diarrhoeal Disease Research, Bangladesh, Scientific Report No. 82.

Figure 2.4.1: Population pyramid for person–years observed in the treatment area of the Matlab DSS site, Bangladesh, 1998.



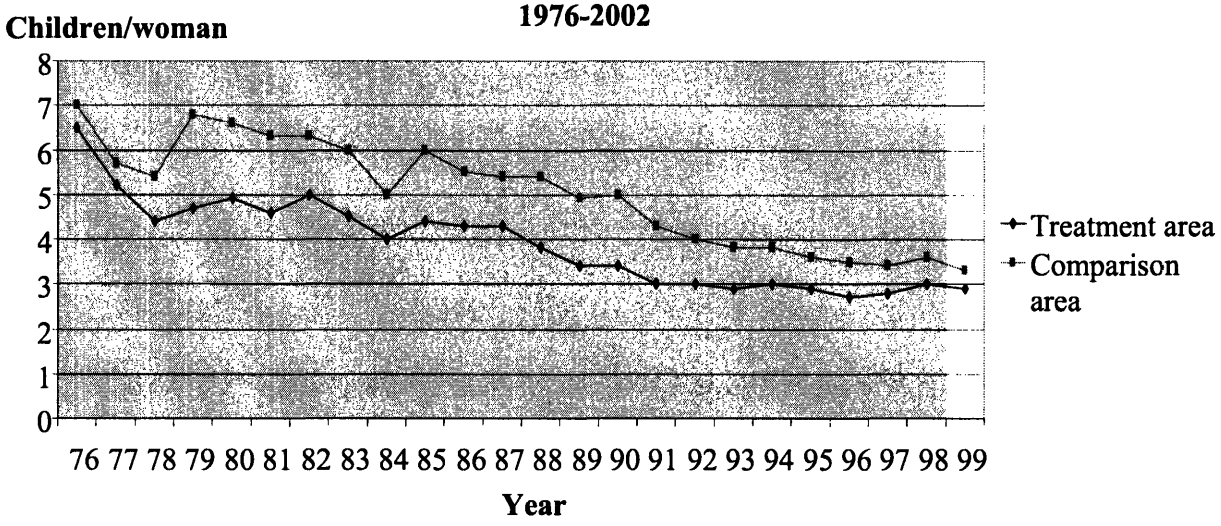
Source: Internet.

Figure 2.4.2: Population pyramid for person–years observed in the comparison area of the Matlab DSS site, Bangaldesh.



Source: Internet

Figure 2.5: Total Fertility Rates in Matlab comparison and MCH-FP areas, 1976-2002



Appendix I

Table I: Effects on 'Purdah' (Group I & Group II)

	Group I			Group II		
	For age<35	For age >=35	For all	For age<35	For age>=35	For all
	ITT	ITT	ITT	ITT	ITT	ITT
	(1)	(2)	(3)	(4)	(5)	(6)
Cover head when outside bari	0.058* (0.03)	0.013 (0.01)	0.025 (0.018)	0.052 (0.03)	0.088** (0.02)	0.06** (0.023)
Cover head inside bari	-0.01 (0.04)	-0.03 (0.04)	-0.02 (0.03)	0.044 (0.04)	0.068* (0.03)	0.05 (0.03)
Cover head inside bari for outside men	0.08** (0.038)	-0.02 (0.02)	0.017 (0.02)	0.017 (0.04)	-0.018 (0.03)	-0.005 (0.03)
Mean effect	0.09 (0.064)	-0.015 (0.07)	0.02 (0.05)	0.09 (0.074	0.2* (0.08)	0.11* (0.06)
No of observation	843	923	1766	719	809	1528

ITT = Intent to treat effect on the treated.
**Significant at the level of 5%. * Significant at the level of 10%.
Standard errors, corrected for heteroscedasticity, are in the parentheses.

Table II: Effects on Property Rights (Group I and Group II)

	Group I			Group II		
	For age <35	For age>=35	For all	For age<35	For age>=35	For all
	ITT	ITT	ITT	ITT	ITT	ITT
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)
Have asset	0.11**	0.05	0.083**	-0.013	-0.005	0.021
	(0.035)	(0.03)	(0.03)	(0.030	(0.02)	(0.019)
Have cash savings	0.06	0.03	0.05	-0.018	0.007	0.006
	(0.04)	(0.03)	(0.03)	(0.039)	(0.018)	(0.015)
Husband knows about savings	0.05	0.03	0.04	0.0008	0.001	0.006
	(0.04)	(0.03)	(0.03)	(0.03)	(0.016)	(0.012)
Inherited property from parents	0.11*	0.002	-0.009	-0.05	-0.013	0.013
	(0.05)	(0.04)	(0.05)	(0.05)	(0.027)	(0.024)
Money taken against wish	-0.005	-0.001	-0.005	-0.014	0.027**	0.016
	(0.02)	(0.009)	(0.01)	(0.02)	(0.011)	(0.012)
Asset taken against wish	-0.02	-0.01	-0.017	-0.001	0.01	0.005
	(0.02)	(0.1)	(0.013)	(0.01)	(0.008)	(0.007)
Mean effect	0.12*	0.05	0.08*	-0.02	0.05	0.019
	(0.06)	(0.04)	(0.04)	(0.05)	(0.04)	(0.03)
No of observation	615	904	1519	544	794	1338

ITT = Intent to treat effect on the treated. **Significant at he level of 5%. * Significant at the level of 10%. Standard errors, corrected for heteroscedasticity, are in the parentheses. Respondents below age 20 are excluded from the sample

Table III: Effects on Mobility (Group I and Group II)

	Group I			Group II		
	For age <35	For age>=35	For all	For age <35	For age>=35	For all
Dependent variable	ITT	ITT	ITT	ITT	ITT	ITT
	(1)	(2)	(3)	(4)	(4)	(6)
Work outside	0.02*	0.03*	0.03**	0.027*	0.004	0.013
	(0.015)	(0.010	(0.008)	(0.016)	(0.015)	(0.012)
Need permission to visit parents	0.003	-0.017	-0.008	-0.029	0.07**	0.036
	(0.03)	(0.03)	(0.02)	(0.04)	(0.028)	(0.022)
Can visit parents	0.0008	-0.03	-0.016	0.029	0.19	0.019
	(0.015)	(0.03)	(0.019)	(0.024)	(0.02)	(0.015)
Can use public transport	0.01	0.017	0.012	0.049	-0.027	-0.009
	(0.05)	(0.04)	(0.04)	(0.050	(0.028)	(0.02)
Can travel by rickshaw	0.03	0.042	0.04	0.013	-0.006	0.023
	(0.04)	(0.03)	(0.029)	(0.05)	(0.02)	(0.017)
Can go to cinema	0.13*	0.02	0.06*	-0.06	0.025	0.02
	(0.06)	(0.02)	(0.036)	(0.04)	(0.02)	(0.019)
Can go to hat	0.145*	0.14**	0.14**	-0.09	0.059*	0.043*
	(0.07)	(0.05)	(0.05)	(0.049)	(0.028)	(0.022)
Can go to hospital if sick	0.1*	0.082*	0.097**	0.048	0.063*	0.09**
	(0.05)	(0.047)	(0.04)	(0.04)	(0.032)	(0.025)
Need permission to go to hospital	0.05	0.06	0.06	-0.017	0.029	0.009
	(0.06)	(0.04)	(0.05)	(0.047)	(0.019)	(0.015)
Mean effect	0.14*	0.12**	0.13**	0.007	0.057*	0.03
	(0.07)	(0.04)	(0.04)	(0.03)	(0.034)	(0.02)
No of observation	633	1047	1680	569	862	1431

ITT = Intent to treat effect on the treated. **Significant at the level of 5%. *Significant at the level of 10%. Standard errors, corrected for heteroscedasticity, are in the parentheses.

Table IV: Effects on Decision Making (Group I & Group II)

	Group I			Group II		
	For age<35	For age>=35	For all	For age< 35	For age>= 35	For all
	ITT	ITT	ITT	ITT	ITT	ITT
Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)
Needs permission to purchase kerosene	-0.01 (0.05)	-0.02 (0.060	-0.018 (0.05)	-0.15 (0.05)	-0.06 (0.06)	-0.11 (0.04)
Needs permission to make personal purchases	-0.02 (0.05)	-0.02 (0.06)	-0.02 (0.05)	-0.17 (0.058)	-0.06 (0.06)	-0.12 (0.047)
Needs permission to buy ice-cream	-0.04 (0.06)	-0.05 (0.06)	-0.04 (0.05)	-0.16 (0.06)	-0.06 (0.06)	-0.12 (0.049)
Can decide to buy cloth	-0.006 (0.04)	-0.06 (0.06)	-0.03 (0.05)	-0.08 (0.039)	-0.07 (0.05)	-0.08 (0.036)
Can decide purchase of sari	0.003 (0.04)	-0.04 (0.06)	-0.03 (0.05)	-0.06 (0.04)	-0.091* (0.054)	-0.08 (0.036)
Can purchase daily bazaar	-0.095 (0.05)	-0.06 (0.06)	-0.04 (0.05)	-0.086 (0.04)	-0.092* (0.053	-0.096 (0.036)
Can decide on purchase of betel-leaf	-0.04 (0.04)	-0.09 (0.06)	-.07 (0.05)	-0.1 (0.04)	0.09 (0.059)	-0.14 (0.038)
Mean effect	-0.042 (0.09)	-0.106 (0.1)	-0.07 (0.1)	-0.24 (0.8)	-0.16 (0.1	-0.22* (0.07)
No of observation	537	588	1125	509	500	1009

ITT = Intent to treat effect on the treated.** Significant at the level of 5%. * Significant at the level of 10%. Standard errors, corrected for heteroscedasticity, are in the parentheses.

