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Schooling and Cognitive Achievements of Children in Morocco

Can the Government Improve Outcomes?

Shahidur R. Khandker
Victor Lavy
Deon Filmer

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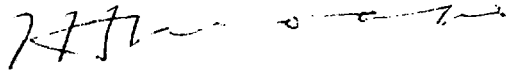
FOREWORD

Although education plays an important role in economic development, many low income countries are failing to develop their education systems fast enough to reap the benefits of an educated workforce. In many countries, two-thirds of school-aged children are not being educated at all or receiving a poor quality education. As part of its commitments to improve education, the World Bank is supporting various education projects in many developing countries. This paper examines the potential contribution of such projects in Morocco. The study observes that although the recent educational reforms and other education projects have desired impacts, the government of Morocco may accelerate educational achievements by furthering investments, especially in rural areas, in complementary inputs such as roads, irrigation and electrification that raise the rate of return to education.



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EXECUTIVE SUMMARY

Education plays an important role in economic development by improving productivity, health and nutrition, and slowing population growth. But many low income countries still have severe problems of low productivity, low health status, malnutrition, and high fertility, and are also failing to develop their education systems fast enough. In many countries, two thirds of school-aged children are not being educated or are receiving a poor quality education. Educational planners blame poor educational achievements on inadequate and inefficient resource allocation. On average low income countries spend some 3 percent of GNP on education as compared to 6 percent in high income countries. Moreover, low income countries tend to spend more on teachers salaries and less on teaching materials and teachers' training: outlays that tend to be more effective in positively influencing educational outcomes.

Morocco, however, is a middle-income country which spends 7.3 percent of GNP on education. Yet its attainments in education and other social development indicators are similar to those of low income countries. It spends about 85 percent of its education budget on teachers' salaries. Moreover, although 52 percent of the population lives in rural areas, Morocco allocated only 10 percent of its total educational investment to rural education in the eighties. Thus, in the education sector it seems that Morocco's problem is not one of inadequate outlays but inefficient resource allocation. The Government of Morocco (GOM) with the help of the World Bank has recently implemented major educational reforms and has increased investment in the country's rural educational system. The GOM effort includes, among others, building new schools in rural areas, more training to teachers, and better teaching materials.

However, given Morocco's dual economy this supply-based approach to educational development may be necessary but not sufficient to improve schooling outcomes. Demand-side factors such as irrigation and electricity which increase the rate of return to education and hence educational attainment are also likely to be important.

Recognizing that both supply-and demand-side factors play important roles and are often complements in schooling production, this paper, using data from the Morocco Living Standard Survey (MLSS), explores the relative effectiveness of both supply- and demand-side factors in determining educational outcomes. The school outcome variables include school enrollment, educational attainment, drop-out rate, and the cognitive achievement of students by gender across different regions. The supply-side explanatory variables include both school access (such as the accessibility of primary and secondary schools, the presence of a paved road and the condition of the roads) and quality (such as teachers' education and the highest class offered by the school) variables. On the demand-side both household (parents' education and assets, and availability of clean drinking water) and market demand variables (such as availability of electricity, irrigation and new crop varieties) are included.

A descriptive analysis of MLSS data reveals the following stylized facts. The school enrollment rate for the upper income group is almost twice that of the low income group. Urban children and rural boys consistently outperform rural children and rural girls in both school attendance and attainment. The school attendance rate is 90 percent in urban areas as compared to 48 percent in rural areas and 64 percent for rural boys compared to 32 percent for rural girls. Similarly, the completion rate for rural primary school pupils is 60 percent as compared to 87 percent for urban pupils and it is 63 percent for rural boys compared to 56 percent for rural girls.

There are also sharp differences in cognitive achievement between male and female and between

rural and urban children in Morocco. Urban children outperform their rural counterparts and boys outperform girls. For example, the mean test score in math is 11 for rural boys and only 4 for rural girls, while it is 19 for urban boys and 16 for urban girls. However, with additional schooling rural girls improve significantly on the math test. Thus, the mean math score of rural girls with no schooling is only 40 percent that of rural boys and 47 percent that of urban girls. In contrast, at the middle secondary level, the math score of rural girls is 90 percent that of rural boys and 86 percent that of urban girls. Under-investment in education and gender differences are more pronounced in rural than in urban areas, especially with regard to school enrollment and attainment.

Poor access to, and low quality of, schools are perhaps the most important sources of rural-urban and gender differences in schooling attainments. About 44 percent of rural children do not have a primary school and some 97 percent do not have a secondary school in their locality. Some 30 percent of primary schools are satellite schools and 71 percent are co-educational. The average class size in primary schools is 21 students. On average primary teachers have nine years of education and 93 percent of them have a school diploma. Only 20 percent of primary teachers are female.

Econometric analysis confirms that both supply- and demand-side factors are important determinants of rural-urban and gender differences in schooling outcomes. The results clearly indicate that improved school quality and access have significant positive effects on the school enrollment and attainments of both boys and girls. The presence of a primary school, or a paved road increases the school enrollment. On the other hand, the school enrollment increases with the number of grades offered in primary school. Teachers' years of education is also positively related to the school attainment of children, especially of girls.

However, educational resources are inefficiently allocated in rural Morocco. For example, low quality schools not only have teachers with below average years of education but are also found to have a higher proportion of trained female teachers and lower size of class. The average class size is small because demand for schooling is low as a result of low school quality. In contrast, more trained teachers are located in low quality schools because of recent recruitment policy that requires that new recruits are placed in rural schools. Thus, their effects on improving school quality are not yet realized.

The demand-side factors also play an important role. Investment in electricity, irrigation, and new crops increases the returns to education and hence the demand for education. Rural electrification increases the school attendance of both boys and girls, while investment in irrigation and advanced crop technology increase the school attendance of boys. In contrast, public investment in clean water improves the efficiency of time-use, especially of girls, at home and thus reduces the transactions cost of schooling leading to higher school attainment. These findings indicate the need for more public investment in rural infrastructure in order to improve overall educational attainment.

Note, however, that although public investments in water, roads, electricity, and new crops are gender-neutral, the benefits of these public investments are not. For example, investments in roads, electrification, and safe drinking water improve girls' school outcomes more than boys', while the opposite is true for investment in irrigation and new crop varieties. Evidence suggests that parents seem to bias private investment toward boys rather than girls. The presence of an additional male member in the family reduces the education girls receive. Moreover, as the household expenditure data show, when gender bias is substantially low, educating girls is more expensive than educating boys. Thus, if male-female cost differences are a partial source of gender bias in educational outcomes and if there are higher social returns to female education, it may be justifiable for the government to introduce stipend for girls

to encourage parents to send more girls to school. The Bank-financed female secondary school stipend project in Bangladesh shows how the government can help improve female education in a country that favors boys over girls.

I. Introduction

The benefits of education are well known and well documented (e.g., Haddad and others 1990; Psacharopoulos 1984; Schultz 1961). Yet many developing countries lag behind in developing their education system. Education improves productivity, directly contributing to economic development. It also helps promote development by slowing population growth and improving health and nutrition. In many developing countries, two-thirds of the school-aged children remain outside the education system. Among those who register for school, approximately three-fourths do not even complete primary school.

In many countries children either do not have access to education or are enrolled in schools of inferior quality. Educational planners blame poor educational achievements on inadequate and inefficient resource allocation. Low income countries spend about 3 percent of GNP on education as compared to almost 6 percent in high income countries. Furthermore, the resources allocated to education tend to be spent on salaries rather than on inputs such as text books and reading materials or on teacher training. These factors have a much stronger influence on educational achievement (Verspoor 1990).

Morocco is a middle income country and spends 7.3 percent of GNP on education. However, Morocco's educational attainments are below the levels expected for a country at this level of per capita income. In fact, Morocco's social and educational indicators are, in some cases, below those of low income countries (see table 1).

Although Morocco spends a larger part of its GNP on education as compared to many low income countries, it inefficiently allocates these resources. For example, Morocco spends about 85 percent of its education budget on teachers' salaries (UNESCO 1991). It also allocates a disproportionate amount of resources to the urban and wealthy classes. Morocco is a highly dualistic society with a large gap in social and educational indicators between rural and urban areas. Some 52 percent of the country's population live in rural areas, 45 percent of whom live below the poverty line. Rural areas do not, however, receive their proportionate share of public resources. For example, in 1989, about 22 percent of villages with a population of less than 1000 had virtually no access to primary education, and only 100 of the 682 middle schools in Morocco were located in rural areas. Worse still is the fact that none of the 340 high schools in the country were located in rural areas. According to a World Bank estimate, rural areas received only 10 percent of the total investment in education during the 80's (World Bank 1991).

To reduce rural-urban differentials in school access and achievements, the Moroccan government, with the help of the World Bank, has implemented major educational reforms and has increased investment in the country's rural school systems in recent years.[1] The objectives were to improve access to primary and middle schools by investing in the rural educational infrastructure as well as optimizing the resources allocated to the education sector.

Inadequate resource allocation to the rural education sector and inefficient overall resource allocation to education are no doubt important factors in explaining low educational attainment in Morocco. Improving school accessibility by building additional schools in rural areas or by improving

[1] The Rural Primary Education Project of 1989 and the Rural Basic Education Development Project of 1991 are two examples of the programs which the government has undertaken in recent years to improve the performance of the educational sector.

school quality through the training of teachers or through better reading material will certainly affect schooling outcomes. However, the role of demand-side factors in educational outcomes should not be underestimated. Education is an important form of human capital and the demand for human capital is perceived as an input in production. Therefore, the demand for education, which is influenced by the rate of return to education, is often related to the availability of complementary inputs such as electricity, irrigation, advanced technology (such as the development of new breeds of crops) and so on. These complementary inputs increase the marginal productivity of human capital and hence the return to education and thus help promote educational attainment. Believing that there is (latent) demand for education, policy makers often ignore the demand aspects of education and emphasize only supply-side factors such as access to and quality of schools.

In Morocco the demand-side factors may play a more important role due to the dualistic nature of its economic development. A little over a decade ago, the rate of return to education was estimated at 16 percent (Psacharopoulos 1981), yet Morocco's school enrollment remains remarkably low compared to even low income countries. However, judging from the national rate of return to education, one cannot draw the conclusion that the demand for education is equally high in all areas. In fact, educational attainment is low in rural areas perhaps because of low returns to education. Although it is possible that rural educated people migrate to urban centers to receive higher returns, it is difficult to judge the extent of this phenomenon. Moreover, massive rural out-migration is perhaps undesirable from the perspective of overall economic development. Thus, investing in complementary inputs such as electrification and irrigation is perhaps as important as building a school or improving the quality of existing schools in rural areas.

Note that the supply-side and demand-side factors often reinforce each other in influencing schooling outcomes. For example, better access to and better quality of schools reduces the cost of schooling and hence increases demand. This increase in better quality schooling should improve returns to education which in turn will generate further demand for schooling. Similarly, investments in complementary inputs such as electrification or irrigation that increase returns to education and hence demand for education also promote the demand for better quality schools, thereby generating further demand for education. Thus, poor access to or low quality of schools is often linked to low returns to education and hence to inadequate demand for schooling that jointly produces lower educational attainments.

The policy issue is whether supply-oriented educational investments in school quality or accessibility are adequate to promote schooling in rural Morocco. Policy makers thus need to assess the relative effectiveness of various supply- and demand-oriented public investment policies. An evaluation of government programs, therefore, can shed light on how to improve educational attainments in a country that lacks in human resources. The recent "Morocco Living Standard Survey (MLSS)" and the accompanying literacy survey carried out by the Directorate of Statistics of the Ministry of Planning with help from the World Bank and UNDP, provide an opportunity to examine the supply-demand nexus of schooling outcomes.

The aim of this report is to use these surveys in assessing the school performance of male and female students from various regions in Morocco and the role played by demand- and supply-side factors in various educational outcomes. The objective is to disaggregate patterns of demand for education into various categories such as primary and secondary levels and identify factors that impede children's participation in schools, especially that of female students in rural areas. We are interested in school attendance, educational attainment, drop-out rates and the cognitive achievements of students by gender

across different regions. The policy variables of particular interest to us are access variables such as the accessibility of primary and secondary schools, the presence of a paved road and the condition of the roads. The other supply-side factors include school quality variables such as teachers' average years of education and the highest grade offered in a given school. Improved school access and quality will reduce the cost of education and hence increase demand. These improvements will also help increase returns to education and hence promote demand.

The demand-side factors include both household- and community-level variables. Household-level variables include assets and parental education, while community-level variables include local health conditions and productive potential. Local health conditions are measured by availability of clean drinking water, while productive potential is proxied by the availability of electricity, irrigation and new crop varieties.