Chapter 3

Where Did All the Aid Go? An Empirical Look at the Macroeconomic Uses of Aid[7]

With Shekhar Aiyar[8]

3.1 Introduction

There has been a long standing controversy surrounding the aid-growth relationship. Despite all the controversy, one issue where everyone agrees is that in order to be of any help aid needs to be used properly. The purpose of aid is to provide resource poor countries with outside resources to foster their short run investment and henceforth consumption in the long run. Aid dollars are held in the first instance by the Central Bank. Governments can use the aid to increase *spending,* typically by increasing domestic expenditure and running larger budget deficits. Meanwhile the Central Bank, by selling aid dollars, can enable the *absorption* of aid through a widening current account deficit. Aid must be absorbed for there to be a transfer of resources from donor to recipient country. Most of the aid literature tacitly assumes that absorption and spending are both complete and equivalent, i.e. that every aid dollar leads to a corresponding transfer of resources, which the government uses to boost consumption or investment. In this paper we will examine how much of the aid inflows are actually absorbed and spent by the recipient countries and how much of it finances investment. The paper also examines whether the absorption and spending rates are different or not. In case aid is not fully absorbed we will try to figure out whether it is accumulated as reserves or finds its way out of the country as capital outflows.

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[7] The authors would like to thank Andy Berg for several invaluable suggestions. All mistakes remain our own. This paper does not necessarily reflect the views of the IMF or its executive board.

[8] International Monetary Fund.

There has been a large literature on aid. The early doctrine in this literature was that good macroeconomic policy and sound institutions are complementary to the aid-growth relationship (Burnside & Dollar, 2000). Access to resources is the key to economic development conditional on sound policies and appropriate incentives. However Hansen and Trap (2001) find that aid is effective irrespective of the policy environment, while, Easterly (2003) and a number of recent studies[9] show that aid does not work even in countries with good policies and institutions. There have been many explanations for this finding. According to Azam, Devarajan and O'Colonnell (1999), aid itself can undermine the institutions in the recipient countries making them overly dependent on aid. In such cases aid impedes long term growth even if donors and recipients have good intentions. Clements, Radelet and Bhavnani (2004) divide aid into different categories and say that not all kinds of aid are supposed to have a positive impact on growth in the short run. According to them aid that support the budget, balance of payments and investment in infrastructure stimulates growth in the short-run. But Rajan & Subramanian (2005) find that these results are not robust. According to them (2005) the negative or insignificant aid growth relationship can be explained by the effect of aid on real exchange rate. They claim that aid causes overvaluation which hurts the growth of the labor intensive and export oriented industries and therefore impairs growth. However, they assume full absorption and the channel of aid hurting labor intensive industries through overvaluation is not valid for countries where the manufacturing and export sectors are highly capital intensive. Therefore it does explain the aid-growth puzzle in these countries.

Another possible explanation to the aid-growth puzzle is that aid is not fully utilized. As much as aid is crucial for the developing and underdeveloped countries, the usefulness of aid is critically dependent on the countries' fiscal and monetary policy responses to aid: absorption and spending. However in this paper we will not try to quantify the link of absorption and spending with growth. Our attention will be focused on the estimation of absorption and spending, i.e., to measure the extent to which aid is utilized. Rajan and Subramanian (2005) show that a one percentage point increase in aid to GDP ratio will increase the growth rate of an economy by only 0.16 percent given aid is fully absorbed and invested. Therefore it is imperative to examine how much of aid results in a real resource transfer and how much of these resources are directed toward investment. And this has important policy implications for both the donor and the

[9] Easterly, Levin and Roodman (2004), Roodman (2004), Rajan and Subramanian (2005).

recipient countries. If all aid is not used to finance increased import demand and some of those increased demand comes from increased domestic consumption but not increased domestic investment then policy makers need to think about more efficient ways to utilize aid before questioning the aid-growth relationship or even increasing aid inflows to some countries.

This paper is motivated by the case study performed by IMF (2005) on five African countries – Ethiopia, Ghana, Mozambique, Tanzania and Uganda. All these countries experienced a surge in aid inflows in the period of 2001-2003. The study finds that among these five countries only in Mozambique spending was 100%. In Ethiopia spending was 0% over this period. Ghana and Tanzania had no absorption at all indicating capital outflow. And in all these five countries the absorption rates were significantly lower than the spending rates. This raises several questions of macroeconomic management, such as the choice of whether to countenance possibly higher inflation or to risk crowding-out the private sector through domestic sterilization. There was no evidence of any aid related Dutch disease in the sample countries. Real effective exchange rates remained stable or depreciated in these five countries over the reference period. However, these findings are hard to generalize because of the small sample size.

In this paper we attempt to systematize the evidence on aid absorption and spending, by looking at a broad sample of aid recipients over a thirty year period. Using a dynamic panel framework, we are able to obtain estimates for both short-run and long-run absorption and spending, while controlling for variables that may be independently responsible for movements in the current account balance and the fiscal balance. The closest parallel to our exercise here is Bosworth and Collins (1999), who examine the absorption of private capital flows for a sample of developing countries, and find that it is only about two-thirds. However, to the best of our knowledge, no such systematic attempt to analyze the usage of aid inflows has been carried out to date.

The results of our study suggest that aid in general is not fully absorbed or spent in the year aid is received. There is also no short run or long run relationship between aid and international reserves for most of our sample countries. This indicates a large outflow of capital from the recipient countries. However the long run spending rate is much higher than that of short run implying that some of these capital outflows come back to the recipient countries. But it varies across regions and for some countries net capital outflow is as high as 60% of aid. We also find that spending is systematically higher than absorption in our sample countries both in

the short run and in the long run and that only a small fraction of aid is directed toward investment and aid crowds out private investment.

The rest of the paper is structured as follows. The next section develops the terminology and accounting framework we use, and briefly expounds the macroeconomic consequences of various policy responses to aid. Section 3.3 describes our data and empirical methodology. Section 3.4 presents and analyses the results while Section 3.5 details various robustness tests and sub-sample results. The subsequent section concludes.

3.2 The Uses of Aid

From a balance of payments perspective, an increment in aid has three possible uses: it can finance a fall in net exports, it can be used to augment international reserves, or it can exit the country through capital outflows. Formally we can decompose the uses of aid using the simple balance of payments identity:

$$CAB + KAB = \Delta R \tag{3.2.1}$$

where CAB is the current account balance, KAB is the capital account balance, and R is international reserves. Net flows of aid have both current and capital account components; while grants and interest payments appear in the current account, loans and amortization appear in the capital account. Separating these components of aid from CAB and KAB, rearranging and taking differences yields:

$$\Delta A = -\Delta NACAB - \Delta NAKAB + \Delta\Delta R \tag{3.2.2}$$

where A is net aid, NACAB is the non-aid current account balance and NAKAB is the non-aid capital account balance.[10]

[10] Formally: $A = Grants + Loans - Amortization - Interest$; $NACAB = CAB - Grants + Interest$; and $NAKAB = KAB - Loans + Amortization$. In this study A is based on grants and loans that are disbursed.

There is a real transfer of resources from donor to recipient only if the aid is used to finance a widening of the current account deficit. If aid dollars are used to augment international reserves or to finance capital outflows, they have no real counterpart in increased consumption or investment. Thus we define absorption as *the fall in the non-aid current account balance that is attributable to aid.*

On the fiscal side we start with the identity:

$$FB = DR - DE + A \tag{3.2.3}$$

Or, $NAFB = DR - DE$

where FB refers to the fiscal balance, DR to domestic revenue, DE to domestic expenditure, and A to net aid. Rearranging and differencing yields:

$$\Delta NAFB = \Delta(DR - DE) \tag{3.2.4}$$

where NAFAB refers to the non-aid fiscal balance.[11] Because of fungibility, the non-aid fiscal balance is a better measure of government expenditure out of aid than simply aggregating aid-financed projects. We define spending as the *fall in the non-aid fiscal balance that is attributable to aid.*

It should be obvious that absorption and spending are not necessarily equivalent to each other. In some cases—aid in kind and aid-financed government imports being obvious examples—absorption and spending must indeed be equal. But in general, spending depends on the fiscal authority, while absorption is primarily controlled by the central bank's willingness to sell the aid dollars. Hence, absent perfect agreement and coordination between the fiscal authorities and the central bank, spending will differ from absorption. IMF (2005a) first examined the macroeconomic consequences of policy choices involving different mixes of absorption and spending. The framework and case studies developed there were further expounded and extended by Berg et al (2006), Aiyar, Berg and Hussain (2005), Foster and

[11] There is a small accounting subtlety regarding equations 2.3 and 2.4. External loans are often shown "below the line" in countries' fiscal accounts, thus rendering equation 2.3 inaccurate. However, equation 2.4, in which all flows of aid are netted out of the left hand side, remains valid, and this is what we use in the paper.

Killick (2006) and Gupta, Powell and Yang (2006). In the remainder of this section we provide a brief summary of what different combinations of absorption and spending entail.

Full absorption and spending is the textbook response to aid, and is usually a tacit assumption in the aid literature. Absorption ensures that there is a real transfer of resources to the recipient country, while government spending reallocates resources from the traded goods sector to the sector receiving government investment. Some real exchange rate appreciation may be necessary to affect this reallocation of resources.[12] This is because some combination of exchange rate appreciation and (if there is excess capacity) increased aggregate demand is necessary to generate the increased net imports that aid allows.

Neither absorbing nor spending the aid is equivalent to not receiving any aid in terms of macroeconomic impact.[13] In principle aid recipients may choose this strategy to build-up international reserves from a perceived low level or to smooth volatile aid flows. In the long-run, however, this response is equivalent to forgoing aid.

Absorbing but not spending substitutes aid for domestic financing of the government deficit. The money supply shrinks as the central bank draws liquidity out of the domestic economy through foreign exchange sales. Where the initial level of domestically financed deficit spending is too high, this can help stabilize the economy. Alternatively, this approach to aid may be used to reduce the level of public debt outstanding, crowding-in the private sector. The mechanism is that the central bank uses the proceeds from its sales of foreign exchange to buy back government debt.

Finally, spending and not absorbing the aid is similar to a fiscal stimulus in the *absence* of aid.[14] The aid dollars stay in reserves, so the increase in government spending must be financed by government borrowing from the domestic private sector or by printing money. This response comes in two variants: unsterilized and sterilized. The unsterilized variant leads to an increase in the money supply and hence risks inflation. The sterilized variant employs treasury bills sales to avoid an expansion of the money supply, thereby raising interest rates. It combines

[12] If traded goods production entails dynamic externalities absent elsewhere in the economy, this can lead to Dutch disease; a topic with a rich and extensive literature.
[13] Here we are assuming that the swelling of international reserves has no second order effect on confidence of agents on the Central Bank..
[14] IMF (2005) finds that in a sample of five countries receiving large recent increments of aid, this was the modal response.

a lack of transferred resources with a reallocation of existing resources from the private to the public sector.

	Absorbed	Not Absorbed
Spent	• Textbook case where central bank sells aid dollars and fiscal deficit rises as aid is spent. • Aid is used for public investment and consumption. • No change in money supply. Risks of Dutch disease.	• Central bank accumulates foreign exchange as reserves; fiscal deficit rises as aid is spent. • No real resource transfer. • Unsterilized: Money supply rises. Risks of inflation. • Sterilized: Crowding out of private sector. Domestic debt accumulates. • If reserves are used to pay back debt in future there is crowding out of private consumption.
Not Spent	• Central bank sells foreign exchange but fiscal deficit remains unchanged. • Helps achieve stabilization, provides resources for private investment.	• Central bank accumulates foreign exchange as reserves; fiscal deficit net of aid unchanged. • No real resource transfer. • No Dutch disease. • Equivalent to rejecting aid (in long run).

It is apparent, therefore, that the macroeconomic consequences of aid depend crucially on a country's policy response in terms of absorption and spending. We turn next to ascertaining this response empirically.

3.3 Data and Methodology

The data used in this study are collected from World Development Indicators (WDI), Global Development Finances (GDF) and World Economic Outlook (WEO). The sample consists of 95 countries; among them 45 are from Sub-Saharan Africa, 19 from Latin America and the Caribbean and the rest belong to Eastern Europe and Asia. These are the countries that are either classified as low income countries or received substantial amount of aid over the last couple of decades. We don't include countries that receive aid for political reasons but are classified as upper middle income countries[15]. Countries born in the 1990s are also excluded from the sample as time series data are not available for them prior to the 90s. A list of the countries in our sample is provided in Appendix II. The sample period is from 1970 to 2004. Table 3.1 shows the summary statistics for our principal variables of interest. On average aid as percent of GDP is 6.8 for all the countries in our sample. Among them the Sub-Saharan Africa received the highest amount of aid as % of their GDP. Their Aid/GDP ratio is 9.7%. They also experienced the largest current account and fiscal deficit over the period of 1970-2004. The average current account and fiscal balances as % of GDP for the Sub-Saharan Africa are -14.83% -29.7% respectively. For the Latin America and the Caribbean the corresponding shares are -3.36% and -7.5% respectively.

The attempt to measure absorption and spending was first taken by the IMF. According to the Occasional Paper on aid inflows (Fund, 2005) absorption rate is the change in non-aid current account deficit over the change in aid. All are expressed as percent of GDP.

$$Absorption_t = \frac{(\text{Non - aid CAB/GDP})_t - (\text{Non - aid CAB/GDP})_{t-1}}{(\text{Aid/GDP})_t - (\text{Aid/GDP})_{t-1}}$$

Similarly spending is calculated as the change in non-aid government fiscal balance (GOB) over the change in aid where all variables are measured as percent of GDP, i.e.,

[15] We follow the classification in World Development Report 2006.

$$Spending_t = \frac{(\text{Non - aid GOB/GDP})_t - (\text{Non - aid GOB/GDP})_{t-1}}{(\text{Aid/GDP})_t - (\text{Aid/GDP})_{t-1}}$$

The average rate of absorption and spending measured in the above way are presented in table 3.1. They are -309.71 and -210.86 respectively for the entire sample. This means that on average each aid dollar reduces current account balance by $309.71 and the fiscal balance by $210.86. But these measures of absorption and spending are faulty as they assume that the only source of change in non-aid CAB and non-aid GOB is aid. But as equation 3.2.2 and 3.2.3 show a country's non-aid CAB and non-aid GOB can change for many reasons other than aid (for example a change in NAKAB or reserves). If a country experiences both a positive terms of trade shock and an aid increase then the current account balance could either increase or decrease depending on the relative forces of improved terms of trade and higher imports financed by aid. Similarly the non-aid GOB can worsen by more than the increased aid amount if the government finances its deficit through seignorage. To obtain estimates for absorption and spending we need to examine the response of NACAB and NAGOB to changes in aid, while controlling for factors that may move the current account balance and the fiscal balance independent of aid.

Accordingly, we specify the following regressions:

3.1 $$NaidCAB_{it} = \alpha_1 + \rho_1 NaidCAB_{it-1} + \beta_1 Aid_{it} + \sum_{k=1}^{k=n} \delta_{1k} X_{kit} + \nu_i + \varepsilon_{1it}$$

And similarly for spending we run the following regression:

3.2 $$NaidGOB_{it} = \alpha_2 + \rho_2 NaidGOB_{it-1} + \beta_2 Aid_{it} + \sum_{k=1}^{k=n} \delta_{2k} X_{kit} + \nu_i + \varepsilon_{2it}$$

Where $NaidCAB_{it}$ is non-aid current account balance as percent of GDP for country i in year t, Aid_{it} is net aid inflow to county i in year t as percent of its GDP, X_{kit} is a vector of size K of country specific variables for country i in period t, ν_i is unobserved country effects, and $NaidGOB_{it}$ is the non-aid government fiscal balance as percent of GDP for country i in year t. The country and year specific control variables in regression equation 3.1 are log of terms of trade, political situation in the country[16]. In regression equation 3.2 instead of terms of trade we control for inflation rate. The country specific controls in both regressions are log of average

[16] It is an aggregate index of autocracy and democracy. Source: Polity IV project of Fund.

nominal GDP per capita and volatility of aid over the reference period. We also use a year dummy in all our regressions.

The parameters of interest are β_1, β_2, ρ_1 and ρ_2. Short-run absorption and spending are measured by β_1 and β_2 respectively, while ρ_1 and ρ_2 are measures of the level of persistence in the non-aid current account balance and the non-aid fiscal balance. Long-run absorption and spending are given by $\frac{\beta_1}{1-\rho_1}$ and $\frac{\beta_2}{1-\rho_2}$ respectively. Our priors are that $\beta_1 < 0$, $\beta_2 < 0$, $0 < \rho_1 < 1$, and $0 < \rho_2 < 1$, i.e. that in the presence of absorption and spending the non-aid current account balance and the non-aid fiscal balance worsen with every additional dollar of aid in both the short-run and the long-run and also the long run absorption and spending rates will be higher than those of the short run rates.

However simple panel OLS regression will not give us consistent estimates of β_1, ρ_1, β_2 and ρ_2 because of the presence of lagged dependent variable and endogenous regressors. To control for this endogeniety bias we use an application of generalized method of moments (GMM) suggested by Blundell and Bond (1998). This entails utilizing a system of equations—the levels equations above and the equations in first differences—for estimation. For example for regression equation (1) the system GMM will run an IV on the equation 3.1 and the following equation in first difference:

$$NaidCAB_{it} - NaidCAB_{it-1} = \rho_1(NaidCAB_{it-1} - NaidCAB_{it-2}) + \beta_1(Aid_{it} - Aid_{it-1}) + \sum_{k=1}^{k=n}\delta_{1k}(X_{kit} - X_{it-1}) + \varepsilon_{1it} - \varepsilon_{it-1}$$

The predetermined and endogenous variables in first differences are instrumented by lags of their own levels, whereas, predetermined and endogenous variables in level equation are instrumented by lags of their first differences. For example in the level equation Aid_{it} is instrumented by $Aid_{i,t-s-2} - Aid_{i,t-s-3}$ where $s \geq 0$ and in the first difference equation $Aid_{it} - Aid_{it-1}$ is instrumented by $Aid_{i,t-s-2}$. The underlying identifying assumptions for the GMM estimation are that the lagged differences in endogenous variables (i.e., $Aid_{it-s-2} - Aid_{it-s-3}$) are correlated with their current levels (Aid_{it}) and the lagged levels (Aid_{it-s-2}) are correlated with the first differences ($Aid_{it} - Aid_{it-1}$) and that they have no direct effect on any of the dependent variables

except through their effect on the endogenous variables. The data support the first assumption. The 1st stage regression equations show that the lagged differences are significantly correlated with the levels and the lagged levels are significantly correlated with the first differences for aid, non-aid CAB, non-aid GOB and other regressors used in this paper[17].Unfortunately, there is no direct way to test for the exclusion restriction. However when the number of instruments is higher than the number of variables that need to be instrumented, one can perform a test of overidentifying restrictions. This is a well established practice in the literature to prove the exogeneity of instruments (Angrist and Kreuger 1991). We perform a Sargan test of overidentifying restriction after each of the GMM estimations. And all these tests reject the hypothesis that the instruments are correlated with the error terms. Therefore the choice of instruments seems quite reasonable. Now, given that the identifying assumptions hold, the system GMM produces consistent estimates (Bond 2002) of the parameters given that the dependent variable is mean stationary and that the unobserved country effects are not correlated with the changes in the error term, i.e.,

$$E[v_i * D.\varepsilon_{it}] = 0$$

The other moment conditions that we need to check are as follows:

$$E[\, D.\varepsilon_{i,t} * D.\varepsilon_{i,t-1}] \neq 0 \text{ and}$$

$$E[\, D.\varepsilon_{i,t} * D.\varepsilon_{i,t-s}] = 0 \text{ for } |s| > 1$$

AR(1) is expected in first differences, because $D.\varepsilon_{i,t} = \varepsilon_{i,t} - \varepsilon_{i,t-1}$ should correlate with $D.\varepsilon_{i,t-1} = \varepsilon_{,t-1} - \varepsilon_{i,t-2}$ since they share the $\varepsilon_{i,t-1}$ term. But higher-order autocorrelation indicates that some lags of the dependent variable, which are used as instruments, are in fact endogenous, thus bad instruments. We will check for these moment conditions as we run these regressions. The results for the stationarity tests of the dependent variables are presented in table 3.2. All the results shown in table 3.2 confirm that the variables are stationary.