Given household demand for education, the productive potential of a region will increase the rate of return to education and hence influence children's schooling outcomes. In contrast, local health conditions influence children's health outcomes which in turn affect children's performance in school.

The data analysis confirms that educational and cognitive achievements in Morocco are higher for wealthy and urban households than for poor and rural households. The school enrollment rate for the upper income group is almost twice that of the low income group. Urban children and rural boys consistently outperform rural children and rural girls, respectively, in school attendance and attainment. The school attendance rate is 90 percent in urban areas as compared to 48 percent in rural areas and 64 percent for rural boys as compared to 32 percent for rural girls. Similarly, the completion rate for rural primary school pupils is 60 percent as compared to 87 percent for urban pupils and it is 63 percent for rural boys as compared to 56 percent for rural girls.

There are also sharp differences in cognitive achievement between male and female and between rural and urban children in Morocco. Urban children outperform their rural counterparts and boys outperform girls. For example, the mean test score in math is 11 for rural boys and only 4 for rural girls, while it is 19 for urban boys and 16 for urban girls. However, with additional schooling rural girls improve significantly on the math test. Thus, the mean math score of rural girls with no schooling is only 40 percent that of rural boys and 47 percent that of urban girls. In contrast, at the middle secondary level, the math score of rural girls is 90 percent that of rural boys and 86 percent that of urban girls. Under-investment in education and gender differences are more pronounced in rural than in urban areas, especially with regard to school enrollment and attainment.

Econometric analysis of the MLSS data confirms that poor access to and low quality of schools are important factors in rural-urban and gender differences in schooling attainments. Rural Morocco has poor access to primary and secondary schools and the quality of existing rural schools is low though not as low as one might expect. There is, in fact, counter-intuitive evidence that suggests that educational resources are inefficiently allocated in rural Morocco. More importantly, rural Morocco lacks complementary investments in roads, irrigation and safe drinking water, all of which are found to significantly contribute to schooling outcomes, especially among girls. Increasing the returns to education and improving the efficiency of the rural school system would improve both school attendance and attainment. These findings call for increased government efforts to improve the efficiency of resource allocation in education. The findings indicate the need for more public investment in rural infrastructure in order to improve overall educational attainment. In particular, investment in roads, electricity, irrigation, new high-yielding crop varieties and clean drinking water, would effectively complement

investment in education infrastructure and quality.

Furthermore, although public investments are gender neutral, parents seem to bias private investment toward boys rather than girls. Yet parents in Morocco who enroll both boys and girls in school may need to spend on average more for girls than for boys at each level of schooling. If the cost differences are partial source of gender bias in parental investment, and if there are large social gains in female education, then the government may provide stipend to girls as an incentive to parents for promoting equal investment in boys and girls.

The report is organized as follows: Section II discusses the MLSS and literacy survey data. Section III presents the stylized facts about Morocco's educational outcomes. Section IV outlines a theoretical framework for estimating the causal impacts of both supply- and demand-side factors on educational outcomes. Section V presents the results. Section VI discusses some policy simulations and their implications. Section VII concludes the report.

II. The Living Standard Measurement and Literacy Surveys

The data used in this report is taken from the 1990-91 Morocco Living Standards Survey (MLSS), a comprehensive household survey implemented by the Morocco Statistical Department on random samples of households throughout Morocco. The MLSS consists of a broad household questionnaire that includes information about schooling, employment, labor and non-labor income, consumption and expenditures, health, fertility and savings. The MLSS sample, stratified across the seven economic regions of Morocco, contained 20 primary clusters of 24 households within each region. Each primary cluster was further divided into 3 secondary clusters of 8 households each. The sample included 3360 households with almost 20,000 individuals. From this sample, 2 of the 3 secondary clusters in each primary cluster were targeted for inclusion in a Literacy Survey, for a total expected sample size of 16 households (including all eligible household members) per primary cluster, or 2224 households nationally.[2]

The literacy survey was administered to household members aged 9 to 69. Information collected included self-reported mother tongue, educational experience, self-judgments on language-specific reading and writing abilities, math abilities and reading and writing practice at home and at the work place. Those with formal education were also given direct assessment tests of document familiarity, basic reading and writing skills in Arabic and French (when some French ability was reported) and mental and written math.[3] The full literacy survey consisted of the following nine sections: (1) general self-reported questions on literacy skills and behavior; (2) questions concerning basic health care behaviors (addressed to heads of households and their spouses, and other persons aged 20 to 50 only); (3) assessment of

[2] When a target household or a majority of eligible individuals within a household could not be surveyed for any reason, a replacement household of similar size from the third secondary cluster in a given primary cluster was selected and surveyed. For greater detail on overall sample structure and representativity, see Lavy and others (1992).

[3] High school graduates with a baccalaureate or its equivalent were exempted from the tests and later assigned the highest score possible. The concept of baccalaureate "equivalency" and specific cases encountered in pretesting led to considerable discussion regarding the appropriate criteria for respondent selection and assessment. A summary of the final system of assessment decision criteria is available in Lavy and others (1992), and in the Literacy Survey Instruction Manual.

information location skills, using common literacy artifacts; (4) mental arithmetic assessment (two levels); (5) Arabic reading assessment (two levels), including word decoding, word-picture matching (level 1), and text comprehension (level 2); (6) Arabic writing assessment (two levels), including signature and word dictation (level 1) and sentence dictation (level 2); (7) French reading assessment (two levels, equivalent to Arabic reading assessment); (8) French writing assessment (two levels; equivalent to Arabic writing assessment); and (9) written numeracy assessments (two levels), including number recognition and writing (level 1) and solving of written equations (level 2).

The results of the direct assessments were used to produce separate scores for each skill or knowledge area. Words used in Arabic and French level-1 reading and writing tasks were selected from primary school textbooks currently in use in Morocco. Texts used in text-comprehension tasks were adapted from primary, secondary and adult literacy textbooks and from local Moroccan newspaper articles. The information location task, sample knowledge of literacy artifacts (envelope, newspaper, electricity bill, medicine label, national identity card) commonly found in Moroccan homes. Math problems, both oral and written, sample the basic arithmetic functions and concepts of measurement, percentages, fractions, decimals and plane geometry. Within each task, efforts were made to order items by increasing level of difficulty (for those tasks using school text content, according to their point of introduction in the curriculum); these orders were adjusted on the basis of pilot testing results.[4]

Supplementary surveys of communities and schools were carried out in all the rural clusters. The community questionnaire was administered in 324 rural communities (i.e. douars), while the school survey was conducted in 186 schools (both primary and secondary). However, these 186 schools were found to serve only 240 out of 324 rural communities. In total there are 240 rural communities for whom we have both community- and school-level information. The community questionnaire was designed to provide information on the availability of social and infrastructure services such as transportation, health, financial and agricultural extension services, as well as general information on local labor markets conditions. The school survey includes detailed information on all the primary and secondary schools attended by children from the community. The school questionnaire includes variables describing the physical condition of the school structure, availability of teaching materials, number and level of trained teachers and their gender composition, as well as summary statistics of schooling outcomes at the school level, such as repetition and drop-out rates by grade level. The school data provides a fair characterization of access to and quality of schooling services available to households in the community.

III. School Performance Indicators: A Descriptive Analysis

In this report, we discuss the school performance of children aged 7 to 20. The term performance is used here to denote school enrollment rates and achievement scores in math and languages. The data are broken down by gender, location, and region in order to highlight differences in school outcomes among various groups of interest. Thus, four location-gender groups -- rural male,

[4] The survey draft was subjected to pretesting, revision, full pilot testing, and a second revision prior to full-scale application in the field. Pretesting of the literacy survey was undertaken as a means of testing the adequacy of interviewer training and the efficiency of survey format and administration procedures. As such, it was intended to provide qualitative information for the finalization of methology, rather than to allow detailed psychometric analyses (carried out in the later piloting phase). Psychometric analyses of all assessment modules were performed in order to examine the internal consistency of the modules, the reliability and difficulty level of individual items and the equivalence of the two forms of each module.

rural female, urban male and urban female -- and seven regions -- South, Tensift, Center, North-West (which includes the capital city -- Rabat), North-Central, Oriental and South-Central provinces of Morocco -- are used to investigate the patterns of male-female, rural-urban and regional differences in various school outcomes.

The sample contains 6801 children aged 7 to 20 from 2397 households taken from seven provinces (see table 2). 42.2 percent of these children are urban and 57.8 percent are rural. 49.6 percent are male and 50.4 percent are female. There is little variation in the male-female ratio across the seven regions. The North-Western region has, however, the lowest percentage of rural children (52.5 percent), while the Southern region has the lowest male rural population (26.4 percent against 31.2 percent rural females).

Schooling Outcomes

We examined three schooling outcomes: (a) never attended school; (b) attended and completed school; (c) currently enrolled in school. Two more outcomes can be defined using the sample of current or ex-students. These are the completion rates of primary level (up to grade 5), secondary 1 level (up to grade 9) and secondary 2 level (up to grade 13) and the transition rate from primary to secondary 1 and from secondary 1 to secondary 2 level.

The achievement scores in mathematics, Arabic and French are indicators of schooling outcomes as well.

Ever Attended School

As table 3 shows, about 66 percent of all children have attended school at one time or another. There is a marked difference between the school enrollment rate in urban and rural areas. Children in rural areas are far less likely to attend school -- the participation rate is only 48 percent compared to 90 percent in urban areas. The difference in male-female ratios in school attendance is not as conspicuous (only 10 percent) in urban Morocco. In contrast, the school enrollment of rural female children is half that of rural male children (32 percent compared to 64 percent).

There has been a 50 percent increase (from 60 to 90 percent) in the school attendance rate in urban Morocco since the introduction of several World Bank-financed school projects in 1989. In rural areas there has been a 20 percent increase, (from 40 percent to 48 percent), with an overall national increase of 30 percent (see table 3). This is a significant increase by any measure.

In order to further examine the impact of program placement among the younger population, the sample is disaggregated into various age-cohort groups. The school enrollment rate for both males and females in urban and rural areas has recently increased dramatically especially for urban female children (from 61 percent for 20-30 year olds to 84 percent for 10-20 year olds (see figure 1)). Although enrollment is lowest among rural women in all age-cohort groups, they have, nonetheless, experienced the largest relative increase in school enrollment in recent years. The enrollment rate is 11 percent for the 20-30 year-old age group, and 30 percent for the younger group (10-20 years old), an increase of 173 percent as compared to 48 percent for rural males of the same age groups. These figures indicate that public investment in education has contributed to an increase in school attendance, but more incentives are still needed in order to improve school attendance rates in rural areas, especially among female children.

Schooling Attainment

The male-female differences in mean grade attainment in both urban and rural areas are small, the mean grade being slightly lower for girls (see figure 2). The mean grade in rural areas is 4.93 for girls and 5.43 for boys. It is 6.96 for girls and 7.14 for boys in urban areas.

A significant difference, however, exists between rural and urban areas. The mean grade for urban children is 7.05 compared to 5.18 for rural children. Primary schools go up to grade 6 which means that many rural children drop out of the school system even before completing the primary cycle.

Table 4 shows that, contrary to expectation, girls are doing better than boys in some regions, especially in Tensift where the mean grade in urban areas is 7.16 for girls compared to 6.65 for boys and in rural areas 5.61 for girls compared to 5.38 for boys in rural areas. It also shows, however, that in some rural areas girls are doing much worse than boys. The male-female gap is the highest in the Central-South region where boys attain a full grade more than girls (5.04 vs. 4.03).

Moving beyond simple means, figure 3 presents the number of children in each age group still in school, conditional on having ever attended school. The age-schooling profile confirms that at each age level, both girls and boys in urban areas tend to spend the same amount of time in school, whereas boys stay in school longer than girls in rural areas. In each age-group the percentage of males and females attending school is higher in urban than in rural areas. This difference is particularly noticeable in the over 11 age group. A regional breakdown (not shown here) also confirms these findings.

An alternative approach to school attainment is to calculate survival probabilities by grade, i.e. the probability that an individual will "survive" until a particular grade (and then either remain in school or drop out). Figure 4a shows the Kaplan-Meier survival curves (taking into account right censoring) for grade attainment among four location-gender groups. The results are consistent with the overall patterns that emerged earlier, i.e., a similar age-schooling profile for girls and boys in urban areas, lower probabilities of survival for rural girls relative to rural boys and markedly different patterns in rural and urban areas. In fact, the probability of survival in rural areas is about half that for urban areas.

The survival pattern reveals an additional dimension of male-female differences in rural areas -- rural girls have a much lower probability of surviving grade 6 (the end of primary school) than their male counterparts. The chance of surviving grade 6 in rural areas is 43 percent for girls and 56 percent for boys. The difference in survival rates for boys and girls persists from grade 6 through 12 after which they tend to equalize.

A regional breakdown of survival patterns (figures 4b and 4c) identifies three regions where male-female differences are particularly large (the remaining four regions show remarkably similar patterns for boys and girls): the Southern, Oriental and South-Central. In these regions, the survival rates at grade 6 are lower for girls than for boys and do not converge in subsequent grades.

School Completion and Transition Rates

The above discussion points to the fact that there may be important thresholds in the Moroccan educational system which have different impacts on individuals depending on location and gender. Up to university level, the schooling system can be divided into three major components: primary school,

secondary level 1 and secondary level 2. Primary school lasts for six years, secondary level 1 lasts four years and secondary level 2 lasts three years.

The completion rate for primary school is similar for boys and girls in both rural and urban areas (see figure 5). This rate is 63 percent for boys and 56 percent for girls in rural areas and 88 percent and 85 percent, respectively, in urban areas. The primary completion rate is even higher for girls than for boys in regions such as Tensift, Center and North-West when the data is broken down by region (not shown here).[5] However, in some rural areas, the completion rate for primary school is substantially lower for girls than for boys. In the Southern, Oriental and South-Central regions, for example, the primary completion rate for boys is 71, 73 and 57 percent, respectively; for girls, the rate is 55, 53 and 36 percent, respectively.

The transition rate to secondary school after completing the primary cycle is in general much lower in rural areas than in urban areas (see figure 6). Although the rate is similar for male and female children in urban areas (86 percent for boys and 85 percent for girls), it is lower for girls than for boys in rural areas (57 percent for boys and 45 percent for girls). The male-female differences in rural areas are significant in all regions (table 5). The male-female difference is highest in the Oriental and Central-South regions. Thus, the transition rate from primary to secondary level 1 is 64 percent for boys and 34 percent for girls. In the South-Central region it is 43 percent for boys and only 13 percent for girls.

Once a child is in secondary level 1, the probability of completing this cycle does not vary significantly by gender. It does, however, vary substantially according to location. Figure 5 shows that the completion rate is approximately 80 percent in urban areas but only 35 percent in rural areas. Although on average the completion rate is lower at the secondary level than at the primary level in all areas, it declines more in rural than in urban areas: the completion rate declines by 17 percent in urban areas as compared to 25 percent in rural areas.[6]

The transition rate from secondary level 1 to secondary level 2 also follows the previously identified pattern. Thus, while we find that transition rates are similar for boys and girls, they differ between rural and urban areas. Unlike the transition pattern of the first cycle (i.e. from primary to secondary level 1), the rural-urban gap during the transition of the second cycle (i.e. from secondary level 1 to level 2) is narrower. In fact, there is almost a 10 percent increase in the transition rate for rural children, whereas the rate declines slightly for urban children.

Overall School Experience

Table 5 shows the typical overall school experience of Moroccan children at various levels. In this table, we follow a fictitious group of 100 children of each gender in each location, and compute, based on the above attendance, attainment and completion rates, the number of children remaining in the school system at each level. This clearly shows the sharp rural-urban differences in the school performance of Moroccan children: of 200 children (100 of each gender) in each location, some 60

[5] The difference is the highest in the Tensift region where some 64 percent of rural girls complete primary school compared to 57 percent for rural boys.

[6] Breaking the sample down by region reveals a very similar pattern. However, interpreting the results of regional differences may be misleading because of the small sample problem, especially in rural areas.

children complete secondary level 2 in urban areas compared to only 4 children in rural areas. Approximately 107 children complete secondary level 1 in urban areas compared to only 11 in rural areas. In contrast, some 156 children complete primary level in urban areas compared to only 58 in rural areas. Of 200 children aged 7-20, some 104 children never attend school in rural areas compared to only 19 children in urban areas.

Gender differences are quite substantial in rural areas, while they are only marginal in urban areas. However, the gender gap in rural areas matters most in terms of school attendance. Thus, out of 100 children of each gender, some 64 male children attend school in rural areas compared to only 32 females. Once girls are enrolled in primary school, their completion rates at each school level are similar to (albeit slightly lower than) those of their male counterparts.

Achievement Test Scores

A series of tests covering mathematical, Arabic and French language skills was administered to a subsample of individuals from the MLSS. Of the 6801 children in the sample, 3785 were tested. Of these, 1089 (29 percent) were rural males, 1124 (30 percent) were rural females, 758 (20 percent) were urban males and 813 (21 percent) were urban females. The children came from 1477 households, of which 815 (55 percent) were rural and 662 (45 percent) are urban households. Since persons with a baccalaureate diploma were not tested, only the test scores at the primary and secondary 1 schooling levels are considered in this report.[7]

The test score results, stratified by schooling level, are presented in figures 7a, 7b and 7c. There is clearly an upward trend in achievement scores for all three tests as educational attainment increases. Math and Arabic scores are most influenced by the transition from no schooling to primary schooling whereas the largest change in French scores occurs with the transition from primary to secondary level 1.

Rural-urban differences are most pronounced on the French test in which the scores of those with primary schooling in urban areas is about double that of their counterparts in rural areas. The score is 7.6 for urban boys compared to 3.8 for rural boys and 7.2 for urban girls compared to 4.0 for rural girls. The rural-urban difference is also present at the secondary level 1, although it is not as pronounced as at the primary level. On the math and Arabic tests, the rural scores range between 70 and 80 percent of those in urban areas.

Given location, there is a strong similarity between the scores achieved by male and female children. The only test with a substantial male-female difference is the math test on which boys outperform girls. The largest difference is in rural areas and among those with no schooling where girls score only about 40 percent as high as boys. At the primary and secondary level 1, girls score about 85 percent as high as boys. On the Arabic and French tests the mean scores of girls range from 85 to 107 percent of those of boys. In Arabic and French, at both secondary level 1 and 2, girls in urban areas outperform boys.

Breaking these scores down by region reveals very little regional variation (not shown in any of the tables or figures). In certain regions rural female children are scoring lower than their male

[7] For more on the test scores, see Lavy et al. (1993).

counterparts. This is especially the case for math scores at the primary school level in the North-West, Center-North and Center-South regions. The same holds true for secondary level 1 in the Southern and South Central regions. On the Arabic and French tests, rural girls score lower than rural boys in the North-West, Center-North, Center-South and Southern regions.

Summary of Schooling Outcome Patterns

The main stylized facts emerging from the analysis can be stated as follows: (i) Urban children consistently outperform rural children according to all schooling outcome measures. (ii) Gender differences are particularly pronounced in rural areas. (iii) Gender differences are most pronounced in the rate of ever attending school. (iv) Given location and ever attending school, gender differences are low in school attainment, completion and transition from one level to another as well as in scores achieved in Arabic and French skill tests. (v) The completion rates at primary and secondary level 1 do not vary by gender but are higher in rural than in urban areas. (vi) There are regional differences in the schooling outcomes of rural girls. Rural girls in the Southern, Tensift and North-Central regions, for example, do not attend as frequently or stay in school as long as their counterparts in other regions.

Demand Factors and Schooling Outcomes

Schooling outcomes are influenced by a variety of individual, household, community- and school-level factors. These factors can be classified into two major groups -- demand-side and supply-side. We will consider first the demand-side, focusing on the association of schooling outcomes with household income and parental education.

Household Income

Household per capita expenditure is used as a proxy for household income. The distribution of children by household expenditure quintiles is presented in table 6a. In the poorest (i.e. lowest) quintile, children of age 7-20 are predominantly (79 percent) from rural areas. The proportion of rural children declines steadily as we get into higher quintiles. In fact, urban children account for 83 percent of all children in quintile 5.

Figure 8 shows the association between household per capita expenditure and the proportion of children who ever attend school. This figure clearly shows an upward trend in the proportion of children who ever attend school, for all location-gender groups, as household per capita expenditure increases. The proportionate increase in the rate of ever attending school is correlated with changes in per capita expenditure and varies with location and gender. Within each quintile, the proportionate increase is lowest for rural girls and highest for urban boys. The rate for rural girls ranges from 25 percent in the lowest quintile to 46 percent in the highest quintile. In contrast, the rate for urban boys varies from 89 percent in the poorest quintile to 100 percent in the richest quintile.

The rural-urban gap in the school attendance rate narrows as income increases. For example, the school participation rate for boys in the poorest quintile is 59 percent in rural areas and 89 percent in urban areas. In contrast, the attendance rate for boys in the richest quintile is 67 percent in rural areas and 100 percent in urban areas.

The male-female gap in school participation also narrows as income increases. For example, in rural areas the school attendance rate for girls in the poorest quintile is only 32 percent of the rate for

boys in the same quintile, while the proportion is 68 percent in the richest quintile. In fact, the school participation of rural girls increases by more than 84 percent from the lowest to the highest quintile. In contrast, the corresponding increase for rural and urban boys is 12 and 13 percent, respectively. However, the school participation of urban girls falls by 11 percent from the poorest to the richest quintile. This is perhaps due to the early age of marriage for girls from the wealthier classes in Morocco.

Figure 9 shows the mean grades attained by children of various expenditure quintiles, conditional on ever attending school. It shows that rural-urban differences in the mean grade completed increase with income. The mean grades completed by rural boys and girls are, 81 and 77 percent respectively, of those for urban boys and girls in the lowest quintile, while in the wealthiest quintile the percentages are 77 and 72. Thus, the income-induced increase in the rural-urban gap in school attainment is similar for males and for females.

The percentage of those still in school by age shows that girls have consistently lower attainment rates than boys in almost all the expenditure quintiles, especially among children aged 12 to 16 in rural areas. Survival rates by grade confirm this result which is consistent for all expenditure quintiles (see figure 10). Although girls in rural areas have lower probabilities of surviving grade six than boys, they tend to outperform boys in the higher grades. There is also a large difference between rural and urban areas in terms of the percentage of children who stay in school once they are enrolled. The rural-urban gap tends to increase with income.

The same pattern is also seen in the completion and transition rates (figures 11a, 11b and 12). The primary completion rates increase with income, the largest increase being for rural girls; the completion rate for girls increases from 48.6 percent in the lowest quintile to 88.9 percent in the highest quintile. For rural boys the primary completion rate only increases from 58.8 to 70.0 percent. The transition rate from primary to secondary level 1 does not follow a uniform pattern for either boys or girls. The transition rate for rural girls in the lowest quintile is almost double that for rural girls in the highest quintile (45.2 percent versus 25 percent) and follows a vertical u-shape as income increases. Results of the achievement tests do not indicate a wide variation in scores between expenditure groups. The gender gap on the language tests is a small one. The largest difference between girls and boys is to be found on the math test for secondary 1 in rural areas among the middle expenditure group. Girls from the second, third and fourth quintiles have math scores 60 to 80 percent lower than hose of boys.

Parental Education

We turn next to the association between schooling outcomes of children and their parents' education. The majority of children whose parents have no education are from rural areas. Some 67 percent of children from families where the head or the spouse has no education are from rural areas. However, children's educational attainments improve with parents' schooling (dramatically in the case of the spouse's education). As figure 13 shows, the rate of ever attending school for children from households where the head has no education is 62 percent for rural boys, 29 percent for rural girls, 94 percent for urban boys and 84 percent for urban girls. The percentages in households where the head has an education of secondary level 1 are 82, 62, 100 and 94 percent, respectively. A similar pattern emerges for the association of spouse's education with children's schooling (with the exception of rural areas where the percentage of boys who ever attend school declines from 64 to 50 percent when the spouse education level changes from no education to secondary level 1).

There is, however, a sharp difference in the association between the education level of the household head and the spouse and the girl's education in rural areas. The school participation rate of rural girls increases by 55 percent when the household head's education increases from none to primary level. In contrast, the participation rate increases by 135 percent when the spouse's education changes from none to primary level. The spouse's education also has a stronger impact than the head's education on boys' and girls' schooling in urban areas.

Once children are in school, the parents' education does not appear to play a role in determining the length of time a child spends in school. Figure 14 shows that the mean grade achieved hardly varies with parent's education. Although there is a positive association between parent's education and children's mean grade attained, this association does not vary significantly with gender or location.