Besides estimating the effects of aid on current account balance and fiscal balance, we are going to check the effect of aid on international reserves. If the aid dollars are not fully

[17] The first stage regression results are not included in this paper. But interested readers can get those from the authors.

absorbed then they must either be accumulated as reserves or leave the country as capital outflow. Therefore to take account of all the possible directions of aid dollars it is important to check how it affects the countries reserve position. To measure this effect we run the following regression:

$$3.3 \qquad \Delta \mathrm{Re}s_{it} = \alpha_3 + \rho_3 \mathrm{Re}s_{it-1} + \beta_3 Aid_{it} + \sum_{k=1}^{k=n} \delta_{3k} X_{kit} + v_{3i} + \varepsilon_{3it}$$

This equation is also estimated by system GMM. And the control variables are the same as those in equation (I). Provided that some aid is initially used to bolster reserve accumulation, we would expect $\beta_3 \geq 0$. Moreover, $1-|\beta_1|+|\beta_3|$ provides an estimate of the impact of aid on the capital account, given the balance of payments identity (2.2). If some aid is used to bolster reserve accumulation even in the long-run then we would expect $\rho_3 < 1$. In a world of delayed absorption, where some of the aid used to accumulate reserves in the short-run is subsequently drawn down to finance imports, we would expect that the long-run impact of aid on reserve accumulation is less than the short-run impact, i.e. $\rho_3 < 0$.

Ideally one would want to run a similar regression for non-aid capital account. Together the coefficients on non-aid current account, changes in reserves and non-aid capital account would equal 1. But data on non-aid capital account is not possible to extract from the existing national accounts available for our sample of countries[18]. However the estimated long run coefficients for absorption and change in reserves should not exceed 1.

Next to see how much of the absorbed aid dollars are invested in the short and the long run we run the following regressions:

$$3.4 \qquad I_{it} = \alpha_5 + \rho_5 I_{it-1} + \beta_5 Aid_{it} + \sum_{k=1}^{k=n} \delta_{5k} X_{kit} + v_{4i} + \varepsilon_{5it}$$

Where I_{it} is investment in country i in year t. Again the controls in equation 3.4 are the same as those in equation 3.1. The reason we control for terms of trade in this equation is that it can affect investment through its effect on current account and interest rate. We are also trying to keep the control variables the same across these regressions so that we can compare the regression coefficients to some extent. One would expect $\beta_4 \geq 0$, and $0 < \rho_4 < 1$, i.e., aid increases total investment and the effect is larger in the long run. Aid that is absorbed must be either

[18] These data are available only for the developed or the donor countries.

invested or consumed, so we would also expect that $0 \leq |\beta_4| \leq |\beta_1|$. We also investigate the possibility that aid used for public investment crowds-out private investment to some extent, by running 3.4 including and excluding private investment as a control variable.

. Equation 3.3 and 3.4 are also estimated by the system GMM. Given that the underlying identifying assumptions and the moment conditions[19] hold the coefficients are consistent and efficient. The results of all the above regressions are presented in the next section.

3.4 Results

The OLS results for regression equation 3.1 and 3.2 are presented in table – 3.3. Column 1 shows the results for absorption. On average the countries in our sample absorb 37 cents out of each aid dollar in the short run and 92 cents in the long run. The corresponding figures for spending are 0.65 and 1.47. And these numbers are statistically significant. However, as described earlier, these estimates are not consistent. Hence we turn to the Blundell-Bond GMM estimates, which turn out to be rather similar.

In all the following regressions we use the first three lags of the endogenous and lagged dependent variables as instruments. We use a different lag structure only if the first three lags fail to satisfy the moment conditions. These results are discussed below.

Table 3.4 presents the system GMM results for absorption and spending. All signs are as expected, and moment conditions are satisfied. Column 1 shows that in the short-run about 30 cents out of every aid dollar is absorbed. However, successive periods see further absorption. Four years from the original aid impact, absorption is greater than 70 percent. In the long-run, absorption is about 83 cents to the dollar (Figure 3.1). This pattern is consistent with, e.g. staggered public investment or public consumption out of aid.

Column 3 and 5 of table 3.4 show absorption rates for Sub-Saharan Africa and Latin America and the Caribbean respectively. The absorption rate is slightly higher than the average for Africa and lower than the average for Latin America and the Caribbean. The short run and long run absorption rates for the Sub-Saharan Africa are 0.40 and 1.08. The aid dollar is fully absorbed in the long run when it goes to Africa. But for Latin America and the Caribbean these figures are 0.09 and 0.40 respectively. Table 4 also shows that a country's average nominal per

[19] These are same assumptions as that for regression equations 3.1 and 3.2.

capita GDP and aid volatility have significant effect on its current account balance. A one percent increase in per capita average nominal GDP increases a country's current account balance position by 1.3% of GDP. Moreover aid volatility has a negative effect on current account balance.

Table 3.5 shows the same results for the estimates for only the most recent decade 1994-2004. Here the short run coefficients are larger than those presented in table 3.4. The long run absorption rate is -0.72 but it is statistically insignificant. This can be explained by figure 3.1. Since it takes on average about 10 years for absorption rate to converge to its long run rate there is simply not enough time period to capture the long run effect when the regression is run only over 11 time periods. But the results give us strong indication that in the 90's the countries increased their instantaneous absorption rate compared to the earlier decades.

Column 1 of table 3.6 presents the results for spending. On average countries spend about 55 cents of each aid dollars instantly. What is surprising here is that the long run spending rate is bigger than 1. Each additional aid dollar encourages governments to increase their expenditure by 1.6 dollars on average. One plausible explanation for this is that certain aid-financed capital expenditures create the need for additional recurrent expenditures in each successive period. For example an aid-financed school may require recurrent public expenditure on teachers and school supplies, or a road may need recurrent maintenance and repair. This would increase non aid government fiscal deficit after an aid surge by more than the aid dollar. And in the long run total government spending should increase by more than the increase in aid. Average nominal per capita GDP has a negative effect on government fiscal balance. A 1% increase in average nominal per capita GDP worsens the government's fiscal balance by 1.6%. Inflation, volatility of aid and the country's political situation however do not have any significant effect on its fiscal balance.

As in the case of absorption, spending rate accelerated in the 90s as is presented in table 3.7. During the last decade the short run spending rate was 0.77 and the long run one was 0.98. One interesting feature of the last decade is that the long run point estimate of spending is not bigger than 1 as it is for the whole sample period. One explanation could be that 11 years is not long enough to capture any long run effects. Another possibility is that the type of aid has changed in the last decade so that governments don't need to spend more than the aid dollars on

public projects. This requires further investigation into the evolution of the composition of aid and is beyond the scope of this study.

One important finding of this paper is that spending is on average higher than absorption. The difference between absorption and spending does not dissipate, but rather increases in subsequent periods.[20] In the full sample both short run and long run spending are higher than short run and long run absorption 90% of the time. The 90% confidence interval for short run absorption is (-0.43, -0.166), whereas the 90% C.I. for short run spending is (-0.66,-0.43). Therefore the short run absorption is smaller than the short run spending 90% of the time. The 80% CI for long run absorption is (-1.2, -0.43) and that of long run spending is (-1.93, -1.2). This fundamental result—that spending exceeds absorption in both short- and long-runs—implies that aid may generate significant macroeconomic imbalances in recipient economies, as discussed in Section II. The result supports the finding of earlier case studies. Different reasons may govern the divergence of spending and absorption in the short- and long-runs. In the short-run, it is likely that there is incomplete coordination between the fiscal and monetary authorities on using the proceeds from aid. In particular, it may be that the government wishes to immediately commence spending on various projects (this is often a pre-condition for the disbursement of project aid), while the monetary authority resists selling aid dollars because it is concerned that currency appreciation will erode competitiveness (IMF 2005)

Another common finding of tables 3.4 – 3.7 is that the short run absorption rates are much less than 100% for all of the sample countries. To see what happens to the rest of the aid we run regression equation 3.3. The results are presented in table – 3.8. Column 1 of table 3.8 shows the results for system GMM estimator run on annual data. It shows that a 1% increase in aid increases reserves in any particular year by 0.05%. But the coefficient is not statistically significant. The coefficient on lagged change in reserves is negative but also not statistically significant. Identity (3.2.2) implies, therefore, that in the short-run, much of the unabsorbed aid—almost 70 %—must be exiting the country through the capital account. Over time, however, most of the initial capital outflow is reversed to accommodate delayed absorption. This is consistent with a world in which the central bank sells most of the aid dollars on disbursement. However, the agents who buy these dollars initially use them to rebalance their portfolios,

[20] Long-run confidence intervals for parameter estimates are calculated using the delta method. The non-linearity of the long-run point estimates implies a loss of precision.

switching from domestic assets to foreign currency assets. Over time, these foreign assets are drawn down to finance greater imports. This result suggests that further research into the links between aid flows and capital account flows may be critical to assessing the impact of aid.

Column 3 of table 3.6 shows the same results for the Sub-Saharan Africa. Following identity 3.2.2, this implies that almost 60% of aid that goes to this region leaves the country instantly through capital account but over time they find their way back and finance imports. The results are slightly different for Latin America and the Caribbean and Eastern Europe and Asia. In Latin America and the Caribbean, a 1% increase in the aid/GDP ratio increases international reserves by 0.06%. The corresponding figure for Eastern Europe and Asia is 0.19%. All these figures again imply that a significant part of aid flows out of the country in the year aid is received. Since for the Latin America and the Caribbean the point estimate of long run absorption is only -0.4, on average, 60% of the aid dollars never comes back to the receiving countries.