Supply-Side Factors and Schooling Outcomes

The supply factors include variables that measure access to and quality of schools. Access is measured by whether there is a school in the community, whether the community has a paved road and how many months of the year the road is unusable. These access variables were measured and collected at the community level. In contrast, school quality is measured by variables such as teacher-student ratios, male-female teacher ratios, school supplies, textbook supplies, etc. which are collected at the school level.

About 44 percent of rural children do not have a primary school located in their community, while some 97 percent do not have a secondary school in their community (table 7).[8] Thus, the presence of a school substantially improves a child's schooling outcomes. For example, as table 7 shows, 56 percent of rural boys and 24 percent of rural girls ever attend school when there is no primary school in the community. In contrast, the school attendance rate increases to 72 percent for boys and 37 percent for girls if there is a primary school in the community. Similarly, 56 percent of rural boys and 44 percent of rural girls go beyond primary school if there is no secondary school in the community. However, 83 percent of rural boys and 75 percent of rural girls go beyond primary school if there is a secondary school in the community.

The presence of a secondary school in the community thus increases substantially the mean grade attained by girls who go beyond primary school (table 9). Thus, when girls go beyond primary school they attain a mean grade of 11 if there is a secondary school in the community as compared to a mean grade of 9 if there isn't. Figure 15 shows the survival rate of boys and girls at various grades in the school system when a primary and secondary school are present in the community. When there is neither a primary nor secondary school in the community, the survival rate declines for both boys and girls with virtually no gender difference in school attainment. However, when there is a primary school but no secondary school, the survival rate beyond the primary level is higher for boys than for girls. When there is both a primary and a secondary school located in a community, the survival rate increases for both boys and girls. However, the rate is lower for girls than for boys. This indicates that providing a secondary school in a community does not automatically reduce the gender gap that exists in school attainment beyond the primary level. More information on school quality and parental preferences are

[8] Similar community-level information is not available for urban areas. Therefore, a similar analysis was not performed for urban children.

needed in order to understand why girls respond differently than boys in deciding whether to continue beyond primary school level.

The presence of a paved road in the community especially influences the schooling outcomes of rural children. Thus, in the absence of a paved road, 21 percent of rural girls as compared to 58 percent of rural boys ever attend school (table 10). If a paved road exists, the school participation rate increases to 48 percent for girls and 76 percent for boys. The survival rate by grade also varies by gender in the presence of a paved road: girls drop out in larger proportions than boys even before completing the primary cycle in the absence of a paved road in the community. However, the presence of a paved road increases girls' survival rate only at the primary level.

The survey data on primary schools is summarized in table 11. The table presents the salient characteristics of the rural school system in Morocco in terms of access and quality. As table 11 indicates, most primary schools are located near the community -- the average distance is 50 meters. About 42 percent of primary students go to school on foot with the trip lasting 49 minutes on average. 30 percent of primary schools are satellite schools. The highest grade offered in the primary system is fifth. 71 percent of these primary schools are co-educational. Only 3 percent of students purchase books from school and only 1 percent get their books free from school. The average size of a primary school is 21 students. The mean years of education for primary teachers is 9; 93 percent of them have capes (i.e. a school diploma certificate). Only 20 percent of primary teachers are females; 56 percent of them have capes. These schools report that only 14 percent of students complete primary school, 83 percent of whom go on to secondary school.

This descriptive analysis shows the association, though not the causality, between various supply- and demand-side factors and schooling outcomes. For policy formulation, however, it is essential to identify the causal impact of various supply- and demand-side factors on schooling demand. This requires the estimation of an econometric model of schooling demand using the MLSS data. In the following sections, we first describe an economic model that explains the relationships between potential explanatory variables and schooling outcomes in an estimable equation form and then estimate the model using the MLSS data and analyze the results.

IV. The Role of Demand- and Supply-Side Factors in Determining School Outcomes: A Theoretical Framework

The purpose of this theoretical framework is to justify the inclusion of certain variables in an estimated model and to provide an economic interpretation of their coefficients. Variables are often included in estimated models that are difficult to justify. To avoid this kind of problem, a household model is developed.[9]

A schooling outcome such as school enrollment is a home-based non-market production that utilizes home-, market- and community-supplied inputs. Parents are key players in schooling outcomes since they initiate the demand for schooling. The price structure facing parents in demanding schooling for children also influences schooling outcomes. Parental influence is direct via preferences (proxied by education) and income. School quality, on the other hand, which is characterized by such factors as

[9] A similar model is developed in Khandker (1993); for general discussion of the household model, see Singh, Squire and Strauss (1986).

school location and the number of classes and teachers (male and female), exerts both a direct and indirect impact on schooling. Similarly, the community environment, as proxied by variables such as roads and electrification, can also have both a direct and indirect effect on schooling. Many community variables also represent the role of both demand-and supply-side factors in influencing schooling.

Given the high incidence of ill-health among school children in developing countries, public investment in, for example, private health care can substantially improve schooling outcomes by (a) directly affecting the health status of children and hence their cognitive achievements and (b) increasing the efficiency of time devoted by children to schooling and other activities. Investment in public health that improves the health conditions of other members of a family such as the mother or sibling can also affect the schooling outcomes of children, especially girls who are responsible for the care of sick household members. It seems, therefore, that the government can play an active and important role in schooling outcomes through various interventions that affect both the school and community environment as well as the price structures of various goods and services which the household consumes.

Identifying the precise influences of all these factors on schooling outcomes is difficult due to the complex relationship between the variables. Nevertheless, estimating the impact of these variables on schooling outcomes is not impossible. In order to facilitate the understanding of the interactions among the variables and their estimation, we first model the underlying household decision-making process that is based on children's health, education and expected earnings. Following this, we discuss the estimation strategy.

Assume that parents, consisting of a mother (m) and a father (f) with preferences Γ^m and Γ^f and a combined income (I) net of consumption, decide how much health care and schooling will be allocated to their children; this, in turn, determines the children's expected earnings over the life cycle.[10] Parents care about the investment in their children because it directly yields utility (U) to them. The utility function of the parents can be written as:

$$U = U(S, H, R, L; \Gamma^m, \Gamma^f) \tag{1.1}$$

where S, H, R and L are, respectively, the schooling, health, expected earnings and leisure of their children. As shown in (1.1), the curvature of the utility function is influenced by the parents' preferences, Γ^m and Γ^f.

Both schooling and health are outputs of home-based non-market production that use both market-purchased and home-provided inputs, given the technology of production and the environment in which the household production takes place. The production function of schooling is given by:

$$S = S(M, H, K; \alpha) \tag{1.2}$$

where M is a vector of market-purchased inputs such as books, papers, pencils, etc., H is the children's health status, K is the "effective" time children devote to schooling and α represents both individual endowment and the school environment. Equation (1.2) states that given the technology and environment,

[10] For simplicity, we assume that the number of children, male and female, is given. In other words, the number of children is not a choice variable. Doing otherwise would only complicate the model and its estimation. In particular, family planning programs that affect fertility outcomes will also influence the schooling and health outcomes of children.

the health status of children directly affects their schooling outcomes. However, children's health (H) is in turn produced with market-purchased inputs (Z) in a health environment summarized by τ, given the household production technology. The production function for health is given by:

$$H = H(Z; \tau) \tag{1.3}$$

The ultimate objective of parents in giving their children better schooling and health is to help children maximize their life-time expected earnings (R). The expected earnings of children are, therefore, assumed to be directly influenced by schooling (S) and indirectly by health status (H), given the productive environment as summarized by σ. By productive environment we mean the productive potential of the local area. The productive potential in a rural setting may be represented by the extent of irrigation, the presence of new high-yielding varieties of crops and the quality of the physical infrastructure. The children's expected earnings function is given by:

$$R = R(S; H, \sigma) \tag{1.4}$$

In the earning equation (1.4), we assume that children's health status (H) and productive environment (σ) affect the earning impact of schooling, but do not directly affect earnings. That is, better health and a productive environment only influence the productivity effect of schooling.

The health status of children also affects the quality of time (N) devoted to schooling which is given by:

$$K = K(N, H) \tag{1.5}$$

The "effective" time (K) devoted to schooling is thus directly affected by children's time allocation to schooling and their health status.

Because improved health status can improve an individual's total time available Σ (see Grossman 1972), and since children in a rural setting where the labor market is not perfectly competitive can alternatively allocate their time for the income generation of parents at some remuneration π, the children's time constraint can be written as:

$$Y + L + N = \Sigma(H) \tag{1.6}$$

where Y is time spent on current income generation for parents.

The parents' budget constraint is then given by

$$P_M M + P_Z Z = I + \pi Y \tag{1.7}$$

The first-order conditions, derived from the maximization of (1.1) subject to the structural conditions (1.2)-(1.7), for the optimal amounts of market-purchased inputs, M and Z, used in the production of schooling and health, respectively, and the time spent on schooling (N) and leisure (L) are given by:

$$(U_s + U_R R_s) S_M = \Phi P_M \tag{2.1}$$

(2.2) $$[(U_H + U_S + U_R R_S)(S_H + S_K K_H)]H_Z = \Phi[P_Z - \pi \Sigma_H H_Z]$$

(2.3) $$(U_S + U_R R_S)S_K K_N = \Phi\pi$$

(2.4) $$U_L = \Phi\pi$$

where Φ is the marginal utility of income which is positive. Equations (2.1) and (2.3) state that in order to obtain the optimal utilization of inputs in school production, the relative productivities of inputs, M and N, in school production must be equal to the ratio of their respective prices, i.e.

(3.1) $$S_M/(S_K S_N) = P_M/\pi$$

Equations (2.1) and (2.2) also state that the use of market-purchased inputs (M) and children's time spent on schooling (N) depends not only on how parents value children's schooling and expected earnings, but also on the expected return to children's schooling. In equation form, this may be written as:

(3.2) $$U_S = \Phi(P_M/S_M) - U_R R_S = \Phi(\pi/S_K K_N) - U_R R_S$$

Similarly, equation (2.2) implies that parental investment in children's health is in part influenced by the return to children's education and the alternative use of time for current income generation. In particular, improved health can reduce the shadow prices of health inputs (Z) since health (a) directly increases current income, (b) increases the total healthy days available that have alternative use in augmenting parental full income and (c) reduces the cost of producing schooling via improved efficiency. In equational form, this can be written as:

(3.3) $$U_H = \Phi A/(S_H + S_K K_H)H_Z$$

where $$A = [P_Z - \pi\{\Sigma_H + 1 + (S_H/S_M)P_M\}H_Z]$$

is the shadow price of producing health for children.

On the other hand, equations (2.3) and (2.4) imply that the parents' marginal utility from children's leisure must be equal to their marginal valuation of children's time in alternative uses such as income generation that augments parental full income.

The reduced-form demand equations for schooling and health of children are given by:

(4) $$S^*, H^* = D^i(P_M, P_Z, I, \pi, \alpha, \gamma, \sigma, \Gamma_m, \Gamma_f), \quad i=S, H$$

The explanatory variables in the schooling and health outcomes equation are prices, household income, parental preferences, current opportunity cost of children's time in schooling, health and school environment and productive potential which is considered exogenous to the parents' investment decisions.

Substituting (4) into (1.4), we derive the optimal earnings function for children:

(5) $$R^* = R(S^*; H^*, \sigma)$$

Equation (5) states that improved market opportunities have both a direct and indirect effect on children's expected earnings. An improvement in productive potential increases the demand for human capital, which in turn increases the returns to schooling and hence affects both the schooling and health status of children. Similarly, an improvement in the health environment also improves children's schooling and expected earnings via the direct impact on schooling and indirect impact on the efficiency of time use in schooling production. For similar reasons, changes in school access and quality that affect school outcomes may also affect returns to schooling and hence the demand for human capital.

The causal impact of many policy variables are a priori difficult to quantify due to their complex interactions with household decision-making and observed behavior. An empirical implementation of this theoretical framework can, however,shed light on the magnitudes and significance of the effects of supply- and demand-side factors. We will estimate the reduced-form schooling outcomes equation (4) that incorporates the impact of all variables considered exogenous to household decision-making, including market opportunities that influence returns to education. The earnings equation (5) is also estimated in order to calculate the return to education for men and women. Assuming that these estimates are the expected returns to children's schooling, they are then evaluated in terms of community and school quality as well as children's school achievements. This exercise will help identify the policy matrix that the government could pursue in order to promote schooling among children, especially in rural areas.