As is shown above, on average almost 80% of the aid is absorbed in all our sample countries and for the Sub-Saharan Africa it is close to 100%. Therefore, one can ask the question, "Why don't we then see any positive relationship between aid and growth, at least in our sample countries?". The answer to this question is that a large absorption rate is necessary but not sufficient to generate a positive aid-growth relationship. Absorbed aid must be either invested or consumed, but whatever the welfare consequences of this division, presumably what matters more for economic growth is the amount invested. Therefore, our final exercise is to directly examine aid's impact on investment. Column 1 of Table 3.9 contains the results of equation (3.4). In the short run, an increase of 1 % of GDP in aid leads to an increase in gross capital formation of about 0.14 % of GDP, that is, close to half of absorbed aid goes toward investment. In the long run gross capital formation due to aid increases slowly to about .26 % of GDP, well under the long-run absorption level. Moreover, we find evidence that the public investment engendered by aid has a crowding-out effect on private investment. This may be seen by comparing column 2 and column 1. In column 1 private investment is included separately and has a significant positive impact on gross capital formation. Under the specification of column 2, with private investment excluded, the coefficient on aid becomes small and insignificant. The very small investment propensity of aid coupled with the crowding out effect and accumulated fiscal imbalance suggest that it should not be surprising to find an insignificant aid-growth

relationship. The results for regression equation 3.4 for the sub sample of Sub-Saharan Africa and Latin America and the Caribbean are similar to those in the full sample.

Summary of Main Empirical Results

	Short Run	Long Run
Aid Impact (%)		
Absorption	30*** (8)	83*** (32)
Spending	56*** (12)	160*** (27)
Reserves Accumulation	5 (12)	5 (24)
Investment (with crowding out)	2 (5)	1 (26)

3.5 Robustness of the Estimates

One objection against using the system GMM is that the results vary a lot as the lag structure and the data change. To check that the estimates presented in the previous section are robust we run the same regressions using different lag structure and different sample of countries. We run the regressions on 3 year average data and only for countries that received significant amount of aid as percent of their GDP. All the following estimates presented below are consistent with those presented in the previous section.

Table 3.10 shows the results for regression equation 3.1 and 3.2 for 3 year average data. The short run absorption in 3 year average data is 0.67 and the long run absorption is 1.2. One reason why the long run absorption is bigger than one in three year average data could be that the panel is unbalanced. The missing values pose a problem when averaging over a number of periods. For example, for the period of 1989 to 1991 if 1990 is missing for any of the variables then the average is actually a two year average of 1989 and 1991 which is used to represent those three years. But in the annual regressions 1990 is treated as missing. However, as we will see below that this does not affect the qualitative analysis of our study in any way.

The results for absorption are also similar to those in the above section for Sub-Saharan Africa and the Latin America and the Caribbean. The Sub-Saharan Africa has a bigger than average short run and long run absorption rate while the Latin America and the Caribbean has a

smaller than average short run and long run absorption rates. And all these estimates are statistically significant.

The rate of spending in the short run is also higher for the 3 year average regression than it is for the annual regression. The short run spending is 1.2 and the long run spending is 1.4. The estimates for the Sub-Saharan Africa and Latin America and the Caribbean are also consistent with those presented in section 3.4. Also note that the spending rate is bigger than the absorption rate in 3 year average data both in the short run and in the long run.

Table 3.11 shows the results for regression equation 3 for 3 year average data. These results are also similar to those presented in section 3.4. For all our sample countries aid has no significant short run or long run effect on reserves. Table 3.11 together with table 3.10 implies a large outflow of capital in all our sample countries. In Africa it flows back in after a while (and finances consumption) but in Latin America and the Caribbean the net outflow is about 50%.

Table 3.12 shows results for investment for 3 year average data. The short run investment propensity of aid in 3 year average data is 0.16 and in the long run it is 0.25. These figures are consistent with those presented in table 3.9. Both in the short run and in the long run the investment propensity of aid is smaller than a third of the absorption rate. Besides, the coefficients are significant only when controlled for private investment. Therefore, the evidence of crowding out is still present.

We do a similar analysis for the major aid receiving countries. These results are presented in tables 3.13, 3.14 and 3.15.

Table 3.13(a) (b) and (c) show the results for absorption and spending for countries that, on average, received more than 2%, 5% and 10% aid as percent of their GDP, respectively, over the period of 1970-2004. There are 49 countries in our sample for which the aid/GDP ratio is bigger than 2%. In these countries the short run and long run absorption rates are 0.34 and 0.87 respectively. There are 35 countries that received aid of more than 5% of their GDP. For these countries the short run and long run absorption rates are 0.36 and 0.92. For the countries with bigger than 10% aid/GDP ratio the corresponding figures are 0.45 and 1.1. As the countries receive more aid the point estimates for absorption tend to increase. We find similar results for spending. The short run and long run spending rates for countries that have higher than 2%, 5% and 10% aid/GDP ratio are 0.55 and 1.6, 0.58 and 1.6, 0.68 and 1.8, respectively, as is shown in column 2 of tables 3.13(a), (b) and (c).

Table 3.14 presents results for the reserves equation for these three groups of countries and estimates show that aid has no significant effect on international reserves. Table 3.15 shows the results for investment. All the estimates show that not all the aid that is absorbed goes into investment. In fact the investment propensity of aid is almost a third of the absorption rate in all these estimates and it crowds out private investment. Therefore the analysis presented in section 3.4 remains unchanged. We have also run all these regressions using different lag structure. The estimates do not change in any significant ways with changes in the lag structure as long as the moment conditions are satisfied. These results are not presented in this paper but can be provided to the interested reader upon request.

3.6 Conclusion

The economic purpose of providing aid is to release the resource constraint for the poor, underdeveloped countries. It is a transitory way to reach out the resource poor countries to help them take a leap toward growth and development. The paper finds that on average a big chunk of aid actually results in real resource transfer. In the long run 83% of aid is used to finance increased imports and this figure varies across regions. For Sub Saharan Africa 60% of the aid dollars leave the country through capital account and it comes back to recipient countries in the long run to finance imports of consumption goods. However, in the Latin America and the Caribbean, 85% of the aid ends up as foreign assets in the year aid is received and 60% of it never actually comes back home. Moreover, the 9% of aid that is actually absorbed finances imports of consumer goods. But aid dollars must be invested in order to promote growth. Our results show that on average only one fourth of the aid dollars are actually invested. But aid also crowds out private investment. Therefore, the overall effect of aid on investment is insignificant. We also find that the government deficit increases by more than the aid dollars in the long run. All these results together—incomplete absorption, high capital outflow, macroeconomic problems arising from the excess of spending over absorption, and the crowding-out of private investment—may help illuminate the weak relationship between aid and growth found in the literature.

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Table 3.1: Summary statistics

Variable	Mean	SE (mean)	Mean	SE (mean)	Mean	SE (mean)
	All countries		Africa		LA and the Caribbean	
Aid/GDP	6.80	.167	9.795	286	2.65	.17
Non-aid CAB/GDP	-10.21	.306	-14.838	.518	-3.36	.32
Non-aid GOB/GDP	-19.49	5.49	-29.758	11.403	-7.50	.27
Change in Reserves/GDP	.39	.068	.364	.105	.27	.11
Consumption/GDP	86.33	.28	89.897	.463	82.08	.32
Private CON/GDP	71.72	.29	74.089	.498	70.13	.37
GK/GDP	21.36	.16	20.306	.289	19.48	.189
Private GFK/GDP	13.38	.158	12.383	.270	13.71	.22
Terms of trade index|	128.34	3.33	148.318	6.436	107.41	1.21
Average nominal GDP/capita	1156.41	17.40	| 763.445	22.354	1945.73	42.71
Index for Autocracy/Democracy	-.73	.138	-3.340	.160	3.642	.26
Volatility of aid	4.99	.077	6.420	.130	2.974	.089
Absorption	-309.71	275.11	-3.19	2.4	-3.75	7.63
Spending	-210.86	197.02	1.59	2.4	4.08	2.58

Note: All the variables other then the Terms of Trade Index and Volatility of aid are as % of GDP.

Table 3.2: Results for stationarity of the main variables of interest

	Aid/GDP	Non-aid CAB/GDP	Non-aid GOB/GDP*	CON/GDP	Gross capital formation to GDP
Levin-Lin rho-stat	-88.35134	-84.75675	-	-22.75147	-12.90941
Levin-Lin t-rho-stat	-28.1426	-28.85518	-	-6.94796	-4.42057
Levin-Lin ADF-stat	-25.12197	-22.45512	-	-7.00188	-4.82501
IPS ADF-stat	-39.3119	-36.00361	-	-10.70979	-7.50397

Positive values of the statistics imply that the variable has unit root and large negative values indicate that they are stationary. The underlying null hypothesis is that the variables are stationary. Therefore positive values of the statistics reject the null.

* We use WINRAT to determine stationarity of the unbalanced panel data. Out of these five variables data on government fiscal deficit is the most irregular one and WINRAT could not perform the test of stationarity for this variable.