V. The Results

As section III suggests, the problems that Morocco faces in terms of schooling outcomes are far more critical in rural areas. Therefore, the empirical implementation of the model in section IV is carried out only for rural Morocco.[11] A total sample of 3652 children aged 7-20, equally divided between boys and girls, is used to estimate the model (table 11). The school participation rate among these children is 48 percent; they have attained an average of 3 years of education. The household demand for schooling is influenced by household income. However, since household income is endogenous, we use the value of land and farm assets as instruments. Since these variables are highly correlated with household income in a rural setting, they should capture the impact of household income on schooling outcomes. Parents' education may influence preferences and hence may affect the technology of schooling production as an input. Male heads of households have an average of two years of education while the female spouse has an average of one. The local demand for educational skills is proxied by the extent of electrification, irrigation and new improved crop varieties at the community level. About 16 percent of rural communities under study have electricity, 42 percent have some irrigated land and 35 percent grow new varieties of crops. These variables measure rural productive potentials and hence determine the impact of returns to education on the demand for human capital. The local health conditions are measured by the sources of water from pipelines and wells as opposed to rivers and ponds. Only 11 percent of these rural households have access to tap water, while 50 percent use well water.

The access to a school is measured by the presence of a school and a paved road; it is also measured by how many months of the year the road is passable. Some 56 percent of the communities have a primary school, while only 3 percent have a secondary school. Only 3 percent of the communities have access to a paved road. The roads are blocked due to bad weather and other conditions an average

[11] Another reason for selecting rural areas for analysis is that community- and school-level variables were collected only from rural areas.

of one month a year. The school quality variables included in the regression include the highest grade in a primary school (grade 5), the proportion of female teachers (18 percent) and the mean education level of teachers (9 years). Although data on other indicators is available (see table 11), they are correlated with each other and often correlated with community characteristics (for example, a wealthier community has a better quality school). Therefore, an aggregate measure of school quality is desirable and was estimated. This is a latent school quality indicator which was estimated using the fixed-effects method. The math scores of children who ever attend a particular community school were regressed against primary school dummies, among others.[12] The fixed-effects coefficients of school dummies are then treated as latent school quality variables in the schooling outcomes regression.

Since community characteristics may influence school quality, three alternative models were specified and estimated: Model I includes, among others, community-level variables, such as pure school access variables, but no school quality variables; models II and III use the alternative measure of school quality along with community characteristics. Table 12 presents the probit regression of school enrollment by gender. Table 13 presents the Cox regression of school attainment (measured by last class attended) that takes into account right-hand censoring. Right-hand censoring is relevant since the highest grade attained is not observed for currently enrolled children. The school attainment regression measures the probability of failure or drop-out at each grade. Thus, the negative coefficient of an explanatory variable means that it tends to reduce the probability of failure or drop-out and hence increase school attainment.

Irrespective of model specification, the sex-composition of a family does not influence the school enrollment rate of either boys or girls, but does influence a girl's school attainment. A 10 percent increase in the proportion of male members in the family increases the probability of a girl dropping out of school by 20 percent. This may indicate that male children get priority in schooling over female children. A male head's education affects both boys' and girls' school participation. A female spouse's education, on the other hand, influences only the girl's school enrollment. However, the female's education rather than the male's is more important for a girl's school enrollment. A 10 percent increase in female education increases the probability of a girl's school enrollment by 3 percent, while a similar percentage increase in the male's education increases a girl's participation by only half of one percent. Although the male's education does not affect a girl's school attainment, it decreases the probability of a boy's dropping out of school and hence increases his school attainment. For example, a 10 percent increase in the male's education increases the probability of a boy's school enrollment by 1 percent and reduces the probability of his dropping out by 7 percent. Note that female education only influences a girl's enrollment but not her attainment.

Land ownership increases the probability of a girl's school participation, while the value of farm assets increases it for a boy. However, none of these household income-proxy variables have any impact on the school attainment of any gender.

The presence of a paved road increases a girl's probability of ever attending a school by 40 percent and reduces the probability of dropping out by 5 percent. Improved road conditions increase the probability of school participation of both boys and girls by 20 and 32 percent, respectively. An improved road reduces a boy's probability of dropping out by 36 percent.

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[12] The estimates are not shown here. The reason for using math rather than Arabic scores is that schooling has a greater influence on math skills.

The presence of a primary school in a community increases the probability of a boy's school attendance by 28 percent. Surprisingly, the school's presence does not influence a girl's school participation or the schooling attainment of either gender, once children are enrolled in school. Rural electrification increases the school attendance of both boys and girls, but its impact is more pronounced (by about 30 percent) for girls than for boys. Access to tap water and well water relative to pond or river water improves the school enrollment of both boys and girls quite substantially and, similarly to electrification, its impact is much larger for girls than for boys. Given school participation, sources of clean water do not affect girls' school attainments but do increase that of boys.

Investments in irrigation and advanced technology such as new varieties of crops increase the school attendance of boys, but not that of girls. This may suggest that boys are more often employed in farming than girls and hence benefit more from these investments.

Boy's enrollment increases with the number of grades offered in primary school. The proportion of female primary teachers is negatively correlated with the school attainment of boys.[13] Teachers' years of education is positively correlated with the school attainment of girls. The effects of a more aggregate measure of (latent) school quality confirm that school quality increases the school attainments of both boys and girls and the school enrollment of boys.

An F-test is conducted for the joint significance of supply-side and demand-side variables. Table 15 presents the results for models I and III.[14] The test suggests that the school access variables such as the presence of different types of schools and a paved road as well as road conditions influence the school participation of both boys and girls and the school attainment of boys. Unobserved school quality makes its largest impact on the school attainment of boys and girls. Even when controlling for their role in latent school quality, the demand-side factors (electrification, irrigation, new crop varieties, tap and well water) influence the school participation of both boys and girls although not to the extent they influence school attainment, given that children are already enrolled in school. Nevertheless, the findings suggest that once children are enrolled in school, it is school quality that most significantly influences their school attainments.

Since (latent) school quality is found to increase both school attainment and participation, it is important for policy formulation to relate latent school quality to observed school and community characteristics.[15] Table 16 shows the distribution of community and school characteristics in the highest and lowest similarly of the distribution of latent school quality. The table clearly shows that there are substantial differences in the attributes of a high quality school community with those of a low quality school community. In particular, a low quality school community has a lower percentage of paved roads and higher incidence of blocked roads. It also has a lower percentage of electrification, irrigation and availability of clean water. The community has fewer schools with a complete primary cycle, fewer

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[13] This may reflect some quality of female primary teachers which is unobserved. In fact, as table 11 suggests, female teachers are less trained than their male counterparts and fewer of them have capes.

[14] An F-test for the joint significance of three school quality variables (according to model II) showed no significance.

[15] The fixed-effects coefficients of the math test (latent school quality) is regressed on observed primary school and community characteristics (estimates are not shown here). This shows, for example, that better roads and irrigation and the presence of a more complete primary cycle significantly improve the quality of a school. However, due to the small sample (less than 100), we cannot precisely estimate these relationships.

primary schools in general and no secondary school. A low quality school also means teachers with less years of education, especially males, but a higher proportion of trained female teachers.[16] Thus, the school system in rural Morocco suffers not only from poor access, but also poor quality.

Because demand-side variables influence the school participation of rural children and since school participation is a serious problem in rural Morocco, these findings have implications for government investment policy. As noted earlier, the demand-side factors influence schooling outcomes through their effect on the marginal productivity of education and hence on the returns to education. Thus, we will now examine the returns to education and how they correlate with observed community and school characteristics.

The rates of return to education depend on how labor markets reward the educated labor force. Table 17 presents the estimates of rates of return to various levels of schooling by gender and region. A semi-log wage regression with correction for the wage-labor market participation decision is estimated for salaried workers above the age of 20.[17] The average rate of return to a year of education in Morocco is 11 percent. The returns to a year of education at the primary, secondary 1 and secondary 2 levels of schooling are 6, 13 and 22 percent, respectively. The return to education is higher for men than for women at all levels except the secondary 1 level. Returns to education at all levels are higher in urban than in rural areas since there are more opportunities in urban areas. For example, the returns to primary and higher secondary education are almost zero in rural areas as compared to 9 and 23 percent, respectively, in urban areas. There also exist sharp regional differences in rates of return to education in Morocco. On average, the rate of return to education is lowest in the South (9 percent) and highest in the Center-North region (14 percent).

The returns to education are again estimated at the community level (not shown). The highest and lowest similarly of community-level rates of return to education are then compared with the distribution of observed community and school characteristics (table 18). In particular, this table confirms that a community with low rates of return to education is characterized by fewer paved roads and primary schools and the absence of electricity, clean water and a secondary school. A low return community has a primary school that is relatively new, and has a higher proportion of trained female teachers and teachers with more years of education.[18] Consequently, the low return area is also characterized by low school enrollment and attainment among children aged 7-20.

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[16] The presence of more trained female teachers, relatively older schools and lower average class size in a low quality school requires further investigation. We were informed that female recruitment is a recent phenomenon in Morocco's school system. Female teachers are young and better trained and are located in rural areas. This explains why we see more trained female teachers in a low quality school community. Because they are relatively new recruits, their impact has not yet been felt in improving school quality. However, the quality of relatively older schools has been improved. On the other hand, it is likely that a low quality school is located in a remote area where the population is smaller, resulting in lower student-teacher ratios in low quality schools. Moreover, better quality schools attract more students.

[17] The estimates are not shown here. A multinomial logit function is first estimated with a choice of whether to work, whether to be self-employed and whether to work for a wage. The instruments for identifying the wage decision from the participation decision are various categories of household assets and unearned income. The estimates are then used to calculate the participation bias factor--lambda--which is then used in the log-wage regression.

[18] Perhaps this suggests that educational resources are not effectively utilized in rural areas. It also confirms our earlier conjecture that young teachers (male and female) with higher education are being placed in rural areas, but that they have not yet been effective in improving school outcomes.

VI. Policy Simulations

The results confirm that rural Morocco suffers from poor access to and low quality of schools, inefficient allocation of educational resources as well as underinvestment in physical infrastructure. Thus, improving access and school quality will help improve schooling outcomes. Similarly, investment in rural infrastructure will also improve opportunities for the productive employment of educated rural people. In the same way, improved efficiency in educational resource allocation will help improve both the quality of the school system and the education the students receive.

Based on the estimates of school participation and attainment, we performed policy simulations in order to suggest ways in which the government of Morocco could improve children's school performance, especially in rural areas. Table 19 presents three sets of policy simulations based on the three models estimated and presented in tables 13 and 14. The first set simulates the impact of ensuring that every community has a primary school, access to a paved road and so on. The overall enrollment rate in the sample is 0.49. This rate increases by more than 10 percent to 0.56 if all communities have access to a paved road. At the means of all variables (according to model I), 68 percent of boys and 29 percent of girls ever attend school. This percentage jumps to 71 for boys and 39 for girls if every community has access to a paved road. The proportionate gain from investment in paved roads is higher for girls than for boys. Similarly, boys would gain more than girls in school enrollment if every community had a primary or secondary school although the increase is not large. The gains are more significant for girls if every community had electricity and clean water. The enrollment rate of girls almost doubles, from 0.29 to 0.51, following a complete electrification of rural communities. The gain is almost as dramatic if running water becomes available to all. In contrast, the gains are larger for boys if every rural community has irrigation and new crop varieties. The gains are relatively larger for changes in demand-side policy variables than for changes in supply-side variables.

Repeating the same simulations with the school attainment regressions suggest that not all the policy changes that will induce higher enrollment rates will also lead to more schooling attainment. For example easier access (in terms of better roads or shorter distances) to primary schools induces higher enrollment rates, but does not induce children to remain in school longer. Conversely, access to a local middle school has a modest impact on school enrollment, but has a great effect on school attainment: it increases the mean schooling by almost 20 percent; more for boys (from 5.1 to 5.8 years) than for girls (from 4.9 to 5.4 years).

Another variable that has a large effect on attainment is school quality as measured by our latent school fixed effect variable. Raising the quality of rural schools to that of the best school in the sample leads to an increase of one full year of schooling completed. This gain does not vary by gender, being almost as high for girls as for boys. On the other hand, the effect of school quality on school enrollment is only evident for boys: the simulation in table 19 suggests that enrollment of boys would be up by more than 10 percent if the quality of all schools were equal to the top school in the sample.

Thus, the government could potentially raise attendance rates to 97 percent for boys and 82 percent for girls and increase years of schooling by 5 years for boys and 7 years for girls by increasing investment in rural Morocco.

Even with all possible policy interventions considered in this paper, we find that gender bias still persists, especially, in the school enrollment of rural Morocco. This is because, even if government policies are gender neutral, parents seem to direct private investment toward more for boys than for girls,

at least in enrolling boys and girls in a school. Parents may have different reasons for allocating resources in this fashion (see Herz and others, 1991 for details). However, our findings suggest that parents incur higher schooling costs for girls than for boys. As table 20 shows, parents in Morocco need to spend more for girls than for boys at each level of schooling. The figures are for the country-level average of schooling costs collected as part of household expenditure survey. Note, however, that rural parents spend less on girls education than on boys. In contrast, in urban areas where gender bias is substantially low, parents spend more on girls than on boys. Therefore, if there is no gender bias, girls are more costly to educate than boys. Therefore, if a family has both a boy and a girl and if the schooling costs are substantial relative to family income, parents may decide to send the boy rather than the girl to school. It follows that if social returns are high for female education, as many studies (e.g., Subbarao and Raney 1993) suggest, then the government may find it justified to subsidize female education.

VII. Conclusions

Unlike many developing countries which do not allocate sufficient resources to education due to budgetary constraints, Morocco spends about 7 percent of its GNP on education. Yet its educational attainments in terms of school enrollment and attainment are low compared to an average middle-income country or even an average low-income country. The problem is partly due to Morocco's inadequate resource allocation to education in rural areas and partly to an inefficient resource allocation to education. To tackle these problems, Morocco has invested in educational reforms in recent years that were geared to improve both the access to and quality of primary and middle schools, especially in rural areas. This report has examined whether this supply-oriented approach is adequate to improve school attainment in Morocco.

The report's premise is that both demand- and supply-side factors are critical to school attainment of Morocco. In other words, demand-side factors such as investment in rural infrastructure are as important as supply-side factors such as investment in school infrastructure. Given the household demand determined by parental education and income, the local market demand for skills generated through public investments in electrification, roads, irrigation and high-yielding varieties of crops, influences the demand for schooling. Public investment in the provision of pure drinking water influences schooling outcomes by improving the efficiency of families' resource allocation to education. Investment in safe drinking water supplies is especially important in rural areas, where lack of pure drinking water constitutes a health hazard and forces rural families to cut back resource allocation to education. This reduction in resources may disproportionately affect female children who are expected to care for sick members of the family. It is hypothesized, therefore, that investment in drinking water provision affects the school enrollment and attainment of girls to a greater extent than that of boys.

The importance of public investment derives from its influence on returns to education, school quality and efficiency in the resource allocation to education. Improved school quality in turn increases returns to education. Thus, returns to education are not fixed and investments directed at promoting the access to and quality of schools and the infrastructure jointly determine both the levels of school attainment and returns to education.

The descriptive analysis of MLSS data confirms that educational investment in Morocco is biased toward the wealthier urban population. Neither are educational outcomes gender-neutral, especially in rural areas. The school enrollment rate for the upper income group is almost twice that of the low income group. Urban children and rural boys consistently outperform their respective rural and female

counterparts in both school attendance and attainment. The school attendance rate is 90 percent in urban areas compared to only 48 percent in rural areas. The rate is 64 percent for rural boys compared to 32 percent for rural girls. Among primary school students the completion rate is 60 percent for rural children compared to 87 percent for urban children. In contrast, the rate is 56 percent for rural girls compared to 63 percent for rural boys. Rural boys and urban girls outperform rural girls in math and other cognitive tests. The performance of rural girls in cognitive achievements, however, improves significantly as their educational attainment increases.

Insufficient investment in education and its effect on the gender gap is thus more pronounced in rural than in urban areas. In terms of supply-side factors, we find that the presence of a school or a paved road plays an important role. For example, only 56 percent of rural boys and 24 percent of rural girls ever attend school if there is no primary school in the community. The school attendance rate increases to 72 percent for boys and 37 percent for girls if there is a primary school in the community. Similarly, 56 percent of rural boys and 44 percent of rural girls go beyond primary school when there is no secondary school in the community. In contrast, this rate increases to 83 percent for boys and 75 percent for girls if there is a secondary school in the community. The presence of a paved road increases school participation for both boys and girls. When there is no paved road in a community, the school attendance rate is 21 percent for rural girls and 58 percent for rural boys. In contrast, the rate increases to 48 percent for rural girls and 76 percent for rural boys if there is a paved road in the community.

The presence of a secondary school or paved road also decreases the drop-out rate and thus increases school attainment for both boys and girls. However, the survival rate is lower for girls than for boys. This finding suggests that public investment in additional secondary schools or roads in rural areas may help reduce overall rural-urban differences in school attainment but not necessarily gender differences in schooling outcomes. However, the major gender difference in rural Morocco is in school enrollment where the rate for girls is only half that for boys. Evidently, when girls do enroll in school, they perform well and, as a result, school attainment hardly varies by gender.

Our econometric analysis suggests that poor access to and quality of schools as well as inefficient resource allocation are important factors in the rural-urban and gender differences in school outcomes. The results also indicate that public investment in roads, irrigation, new varieties of crops and water supply improve schooling outcomes. This is because public investment increases the return to education as well as improving school access and quality and hence school attendance and attainment. The benefits of these public investments are, however, not gender-neutral. For example, investment in roads, electrification and safe drinking water improve girls' outcomes more than boys', while the opposite is true for investment in irrigation and new crop varieties. Since public investment is gender-neutral, parents seem to bias private investment toward male children. The Moroccan family clearly displays a preference for the education of boys over girls. The more education the father has, the more the boy will receive; the more education the mother has, the more the girl will receive. Overall the presence of an additional male member in the family reduces the education girls receive.

The findings call for more government effort to improve efficiency in resource allocation to education. They also call for more public investment in rural education and infrastructure that are required to improve overall educational attainments. Government has an important role to play in influencing parental investment in education. Although building more higher quality schools in rural areas will help promote schooling outcomes, this is not sufficient. Public investment in roads, electricity, irrigation, new high-yielding crop varieties and pure drinking water supplies are the types of investment in rural infrastructure that clearly increase the demand for education. However, as our findings suggest,

public investments do not necessarily reduce the gender bias in school enrolment; parents seem to bias private investment toward boys rather than girls. In such a case, if, as different studies show, the social returns to female education are high then the government of Morocco may introduce stipend for girls to offset parental bias against female education. The Bank-financed female scholarship project in Bangladesh shows how the government can help improve female education in a country that strongly favors boys over girls.

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STATISTICAL APPENDIX

Table 1: Major Indicators of Economic and Social Development in Morocco, 1990

Indicators countries	Morocco	Average for lower middle income countries	Average for low income
Per capita income	US$ 950	US$ 1,530	$ 360
Life expectancy at birth (years)	62	65	63
Population growth rate	2.6	2.2	2.0
Total fertility rate	4.5	4.0	3.8
Infant mortality rate (per 1000 live births)	67	51	69
Adult literacy rate (percent)	49	75	60
Adult female literacy (percent)	38	68	48
Primary school enrollment (net)	55	86	68
Female enrollment as percentage of male primary (gross) enrollment	65	89	78
Secondary school (gross) enrollment	36	54	36
Female enrollment as percentage of male secondary (gross) enrollment	68	109	64

Source: World Development Report, 1992
Note: The school enrollment figures are for 1989.

Table 2
Population Breakdown in LSMS Sample (Children 7-20)

	Rural		Urban		
Regions	Male	Female	Male	Female	Total
South	236	279	191	187	893
	26.43	31.24	21.39	20.94	100.00
Tensift	284	295	177	215	971
	29.25	30.38	18.23	22.14	100.00
Center 1	298	296	155	170	919
	32.43	32.21	16.87	18.50	100.00
North-West	250	274	242	232	998
	25.05	27.45	24.25	23.25	100.00
Central-North	317	300	205	223	1045
	30.33	28.71	19.62	21.34	100.00
Oriental	284	276	251	224	1035
	27.44	26.67	24.25	21.64	100.00
Central-South	285	258	199	198	940
	30.32	27.45	21.17	21.06	100.00
All Regions	1954	1978	1420	1449	6801
	28.73	29.08	20.88	21.31	100.00

Table 3
Proportion Ever Went to School (Children Ages 7-20)

	Rural		Urban		
Regions	Male	Female	Male	Female	Total
South	167 70.76	70 25.09	180 94.24	156 83.42	573 64.17
Tensift	142 50.00	84 28.47	164 92.66	183 85.12	573 59.01
Center	201 67.45	92 31.08	152 98.06	148 87.06	593 64.53
North-West	163 65.20	99 36.13	226 93.39	195 84.05	683 68.44
Central-North	186 58.68	69 23.00	199 97.07	183 82.06	637 60.96
Oriental	187 65.85	122 44.20	235 93.63	202 90.18	746 72.08
Central-South	212 74.39	97 37.60	192 96.48	176 88.89	677 72.02
Ever attended all regions	1258 64.38	633 32.00	1348 94.93	1243 85.78	4482 65.90
Never Attended	696 35.62	1345 68.00	72 5.07	206 14.22	2319 34.10
TOTAL	1954 100.00	1978 100.00	1429 100.00	1449 100.00	6801 100.00

Table 4
Mean Last Grade Attended For Those Who Ever Went to School

Variable	Rural Male		Rural Female		Urban Male		Urban Female	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
South	5.62	(2.85)	4.71	(2.29)	7.08	(3.49)	6.28	(3.0)
Tensift	5.38	(2.77)	5.61	(2.76)	6.65	(3.34)	7.16	(3.3)
Center	5.57	(2.52)	5.41	(2.65)	7.13	(3.35)	6.66	(3.5)
North-West	5.09	(2.45)	4.83	(2.33)	7.27	(3.58)	7.38	(3.8)
Central-North	5.62	(2.66)	5.13	(2.91)	7.26	(3.58)	7.30	(3.6)
Oriental	5.70	(2.49)	4.89	(2.23)	7.29	(3.63)	6.57	(3.5)
Central-South	5.04	(2.18)	4.03	(1.64)	7.15	(3.36)	7.27	(3.5)
All Regions	5.43	(2.56)	4.93	(2.44)	7.14	(3.49)	6.96	(3.53)

Table 5
Profile of School Experience of Moroccan Children at Different Levels

	Rural Boys		Rural Girls		Urban Boys		Urban Girls	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
	100		100		100		100	
Did not go to primary	36	36	68	68	5	5	14	14
Went to primary school	64	64	32	32	95	95	85	85
Did not complete primary	24	37	14	44	11	12	13	15
Completed primary school	40	63	18	56	84	88	72	85
Did not go to secondary 1	17	43	10	55	12	14	11	15
Went to secondary 1	23	57	8	45	72	86	61	85
Did not complete secondary 1	15	64	5	66	15	21	11	18
Completed secondary 1	8	36	3	34	57	79	50	82
Did not go to secondary 2	3	33	1	47	10	17	11	22
Went to secondary 2	5	67	2	53	47	83	39	78
Did not complete secondary 2	4	86	0	0	8	18	15	38
Completed secondary 2	1	14	2	100	39	82	24	62

Table 6a
Distribution of Children by Household Per Capita Expenditure Quintiles

	Rural		Urban			
Per Capita expenditure Quintiles	Male	Female	Male	Female	Total Percent	Observations
Quint 1	50.20	49.39	17.89	18.63	36.49	2482
Quint 2	27.89	27.45	26.13	24.22	26.61	1810
Quint 3	14.07	15.32	27.96	27.88	20.28	1379
Quint 4	6.60	6.17	19.65	18.98	11.84	805
Quint 5	1.24	1.67	8.37	10.28	4.78	325
TOTAL (Percent)	100.00	100.00	100.00	100.00	100.00	
No. of observation	1954	1978	1420	1449		6801

Table 6b
Distribution of Children Ever Been to School
by Expenditure Quintiles

	Rural		Urban		
All Regions	Male	Female	Male	Female	Total
Quint 1	981	977	254	270	2482
	59.33	24.67	88.58	81.85	51.13
Quint 2	545	543	371	351	1801
	66.97	36.65	93.53	88.87	67.57
Quint 3	275	303	397	404	1379
	71.63	42.57	97.22	88.61	77.59
Quint 4	129	122	279	275	805
	75.97	40.16	97.13	88.36	82.11
Quint 5	24	33	119	149	325
	66.67	45.45	100	73.15	79.69

Table 7
Distribution of Children by Presence of a School

Presence of a School	Rural Male	Rural Female	Total
A. Presence of a primary school			
No	818 (45.3)	782 (42.4)	1600 (43.8)
Yes	988 (54.7)	1064 (57.6)	2052 (56.2)
B. Presence of a secondary school			
No	1752 (97.0)	1787 (96.8)	3539 (96.9)
Yes	54 (3.0)	59 (3.2)	113 (3.1)
Total number of children	1806 (100.0)	1846 (100.0)	3652 (100.0)

Note: Percentages are in parentheses.