Table 3.3: The Effects of Aid (OLS Estimates, 1970-2004)

	(1) Non-aid CAB/GDP	(2) Non-aid GOB/GDP	(3) Change in Reserves/GDP	(4) Gross Capital/GDP	(5) Gross Capital/GDP
L.Non-aid CAB/GDP	0.603				
	(0.016)***				
Aid/GDP	-0.376	-0.656	0.082	0.108	0.090
	(0.032)***	(0.053)***	(0.016)***	(0.014)***	(0.018)***
Log of TOT	1.557		0.516	-0.942	0.066
	(0.592)***		(0.321)	(0.277)***	(0.341)
Log of average nominal GDP/capita	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Index for Autocracy/Democracy	0.020	0.073	0.008	0.042	-0.003
	(0.042)	(0.057)	(0.021)	(0.018)**	(0.022)
Volatility of aid	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L.Non-aid GOB/GDP		0.559			
		(0.021)***			
Log of Inflation		-0.273			
		(0.258)			
Private CON/GDP					
l.Gross capital/GDP				0.372	0.760
				(0.015)***	(0.015)***
Private GFK/GDP				0.615	
				(0.015)***	
l.ΔReserves/GDP			0.050		
			(0.024)**		
Observations	2218	1290	2073	1813	2047
Number of Country	72	62	72	72	72
R-squared	0.51	0.55	0.05	0.79	0.61

Standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.4: The Effects of Aid on Absorption and Spending (Blundell-Bond Estimates, 1970-2004)

	(1)	(2)	(3)	(4)	(5)	(6)
	NA-CAB/GDP (all)	NA-CAB/GDP (all)	NA-CAB/GDP (Africa)	NA-CAB/GDP (Africa)	NA-CAB/GDP (Latin America & the Caribbean)	NA-CAB/GDP (Latin America & the Caribbean)
L. Non-aid CAB to GDP	0.642	0.701	0.631	0.705	0.771	0.785
	(0.063)***	(0.046)***	(0.058)***	(0.061)***	(0.066)***	(0.057)***
Aid to GDP	-0.305	-0.388	-0.406	-0.420	-0.094	-0.147
	(0.080)***	(0.099)***	(0.081)***	(0.117)***	(0.050)*	(0.061)**
Log of TOT	-0.202		1.089		-0.402	
	(1.208)		(1.131)		(0.872)	
Log of average nominal GDP/capita	1.339		1.174		0.585	
	(0.581)**		(0.631)*		(0.617)	
Index for Autocracy/Democracy	-0.009		-0.044		-0.038	
	(0.060)		(0.079)		(0.039)	
Volatility of aid	-0.35		-0.36		0.08	
	(0.09)***		(0.106)***		(0.09)	
Observations	2218	2821	1087	1369	594	646
Number of Country	72	93	37	45	18	19
Arellano-Bond test for AR(1)	-3.00	-3.63	-2.29	-2.93	-2.86	-2.99
'Arellano-Bond test for AR(2)	-0.20	-0.30	0.04	-0.10	-0.44	-0.55
Hansen test of over id restriction	42.03	55.34	3.43	15.83	0	7.42
Prob>Chi2	1	1	1	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.5: The Effects of Aid on Absorption and Spending (Blundell-Bond Estimates, 1994-2004)

	(1)	(2)	(3)	(4)	(5)	(6)
	NA-CAB/GDP (all)	NA-CAB/GDP (all)	NA-CAB/GDP (Africa)	NA-CAB/GDP (Africa)	NA-CAB/GDP (Latin America & the Caribbean)	NA-CAB/GDP (Latin America & the Caribbean)
L. Non-aid CAB to GDP	0.236	0.584	0.212	0.423	0.383	0.796
	(0.147)	(0.028)***	(0.162)	(0.026)***	(0.139)***	(0.048)***
Aid to GDP	-0.554	-0.622	-0.674	-0.819	0.025	-0.186
	(0.126)***	(0.067)***	(0.200)***	(0.078)***	(0.230)	(0.140)
Log of TOT	13.233		19.188		5.962	
	(7.817)*		(9.818)*		(4.308)	
Log of average nominal GDP/capita	5.468		5.882		4.066	
	(2.073)***		(2.642)**		(1.998)**	
Index for Autocracy/Democracy	0.145		0.481		-0.436	
	(0.269)		(0.403)		(0.326)	
Volatility of aid	-0.56		-0.56		-0.42	
	(0.33)*		(0.36)		(0.55)	
Observations	646	930	331	450	162	190
Number of Country	72	93	37	45	18	19
Arellano-Bond test for AR(1)	-1.81	-1.48	-1.75	-1.32	-1.66	-2.51
Arellano-Bond test for AR(2)	0.82	0.44	1.06	0.55	-1.95	-1.32
Hansen test of over id restriction	61.10	86.14	27.44	37.09	2.70	10.56
Prob>Chi2	1	0.03	1	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.6: The Effects of Aid on Spending (Blundell-Bond Estimates, 1970-2004)

	(1)	(2)	(3)	(4)	(5)	(6)
	NA-GOB/GDP (All)	NA-GOB/GDP (All)	NA-GOB/GDP (Africa)	NA-GOB/GDP (Africa)	NA-GOB/GDP (Latin America & the Caribbean)	NA-GOB/GDP (Latin America & the Caribbean)
L. Non-aid GOB/GDP	0.650 (0.029)***	-0.014 (0.006)**	0.626 (0.021)***	0.433 (0.005)***	0.679 (0.040)***	0.730 (0.045)***
Aid to GDP	-0.559 (0.071)***	-5.495 (3.988)	-0.793 (0.172)***	-1.823 (1.012)*	-0.354 (0.091)***	-0.204 (0.052)***
Log of average nominal GDP/capita	-1.633 (0.604)***		-1.723 (1.585)		-1.214 (0.395)***	
Index for Autocracy/Democracy	0.042 (0.056)		0.407 (0.145)***		0.029 (0.042)	
Volatility of aid	-0.016 (0.08)		0.13 (0.14)		-0.15 (0.11)	
Log of Inflation	-0.287 (0.337)		-0.914 (0.537)*		0.082 (0.21)	
Observations	1290	1991	539	957	388	430
Number of Country	62	83	31	41	16	17
Arellano-Bond test for AR(1)	-3.09	-1.07	-2.27	-1.05	-2.96	-3.24
'Arellano-Bond test for AR(2)	-1.04	0.91	-1.05	1.02	-1.20	-1.06
Hansen test of over id restriction	26.96	81000000	3.81	650000	0	0
Prob>Chi2	1	0	1	0	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.7: The Effects of Aid on Spending (Blundell-Bond Estimates, 1994-2004)

	(2)	(4)	(6)	(8)	(10)	(12)
	NA-GOB/GDP (All)	NA-GOB/GDP (All)	NA-GOB/GDP (Africa)	NA-GOB/GDP (Africa)	NA-GOB/GDP (Latin America & the Caribbean)	NA-GOB/GDP (Latin America & the Caribbean)
L. Non-aid GOB/GDP	0.212	0.489	0.051	0.443	0.609	0.719
	(0.074)***	(0.106)***	(0.056)	(0.096)***	(0.101)***	(0.101)***
Aid to GDP	-0.775	-0.652	-0.790	-0.794	-0.226	-0.185
	(0.112)***	(0.126)***	(0.153)***	(0.105)***	(0.123)*	(0.138)
Log of average nominal GDP/capita	-1.183		-0.959		-0.962	
	(1.010)		(1.628)		(0.978)	
Index for Autocracy/Democracy	0.087		0.321		0.252	
	(0.094)		(0.171)*		(0.154)	
Volatility of aid	-0.39		-1.07		-0.14	
	(0.32)		(0.41)***		(0.26)	
Log of Inflation	0.185		-0.485		0.551	
	(0.410)		(0.595)		(0.368)	
Observations	508	830	236	410	144	170
Number of Country	61	83	30	41	16	17
Arellano-Bond test for AR(1)	-1.91	-2.80	-1.54	-2.33	-2.23	-2.53
Arellano-Bond test for AR(2)	-1.42	0.56	-0.89	0.45	-1.43	-1.51
Hansen test of overid restriction	54.94	75.86	11.13	32.46	1.75	6.43
Prob>Chi2	1	.69	1	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.8: Effects of Aid on Reserves (Blundell-Bond Estimates, 1970-2004)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔReserves	ΔReserves	ΔReserves (Africa)	ΔReserves (Africa)	ΔReserves (LA & the Caribbean)	ΔReserves (LA & the Caribbean)	ΔReserves (Other countries)	ΔReserves (Other countries)
L. ΔReserves/GDP	0.021	-0.012	0.035	0.004	0.102	0.063	-0.005	-0.063
	(0.27)	(0.16)	(0.35)	(0.04)	(0.76)	(0.47)	(0.11)	(1.09)
Aid to GDP	0.052	0.032	0.010	0.009	0.060	0.049	0.190	0.085
	(1.24)	(1.40)	(0.34)	(0.43)	(2.02)**	(2.13)**	(2.48)**	(2.26)**
Log of TOT	0.537		0.609		0.264		0.000	
	(1.44)		(1.78)*		(0.49)		(0.00)	
Log of average nominal GDP/capita	0.365		0.524		0.222		0.224	
	(1.46)		(1.95)*		(2.26)**		(1.57)	
Index for Autocracy/Democracy	-0.018		0.041		0.001		-0.016	
	(0.58)		(1.63)		(0.05)		(1.07)	
Volatility of aid	-0.047		0.010		-0.054		-0.236	
	(0.83)		(0.36)		(1.94)*		(3.11)***	
Observations	2073	2606	1007	1254	576	621	490	731
Number of Country	72	93	37	45	18	19	17	29
Arellano-Bond test for AR(1)	-3.80	-5.19	-2.70	-3.18	-2.91	-3.05	-2.77	-3.54
Arellano-Bond test for AR(2)	-0.03	-0.27	0.65	0.80	-0.37	-0.89	-1.43	-1.16
Hansen test of over id restriction	35.07	54.79	3.22	14.45	0.00	3.11	0.00	1.34
Prob>Chi2	1	1	1	1	1	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.9: Effects of Aid on Investment (Blundell-Bond Estimates, 1970-2004)

	(1)	(2)	(3)	(4)	(5)	(6)
	Investment (All)	Investment (All)	Investment (Africa)	Investment (Africa)	Investment (LA & the Caribbean)	Investment (LA & the Caribbean)
L. Gross capital formation/GDP	0.476 (0.106)***	0.805 (0.047)***	0.426 (0.113)***	0.832 (0.059)***	0.634 (0.051)***	0.819 (0.030)***
Aid to GDP	0.135 (0.034)***	0.021 (0.058)	0.148 (0.049)***	0.003 (0.053)	0.021 (0.044)	-0.015 (0.030)
Log of Average GDP/capita	0.600 (0.382)	1.141 (0.376)***	0.394 (0.507)	1.267 (0.607)**	-0.491 (0.316)	-0.117 (0.258)
Log of TOT	-1.789 (0.737)**	-2.783 (1.456)*	-1.700 (0.920)*	-2.637 (1.342)**	-1.367 (0.900)	-0.902 (0.592)
Index for Autocracy/Democracy	-0.010 (0.040)	-0.043 (0.050)	0.078 (0.049)	-0.051 (0.063)	0.106 (0.036)***	0.037 (0.022)*
Volatility of Aid	0.204 (0.075)***	0.294 (0.201)	0.227 (0.079)***	0.295 (0.220)	0.014 (0.050)	0.044 (0.048)
Gross pr capital formation/GDP	0.540 (0.091)***		0.598 (0.094)***		0.345 (0.060)***	
Observations	1813	2047	888	967	497	571
Number of Country	72	72	37	37	18	18
'Arellano-Bond test for AR(1	-3.59	-2.40	-2.83	-2.03	-3.46	-3.56
'Arellano-Bond test for AR(2	0.27	-0.01	0.89	0.53	-2.06	-2.68
Hansen test of over id restriction	25.72	32.46	0.82	3.11	0.00	0.00
Prob>Chi2	1	1	1	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.10: The Effects of Aid on Absorption and Spending (Blundell-Bond Estimates, 3 year average, 1970-2004)

	(1)	(2)	(3)	(4)	(5)	(6)
	NA-CAB/GDP (all)	NA-GOB/GDP (All)	NA-CAB/GDP (all)	NA-GOB/GDP (All)	NA-CAB/GDP (Africa)	NA-GOB/GDP (Africa)
L. Non-aid CAB to GDP	0.588 (0.051)***		0.468 (0.060)***		0.582 (0.059)***	
Aid to GDP	-0.621 (0.089)***	-1.287 (0.152)***	-0.893 (0.117)***	-5.661 (3.717)	-0.716 (0.085)***	-0.993 (0.201)***
Log of TOT	0.188 (1.910)				0.957 (1.485)	
Log of average nominal GDP/capita	1.192 (0.983)	-3.177 (1.195)***			1.668 (0.683)**	0.391 (1.922)
Index for Autocracy/Democracy	0.078 (0.076)	0.160 (0.113)			0.131 (0.099)	0.277 (0.128)**
Volatility of aid	-0.25 (0.28)	-0.55 (0.28)*			-0.48 (0.19)***	-0.39 (0.33)
L. Non-aid GOB/GDP		0.134 (0.005)***		-0.364 (0.001)***		0.143 (0.006)***
Log of Inflation		-0.411 (0.440)				-0.144 (0.390)
Observations	736	452	911	640	369	199
Number of Country	71	62	93	83	37	31
Arellano-Bond test for AR(1)	-2.97	-2.5	-3.43	-0.82	-2.43	-1.75
Arellano-Bond test for AR(2)	-0.67	-.68	-0.29	-1.05	-0.34	0.71
Hansen test of over id restriction	56.93	2575.18	83.43	76.22	19.47	10.30
Prob>Chi2	1	0.00	0.99	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.10 (cont.): The Effects of Aid on Absorption and Spending (Blundell-Bond Estimates, 3 year averages 1970-2004)

	(7)	(8)	(9)	(10)	(11)	(12)
	NA-CAB/GDP (Africa)	NA-GOB/GDP (Africa)	NA-CAB/GDP (Latin America & the Caribbean)	NA-GOB/GDP (Latin America & the Caribbean)	NA-CAB/GDP (Latin America & the Caribbean)	NA-GOB/GDP (Latin America & the Caribbean)
L. Non-aid CAB to GDP	0.476		0.667		0.648	
	(0.071)***		(0.054)***		(0.029)***	
Aid to GDP	-0.874	-6.501	-0.177	-0.486	-0.286	-0.407
	(0.143)***	(4.490)	(0.080)**	(0.207)**	(0.102)***	(0.121)***
Log of TOT			1.588			
			(1.374)			
Log of average nominal GDP/capita			1.437	-0.718		
			(0.449)***	(0.619)		
Index for Autocracy/Democracy			-0.051	0.007		
			(0.077)	(0.067)		
Volatility of aid			0.09	-0.077		
			(0.11)	(0.11)		
L. Non-aid GOB/GDP		-0.363		0.618		0.643
		(0.002)***		(0.075)***		(0.057)***
Log of Inflation				-0.223		
				(0.344)		
Observations	443	311	198	129	209	137
Number of Country	45	41	18	16	19	17
Arellano-Bond test for AR(1)	-2.55	-0.72	-2.71	-2.88	-3.03	-2.95
Arellano-Bond test for AR(2)	-0.19	-1.09	-1.69	-0.56	-1.43	-0.85
Hansen test of over id restriction	35.05	1587.58	2.66	4.70	5.17	9.11
Prob>Chi2	1	0.00	1	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.11: Effects of Aid on Reserves (Blundell-Bond Estimates, 3 year averages 1970-2004)

	(1)	(2)
	ΔReserves (3 year average)	ΔReserves (3year average)
L. ΔReserves/GDP	0.238 (4.06)***	0.207 (3.74)***
Aid to GDP	0.048 (0.67)	0.064 (1.24)
Log of TOT	-0.253 (0.20)	
Log of average nominal GDP/capita	0.382 (0.69)	
Index for Autocracy/Democracy	-0.106 (1.31)	
Volatility of aid	-0.042 (0.44)	
Observations	649	788
Number of Country	72	93
Arellano-Bond test for AR(1)	-.4.56	-5.05
Arellano-Bond test for AR(2)	-1.51	-2.00
Hansen test of over id restriction	53.66	86.58
Prob>Chi2	1	0.98

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.12: Effects of Aid on Investment (Blundell-Bond Estimates, 3 year averages)

	(1)	(2)
	Investment	Investment
L. Gross capital formation/GDP	0.389 (0.068)***	0.836 (0.078)***
Aid to GDP	0.161 (0.041)***	0.011 (0.106)
Log of Average GDP/capita	0.263 (0.526)	1.679 (0.868)*
Log of TOT	-0.973 (1.042)	-0.581 (2.278)
(mean) polity2	-0.038 (0.071)	-0.076 (0.087)
Volatility of Aid	0.200 (0.142)	0.468 (0.398)
Gross private capital formation/GDP	0.711 (0.062)***	
Observations	624	688
Number of Countries	72	72
Arellano-Bond test for AR(1)	-4.14	-4.53
Arellano-Bond test for AR(2	-1.59	-1.94
Hansen test for over id restriction	50.39	53.19
Prob>Chi2	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.13(a): The Effects of Aid on Absorption and Spending for AID/GDP>0.02 (Blundell-Bond Estimates, 1970-2004)

	(1)	(2)	(3)	(4)
	Non-aid CAB/GDP	Non-aid GOB/GDP	Non-aid CAB/GDP	Non-aid GOB/GDP
L. Non-aid CAB to GDP	0.615 (8.64)***		0.667 (12.25)***	
Aid to GDP	-0.345 (4.17)***	-0.551 (7.71)***	-0.387 (3.49)***	-6.463 (1.32)
Log of TOT	-0.157 (0.11)			
Log of average nominal GDP/capita	1.339 (2.16)**	-1.498 (2.01)**		
Index for Autocracy/Democracy	-0.027 (0.31)	0.061 (1.04)		
Volatility of aid	-0.380 (2.77)***	0.074 (0.81)		
L. Non-aid GOB/GDP		0.663 (34.29)***		0.000 (0.05)
Log of Inflation		-0.458 (1.26)		
Observations	1518	841	1989	1453
Number of Country	49	41	66	59
Arellano-Bond test for AR(1)	-2.75	-3.24	-3.35	-1.07
Arellano-Bond test for AR(2)	0.38	-0.93	-0.16	0.90
Hansen test of over id restriction	8.76	14.11	37.35	2104.04
Prob>Chi2	1	1	1	0.00

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.13(b): The Effects of Aid on Absorption and Spending for AID/GDP>0.05 (Blundell-Bond Estimates, 1970-2004)

	(1)	(2)	(3)	(4)
	Non-aid CAB/GDP	Non-aid GOB/GDP	Non-aid CAB/GDP	Non-aid GOB/GDP
L. Non-aid CAB to GDP	0.619 (8.73)***		0.617 (10.51)***	
Aid to GDP	-0.363 (4.43)***	-0.587 (7.08)***	-0.471 (3.63)***	-6.344 (1.32)
Log of TOT	-0.071 (0.05)			
Log of average nominal GDP/capita	1.915 (3.22)***	-0.613 (0.84)		
Index for Autocracy/Democracy	-0.065 (0.76)	0.116 (1.60)		
Volatility of aid	-0.358 (2.20)**	-0.066 (0.68)		
L. Non-aid GOB/GDP		0.648 (29.14)***		-0.022 (2.79)***
Log of Inflation		-0.253 (0.80)		
Observations	1068	495	1452	1012
Number of Country	35	28	49	43
Arellano-Bond test for AR(1)	-2.55	-2.61	-3.09	-1.08
Arellano-Bond test for AR(2)	0.34	-0.93	0.01	0.90
Hansen test of over id restriction	1.51	2.42	278	350000
Prob>Chi2	1	1	1	0.00

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.13(c): The Effects of Aid on Absorption and Spending for AID/GDP>.0.1 (Blundell-Bond Estimates, 1970-2004)

	(1)	(2)	(3)	(4)
	Non-aid CAB/GDP	Non-aid GOB/GDP	Non-aid CAB/GDP	Non-aid GOB/GDP
L. Non-aid CAB to GDP	0.595 (7.97)***		0.605 (8.24)***	
Aid to GDP	-0.450 (5.65)***	-0.683 (5.28)***	-0.445 (2.90)***	-6.777 (1.30)
Log of TOT	2.281 (1.24)			
Log of average nominal GDP/capita	2.207 (1.40)	-0.753 (1.32)		
Index for Autocracy/Democracy	0.210 (1.26)	0.017 (0.19)		
Volatility of aid	-0.396 (1.99)**	-0.216 (1.80)*		
L. Non-aid GOB/GDP		0.630 (31.78)***		-0.039 (3.11)***
Log of Inflation		-1.348 (2.03)**		
Observations	535	241	739	558
Number of Country	18	15	26	24
Arellano-Bond test for AR(1)	-2.08	-1.95	-1.06	-2.54
Arellano-Bond test for AR(2)	-0.25	-1.01	-0.10	0.89
Hansen test of over id restriction	0.00	0.00	1.82	30496
Prob>Chi2	1	1	1	0