Table 8
Percentage of Children Ever Attend School by Presence of a School

	Ever Attended a School		
Presence of a School	Rural Male	Rural Female	Total
A. Presence of a primary school			
No	56.1 (818)	24.3 (782)	40.6 (1600)
Yes	71.9 (988)	36.7 (1064)	53.6 (2052)
Total	64.7 (1806)	31.4 (1846)	47.9 (3652)
B. Presence of a secondary school	Ever Went Beyond Primary School		
No	55.8 (344)	43.9 9157)	52.1 (501)
Yes	83.3 (18)	75.0 (8)	80.8 (26)
Total	57.2 (362)	46.5 (165)	53.5 (527)

Note: Percentages are in parentheses

Table 9
Mean Grade Attained by Presence of a School

Presence of a School	Mean Grade Attained by Presence of a School								
	Rural Male			Rural Female			Total		
	Obs.	Mean	(S.D.)	Obs.	Mean	(S.D.)	Obs.	Mean	(S.D.)
A. Primary school									
No	454	5.14	(2.39)	190	5.00	(2.57)	644	5.10	(2.45)
Yes	676	5.54	(2.61)	367	4.89	(2.34)	1093	5.31	(2.53)
Total	1130	5.38	(2.53)	557	4.93	(2.42)	1687	5.23	(2.50)
Presence of primary school but no secondary school	Mean grade attained by those who went to beyond primary school								
No	5	6.40	(3.05)	0	0	0	5	6.40	(3.05)
Yes	34	6.65	(3.06)	23	5.78	(3.44)	57	6.30	(3.22)
Total	39	6.62	(3.02)	23	5.78	(3.44)	62	6.31	(3.18)
Presence of a secondary school									
No	255	9.13	(1.78)	93	9.11	(1.89)	348	9.12	(1.80)
Yes	19	9.21	(1.62)	6	11.17	(0.41)	25	9.68	(1.65)
Total	274	9.14	(1.76)	99	9.23	(1.89)	373	9.16	(1.80)

Table 10
School Performances of Children by Whether Paved Road is Accessible to Community

Paved road to the community	Ever been in school		
	Rural Male	Rural Female	Total
No	58.27 (1136)	21.25 (1157)	39.64 (2293)
Yes	75.67 (670)	48.33 (689)	61.81 (1359)
Total	64.73 (1806)	31.42 (1846)	47.89 (3652)
		Mean grade attained	
No	58.27 (662)	21.35 (247)	39.64 (909)
Yes	5.59 (507)	5.18 (333)	5.43 (840)
Total	5.42 (1169)	4.96 (580)	5.27 (1749)

Note: Number of observations are in parentheses.

Table 11
Mean School Characteristics

Characteristics	Observation	Mean	Standard Deviation
Distance to primary school (Km)	240	0.05	0.29
Mode of transport to primary school (= 1 if foot)	240	0.42	0.49
Time spent to go to school	240	49.10	70.59
Type of school (1 = mother, 0 = satellite)	240	0.71	1.73
Age of primary school	218	24.05	17.97
Is primary school co-educated?	240	0.71	0.46
Books bought by students from primary school	240	0.77	0.42
Books bought from primary school	240	0.03	0.17
Books free from primary school	240	0.01	0.11
Highest class offered in primary school	218	5.27	1.44
Do all children get in if applied	218	0.89	0.31
Proportion of female teacher in primary school	218	0.19	0.22
Proportion of female primary teachers with *capes*	240	0.56	0.49
Proportion of male primary teachers with *capes*	240	0.93	0.23
Proportion of all teachers with *capes*	240	0.93	0.20
Proportion of male teachers with training	214	0.87	0.23
Proportion of female teachers with training	214	0.51	0.49
Mean education of primary teachers	216	9.37	4.25
Average size of classes in primary school	218	20.72	8.91
Failure rate in primary school	215	0.13	0.07
Proportion of primary students who completed last class	196	0.14	0.07
Proportion of students who completed last class of primary go to secondary level	177	0.67	0.36

Table 12
Descriptive Statistics
(Sample of children aged 7 - 20)

Variable	No. of observations	Mean	Standard Deviation
Proportion of female children	3652	.495	.500
School participation	3652	.479	.499
School attainment	3652	2.922	2.621
Age of the child	3652	13.091	3.907
Proportion of male members in the household	3652	.487	.160
Education (in years) of the head	3652	1.514	2.040
Education (in years) of the spouse	3188	1.092	.713
Land under cultivation	3652	5.188	22.275
Value of farm assets x 1000	3652	2.091	10.900
South	3652	.135	.342
Tensift	3652	.152	.359
Center 1	3652	.158	.365
North-West	3652	.124	.330
Central-North	3652	.153	.360
Oriental	3652	.142	.349
Central-South	3652	.136	.343
Paved road in the community	3652	.372	.483
No. of months road is blocked	3652	.096	.473
Is there any *m^sid* or Koranic school	3652	.789	.408
Is there any primary school?	3652	.562	.496
Is there any secondary school?	3652	.031	.173
Is there electricity?	3644	.163	.370
Source of drinking water - pipe?	3652	.108	.310
Source of drinking water - well?	3652	.494	.500
Some land is irrigated?	3490	.423	.494
New crops in the past 10 years?	3565	.347	.476
Highest class in community primary school	2615	5.309	1.352
Proportion of female teachers	2615	.182	.207
Mean years of education of teachers	2610	9.093	4.224

Table 13
Determinants of School Participation of Rural Children in Morocco

Explanatory Variables	Model I		Model II		Model III	
	Boys	Girls	Boys	Girls	Boys	Girls
Proportion of male members	-0.093	-0.428	-0.069	-0.379	-0.225	-0.049
	(0.352)	(1.577)	(0.223)	(1.212)	(0.677)	(0.149)
Education (in years) of the male head	.078	.048	.065	.052	.084	.037
	(3.582)	(2.546)	(2.559)	(2.465)	(2.977)	(1.701)
Education (in years) of the female spouse	.054	.297	.101	.284	.135	.306
	(0.731)	(4.623)	(0.995)	(3.726)	(1.258)	(4.087)
Land under cultivation	.001	.003	.002	.002	.002	.003
	(0.373)	(1.952)	(1.084)	(0.616)	(1.099)	(1.946)
Value of farm assets x 1000	.006	.002	.005	.002	.017	.005
	(1.989)	(0.651)	(1.261)	(0.536)	(2.389)	(1.098)
Paved road in the community	.134	.444	.032	.407	.020	.351
	(1.542)	(4.971)	(0.308)	(3.831)	(0.174)	(3.026)
No. of months road is blocked	-0.168	-0.340	-0.227	-0.301	-0.198	-0.327
	(2.137)	(3.330)	(1.946)	(2.009)	(1.781)	(2.193)
Is there any *m^sid* or Koranic school?	.029	-0.070	.092	-0.028	.241	.099
	(0.326)	(0.753)	(0.816)	(0.247)	(2.078)	(0.815)
Is there any primary school?	.284	.006	.106	-0.185	.191	.054
	(3.734)	(0.076)	(0.977)	(1.583)	(1.790)	(0.467)
Is there any secondary school?	.211	.007	.621	.200	.312	.165
	(0.894)	(0.032)	(1.974)	(0.699)	(1.024)	(0.619)
Is there electricity?	.453	.698	.494	.701	.480	.824
	(3.664)	(6.340)	(3.522)	(5.475)	(2.739)	(5.388)
Source of drinking water - pipe?	.414	.555	.365	.607	.393	.418
	(2.163)	(3.500)	(1.652)	(3.242)	(1.647)	(2.140)
Source of drinking water - well	.078	.443	.048	.528	.010	.445
	(1.013)	(5.137)	(0.479)	(4.904)	(0.090)	(3.813)
Some land is irrigated?	.181	.047	.154	.034	.337	.183
	(2.276)	(0.556)	(1.511)	(0.325)	(3.172)	(1.742)

.../

Table 13 (continued)

Explanatory Variables	Model I		Model II		Model III	
	Boys	Girls	Boys	Girls	Boys	Girls
New crops in the past 10 years?	.325 (3.154)	.085 (0.844)	.237 (1.940)	.069 (0.594)	.101 (0.771)	-0.045 (0.361)
Highest class in primary school			.074 (2.075)	-0.024 (0.645)		
Proportion of female teachers			.104 (0.450)	.067 (0.282)		
Mean education (years) of teachers			-0.001 (0.077)	-0.011 (0.501)		
Latent school quality					0.025 (2.101)	-0.005 (0.426)
Chi-square	184.94	335.03	131.60	235.38	154.71	238.07
Number of observations	1490	1517	1089	1094	969	963

Note: t-statistics are in parentheses.

Table 14
Determinants of School Attainment of Rural Children in Morocco

	Model I		Model II		Model III	
	Boys	Girls	Boys	Girls	Boys	Girls
Proportion of male members	.602	1.183	.623	1.264	.571	2.004
	(1.428)	(2.175)	(1.288)	(1.913)	(1.175)	(2.916)
Education (in years) of the male head	-0.735	-0.018	-0.065	-0.030	-0.071	-0.040
	(2.303)	(0.536)	(1.817)	(0.713)	(1.898)	(0.985)
Education (in years) of the female spouse	-0.031	-0.006	-0.053	-0.022	-0.021	.030
	(0.353)	(0.091)	(0.511)	(0.263)	(0.222)	(0.412)
Land under cultivation	-0.001	-0.001	-0.001	.001	-0.001	-0.002
	(0.437)	(0.426)	(0.155)	(0.197)	(0.379)	(0.839)
Value of farm assets x 1000	.005	.008	-0.009	-0.000	-0.004	.004
	(0.987)	(0.118)	(1.380)	(1.079)	(0.825)	(0.506)
Paved road in the community	-0.089	-0.178	-0.147	-0.480	.168	-0.149
	(0.691)	(0.968)	(0.964)	(2.031)	(1.005)	(0.574)
No. of months road is blocked	.432	-0.199	.313	-11.676	-0.365	-0.343
	(3.919)	(0.543)	(1.835)	(0.000)	(2.357)	(0.858)
Is there any *m^sid* or Koranic school?	.122	.002	.125	.273	.230	.179
	(0.896)	(0.008)	(0.726)	(0.992)	(1.355)	(0.658)
Is there any primary school?	-0.148	-0.122	.089	.064	-0.172	.209
	(1.248)	(0.645)	(0.542)	(0.234)	(1.051)	(0.719)
Is there any secondary school?	-0.239	.146	-0.107	.655	-0.062	.373
	(0.664)	(0.318)	(0.256)	(1.036)	(0.163)	(0.742)
Is there electricity?	-0.234	.093	-0.093	.068	-0.121	.068
	(1.417)	(0.427)	(0.502)	(0.255)	(0.588)	(0.243)
Source of drinking water - pipe?	-0.280	.163	-0.719	.245	-0.639	-0.025
	(1.095)	(0.527)	(2.265)	(0.641)	(2.094)	(0.062)
Source of drinking water - well	-0.260	.036	-0.248	.209	-0.253	.026
	(2.105)	(0.178)	(1.570)	(0.840)	(1.656)	(0.101)
Some land is irrigated?	-0.079	-0.060	-0.057	-0.274	-0.047	-0.005
	(0.649)	(0.332)	(0.376)	(1.267)	(0.311)	(0.024)

..../

Table 14 (continued)

	Model I		Model II		Model III	
	Boys	Girls	Boys	Girls	Boys	Girls
New crops in the past 10 years?	.018 (0.125)	.180 (0.840)	.090 (0.525)	.138 (0.567)	-0.127 (0.683)	.111 (0.410)
Highest class in primary school			-0.025 (0.420)	.088 (0.991)		
Proportion of female teachers			.675 (1.972)	-0.313 (0.643)		
Mean education (years) of teachers			-0.019 (0.635)	-0.086 (1.722)		
Latent school quality					-0.097 (4.784)	-0.125 (4.425)
Chi-square	119.89	39.00	93.03	37.39	131.99	56.36
No. of observations	968	479	750	368	671	347

Note: t-statistics are in parentheses

Table 15
F-test for Joint Siginifcance of School Access, Quality
and Demand-Side Variables

Policy Variable	Model I		Model III	
	Male	Female	Male	Female
School access				
Participation	5.16	7.52	3.0	3.37
Attainment	3.76	0.42	2.04	0.47
School access + latent school quality				
Participation			4.26	2.82
Attainment			7.54	3.34
Demand-side factors				
Participation	8.17	18.60	5.65	12.68
Attainment	1.89	0.26	1.67	0.05

Note: School access includes the availability of paved road and different types of schools as well as road conditions, while the demand-side factors include electrification, irrigation, new crop varieties, piped and well water.