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.14: Effects of Aid on Reserves – Major Aid Receiving Countries (Blundell-Bond Estimates)

	(1)	(2)	(3)
	Change in Reserves	Change in Reserves	Change in Reserves
	Aid/GDP > 0.02	Aid/GDP > 0.05	Aid/GDP > 0.1
L. ΔReserves/GDP	0.058 (0.77)	0.059 (0.71)	-0.052 (0.68)
Aid to GDP	0.050 (1.36)	0.059 (1.51)	0.055 (1.12)
Log of TOT	0.727 (2.27)**	0.726 (2.42)**	0.515 (1.18)
Log of average nominal GDP/capita	0.581 (1.67)*	0.471 (1.91)*	0.275 (2.10)**
Index for Autocracy/Democracy	0.015 (0.53)	0.035 (1.20)	0.040 (1.36)
Volatility of aid	-0.020 (0.35)	-0.019 (0.34)	-0.015 (0.48)
Observations	1409	974	485
Number of Country	49	35	18
Arellano-Bond test for AR(1)	-3.34	-3.04	-3.09
Arellano-Bond test for AR(2)	0.93	0.96	-0.68
Hansen test of over id restriction	11.17	7.24	0.00
Prob>Chi2	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Table 3.15: Effects of Aid on Investment – Major Aid Receiving Countries (Blundell-Bond Estimates)

	(1)	(2)	(3)	(4)	(5)	(6)
	Gross capital formation >.02		Gross capital formation >.05		Gross capital formation >.1	
	Aid/GDP > 0.02		Aid/GDP > 0.05		Aid/GDP > 0.1	
L. Gross capital formation/GDP	0.443 (0.115)***	0.821 (0.05)***	0.454 (0.115)***	0.845 (0.05)***	0.417 (0.112)***	0.87 (0.5)***
Aid to GDP	0.144 (0.032)***	0.034 ((0.054)	0.154 (0.037)***	0.032 (0.053)	0.188 (0.044)***	0.056 (0.043)
Log of Average GDP/capita	0.392 (0.408)	1.08 (0389)***	0.481 (0.453)	0.884 (0.4)**	0.162 (0.559)	0.34 (0.32)
Log of TOT	-1.742 (0.801)**	-2.335 (1.52)	-1.673 (0.862)*	-1.646 (1.4)	-0.585 (1.743)	-3.77 (1.74)**
(mean) polity2	-0.001 (0.050)	-0.064 (0.052)	-0.057 (0.047)	-0.056 (0.043)	-0.044 (0.058)	-0.094 (0.054)*
Volatility of Aid	0.229 (0.094)**	0.26 (0.2)		0.22 (0.2)		0.096 (0.139)
Gross private capital formation/GDP	0.578 (0.092)***		0.588 (0.094)***		0.675 (0.066)***	
Observations	1227	1364	823	924	389	451
Number of Country	49	49	35	35	18	18
Arellano-Bond test for AR(1)	-3.27	-2.15	-2.80	-1.97	-2.43	-1.74
Arellano-Bond test for AR(2	0.92	0.44	0.86	0.45	1.16	0.51
Hansen test for over id restriction	8.59	9	2.39	1	0.00	0.00
Prob>Chi2	1	1	1	1	1	1

Robust standard errors are in parentheses. *significant at 10%;**significant at 5%;***significant at 1%. First order autocorrelation is expected. Therefore we want the test statistic for AR(1) to be close to |2| and the test statistic for AR(2) to be less than |2|. Prob>Chi2 gives the probability with which the Hansen test of over identifying restriction is rejected. The underlying hypothesis is that the instruments are correlated with the error term.

Figure 3.1: Time Path of Absorption and Spending

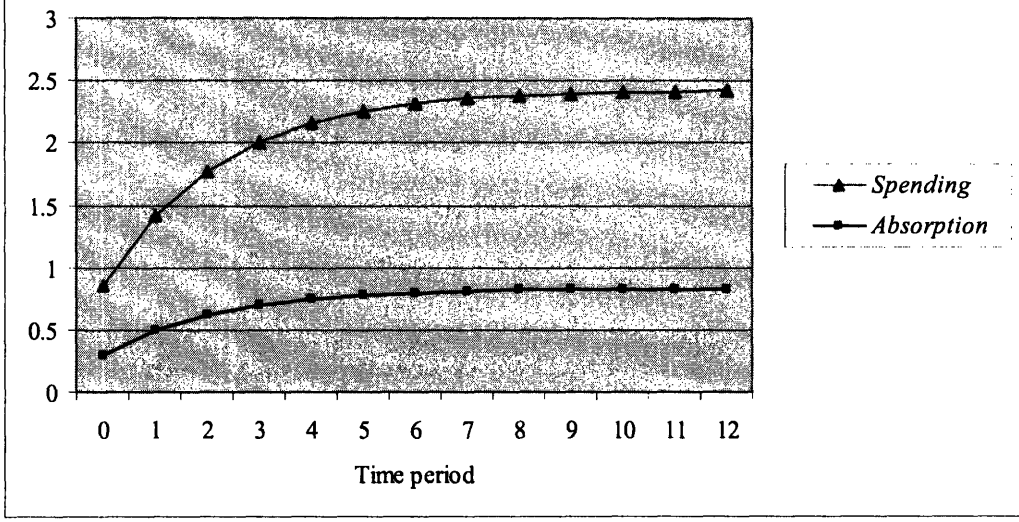
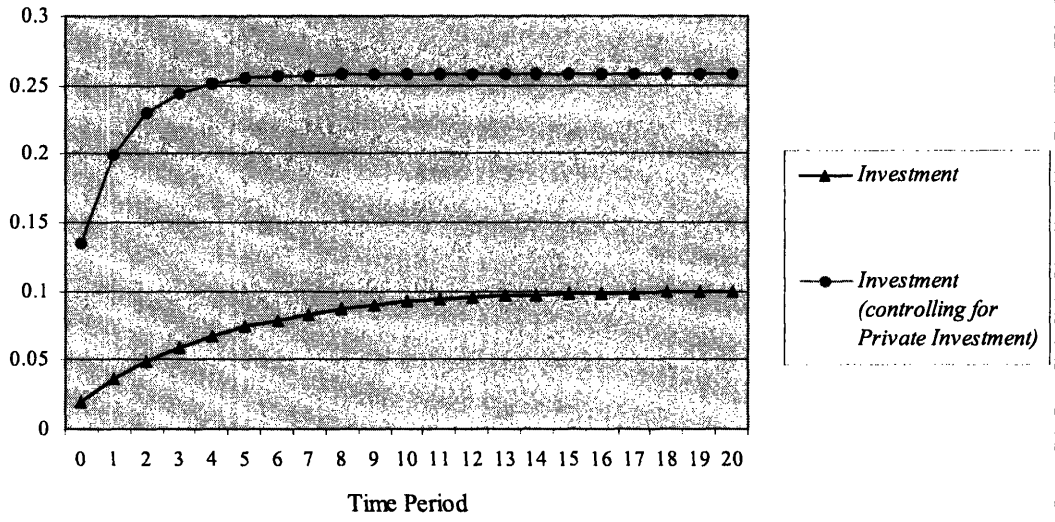


Figure 3.2:Time Path of Investment



Appendix II

Country	Country code
Albania	914
Algeria	612
Armenia	911
Bangladesh	513
Belize	339
Benin	638
Bhutan	514
Bolivia	218
Botswana	616
Brazil	223
Burkina Faso	748
Burundi	618
Cameroon	622
Cape Verde	624
Central African Rep.	626
Chad	628
Chile	228
China,P.R.: Mainland	924
Colombia	233
Comoros	632
Congo, Republic of	634
Costa Rica	238
Côte d'Ivoire	662
Djibouti	611
Dominica	321
Dominican Republic	243
Ecuador	248
Egypt	469
El Salvador	253
Equatorial Guinea	642
Ethiopia	644
Fiji	819
Gabon	646
Gambia, The	648
Ghana	652
Grenada	328
Guatemala	258
Guinea	656
Guinea-Bissau	654
Guyana	336
Haiti	263
Honduras	268
Hungary	944
India	534
Indonesia	536
Iran, I.R. of	429
Jamaica	343
Jordan	439
Kenya	664
Lebanon	446
Lesotho	666
Madagascar	674
Malawi	676
Malaysia	548
Maldives	556
Mali	678
Mauritania	682
Mauritius	684
Mexico	273
Morocco	686
Mozambique	688
Nepal	558
Niger	692
Nigeria	694
Pakistan	564
Panama	283
Papua New Guinea	853
Paraguay	288
Philippines	566
Romania	968
Rwanda	714
Senegal	722
Seychelles	718
Sierra Leone	724
South Africa	199
Sri Lanka	524
St. Lucia	362
St. Vincent & Grens.	364
Sudan	732
Swaziland	734
Syrian Arab Republic	463
São Tomé & Príncipe	716
Tanzania	738
Thailand	578
Togo	742
Tonga	866
Trinidad and Tobago	369
Tunisia	744
Turkey	186
Uganda	746
Uruguay	298
Venezuela, Rep. Bol.	299
Vietnam	582
Zambia	754
Zimbabwe	698

Appendix III: List of Abbreviations.

CAB	Current account balance
CHW	Community Health Workers
FPP	Family Planning Program
GOB	Government fiscal balance
IMF	International Monetary Fund
TOT	Terms of Trade
GDP	Gross Domestic Product
OP	Occasional Paper
NA	Non-Aid