Table 16
Correlates of Latent School Quality

Selected community and school characteristics	Upper decile school quality	Lower decile school quality
Highest class	5.36 (1.50)	3.78 (2.11)
Proportion of female teachers	0.09 (0.13)	0.24 (0.21)
Mean years of teachers' education	9.79 (4.40)	9.37 (3.69)
Distance to primary school (km)	0	0.33 (0.71)
Is primary school co-educated?	0.87 (0.35)	0.67 (0.50)
Do all children get in if applied	0.93 (0.27)	0.78 (0.44)
Average size of the class in the primary school	23.07	14.92 (7.37)
Average student-teacher ratio	25.60 (8.97)	15.39 (7.08)
Failure rate in primary school	0.11 (0.05)	0.17 (0.12)
Proportion of female teachers with training	0.36 (0.49)	0.57 (0.53)
Proportion of male teachers with training	0.91 (0.23)	0.83 (0.22)
Proportion of female teachers with *capes*	0.47 (0.52)	0.67 (0.50)
Proportion of male teachers with *capes*	0.93 (0.26)	0.98 (0.07)
Age of primary school	22.79 (22.62)	27.89 (16.65)
Paved road	0.53 (0.52)	0.22 (0.41)
Road blocked in months	0	0.47 (1.06)
Primary school	0.60 (0.31)	0.40 (0.31)
Secondary school	0.06 (0.24)	0
Electricity	0.13 (0.35)	0.07 (0.26)
Water source - pipe	0.07 (0.26)	0
Some land irrigated	0.36 (0.49)	0.36 (0.50)
No. of observations	15	9

Note: Standard deviations are in parentheses.

Table 17

Estimates of Returns to Education by Gender and Location

	Regions							
	South	Tensift	Center	North-West	Center-North	Center-Oriental	South	Country
Primary								
All	0.04 (0.02)	0.07 (0.02)	0.09 (0.03)	0.06 (0.02)	0.11 (0.03)	0.01 (0.03)	0.06 (0.03)	0.06 (0.03)
Male	0.03 (0.02)	0.06 (0.03)	0.09 (0.03)	0.06 (0.03)	0.08 (0.03)	0.02 (0.03)	0.05 (0.03)	0.06 (0.03)
Female	0.07 (0.07)	0.09 (0.05)	0.04 (0.07)	0.08 (0.07)	0.20 (0.06)	-0.29 (0.11)	0.12 (0.07)	0.04 (0.07)
Rural	-0.01 (0.04)	0.03 (0.04)	0.03 (0.04)	-0.01 (0.04)	0.18 (0.05)	0.03 (0.04)	0.01 (0.04)	0.04 (0.04)
Urban	0.08 (0.03)	0.11 (0.03)	0.12 (0.03)	0.10 (0.03)	0.08 (0.03)	0.03 (0.04)	0.11 (0.04)	0.09 (0.03)
Secondary 1 level								
All	0.08 (0.05)	0.16 (0.05)	0.14 (0.05)	0.16 (0.05)	0.13 (0.05)	0.10 (0.06)	0.15 (0.05)	0.13 (0.05)
Male	0.08 (0.05)	0.11 (0.06)	0.11 (0.06)	0.13 (0.06)	0.09 (0.06)	0.05 (0.06)	0.15 (0.06)	0.10 (0.06)
Female	-0.03 (0.15)	0.21 (0.10)	0.11 (0.13)	0.13 (0.11)	0.20 (0.13)	0.61 (0.20)	0.05 (0.13)	0.18 (0.00)
Rural	0.13 (0.10)	0.00 (0.10)	0.21 (0.08)	0.11 (0.08)	-0.19 (0.20)	0.11 (0.09)	0.12 (0.14)	0.07 (0.00)
Urban	0.08 (0.06)	0.18 (0.06)	0.11 (0.07)	0.12 (0.07)	0.17 (0.07)	0.11 (0.08)	0.12 (0.07)	0.13 (0.07)
Secondary 2 level								
All	0.17 (0.08)	0.20 (0.08)	0.19 (0.08)	0.17 (0.08)	0.27 (0.08)	0.27 (0.09)	0.25 (0.09)	0.22 (0.08)
Male	0.13 (0.08)	0.24 (0.09)	0.14 (0.09)	0.16 (0.09)	0.30 (0.09)	0.30 (0.10)	0.22 (0.09)	0.21 (0.09)
Female	0.30 (0.22)	0.07 (0.15)	0.32 (0.19)	0.15 (0.14)	0.10 (0.17)	-0.13 (0.23)	0.37 (0.21)	0.17 (0.19)
Rural	0.09 (0.19)	0.01 (0.21)	-0.19 (0.17)	0.14 (0.16)	0.24 (0.28)	0.26 (0.20)	0.43 (0.24)	0.14 (0.21)
Urban	0.18 (0.09)	0.21 (0.10)	0.21 (0.11)	0.15 (0.11)	0.29 (0.10)	0.32 (0.13)	0.25 (0.12)	0.23 (0.11)
All schooling level	0.09 (0.008)	0.12 (0.007)	0.12 (0.007)	0.11 (0.007)	0.14 (0.008)	0.10 (0.009)	0.13 (0.009)	0.11 (0.003)

Note: Standard errors are in parentheses

Table 18
Correlates of Returns to Education
(At the Community Level)

Community and school characteristics	Upper decile of returns	Lower decile of returns
Highest class in primary cycle	5.45 (1.51)	5.75 (0.71)
Proportion of primary female teachers	0.28 (0.22)	0.30 (0.09)
Mean year of primary teachers' education	8.74 (4.39)	10.23 (3.89)
Do all children get in primary school if applied	0.82 (0.40)	0.63 (0.52)
Age of primary school	31.0 (16.0)	28.25 (19.24)
Proportion of female primary teachers with *capes*	0.71 (0.46)	0.98 (0.05)
Proportion of male primary teachers with *capes*	0.92 (0.25)	1.0 (0.)
Proportion of female teachers with training	0.82 (0.33)	0.98 (0.05)
Proportion of male teachers with training	0.93 (0.15)	0.87 (0.15)
Paved road	0.64 (0.50)	0.40 (0.52)
Presence of a primary school	0.73 (0.47)	0.20 (0.42)
Presence of a secondary school	0.09 (0.30)	0
Electricity	0.27 (0.47)	0
Piped water	0.18 (.040)	0
Some land irrigated	0.30 (0.48)	0.30 (0.48)
New crops	0.46 (0.52)	0.44 (0.53)
School participation rate	0.61 (.30)	0.41 (0.28)
School attainment	3.17 (1.69)	2.42 (0.95)
No. of observations	11	10

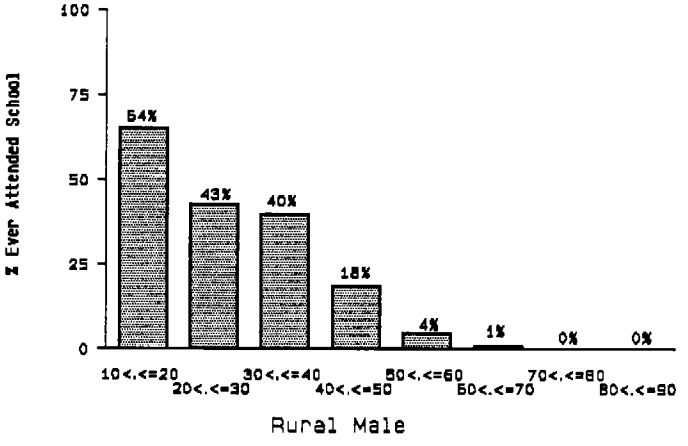
Note: Standard deviations are in parentheses.

Table 19
Improved School Performance for Changes in
Selected Policy Variables
(Simulation)

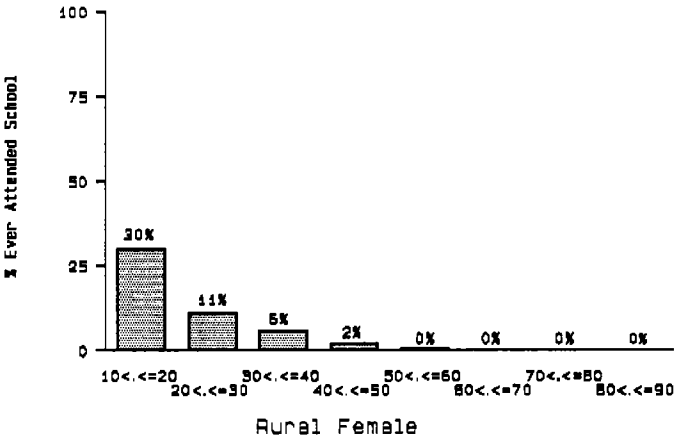
	Enrollment			School Attainment		
	Boys	Girls	All	Boys	Girls	All
At means of all variables (Model I)	0.68	0.29	0.49	5.15	4.94	5.08
Paved road for all communities	0.71	0.39	0.56	5.20	5.04	5.15
Roads are not blocked	0.68	0.30	0.50	5.20	4.91	5.12
Koranic school for all communities	0.68	0.28	0.48	5.14	4.94	5.06
Primary school for all communities	0.72	0.29	0.50	5.24	5.00	5.15
Secondary school for all communities	0.75	0.29	0.52	5.81	5.42	5.68
Electrification for all communities	0.80	0.51	0.66	5.53	4.77	5.19
Piped water for all communities	0.80	0.47	0.62	5.21	4.82	5.00
Well water for all communities	0.69	0.37	0.53	5.27	4.96	5.15
Irrigation for all communities	0.71	0.30	0.51	5.23	5.04	5.19
New crops made available for all communities	0.75	0.31	0.53	5.24	4.89	5.11
Changes in all except Koranic school and well water	0.97	0.82	0.89	6.58	5.33	6.03
Changes in all policy variables	0.97	0.87	0.91	6.70	5.35	6.08
At means of all variables (Model II)	0.71	0.29	0.52	5.17	4.87	5.08
All communities with 6-years primary school	0.72	0.29	0.52	5.23	4.90	5.12
For changes in all variables	0.99	0.90	0.95	6.56	4.98	5.93
At means with latent school quality (Model III)	0.71	0.33	0.52	5.20	5.04	5.14
With highest quality for all schools	0.79	0.31	0.58	6.16	5.91	6.08
Changes in all variables	0.99	0.89	0.94	7.49	6.09	6.86

Figure 1

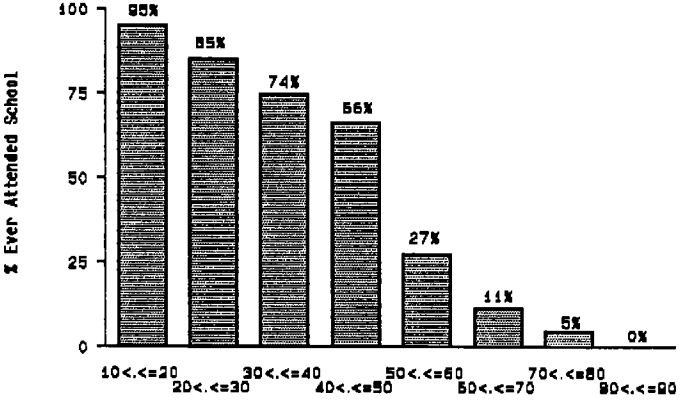
Percentage Ever Attended School



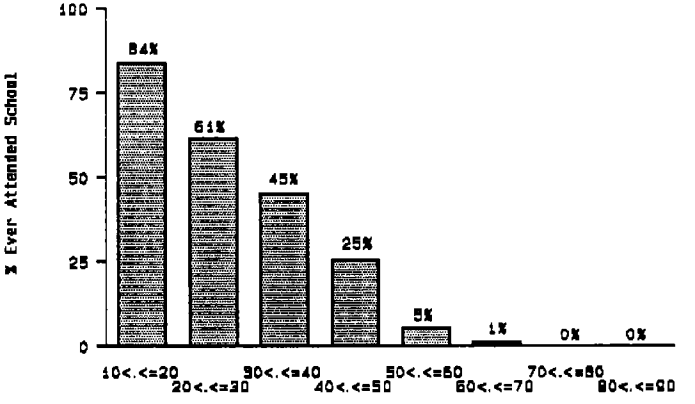
Rural Male



Rural Female



Urban Male



Urban Female

Figure 2

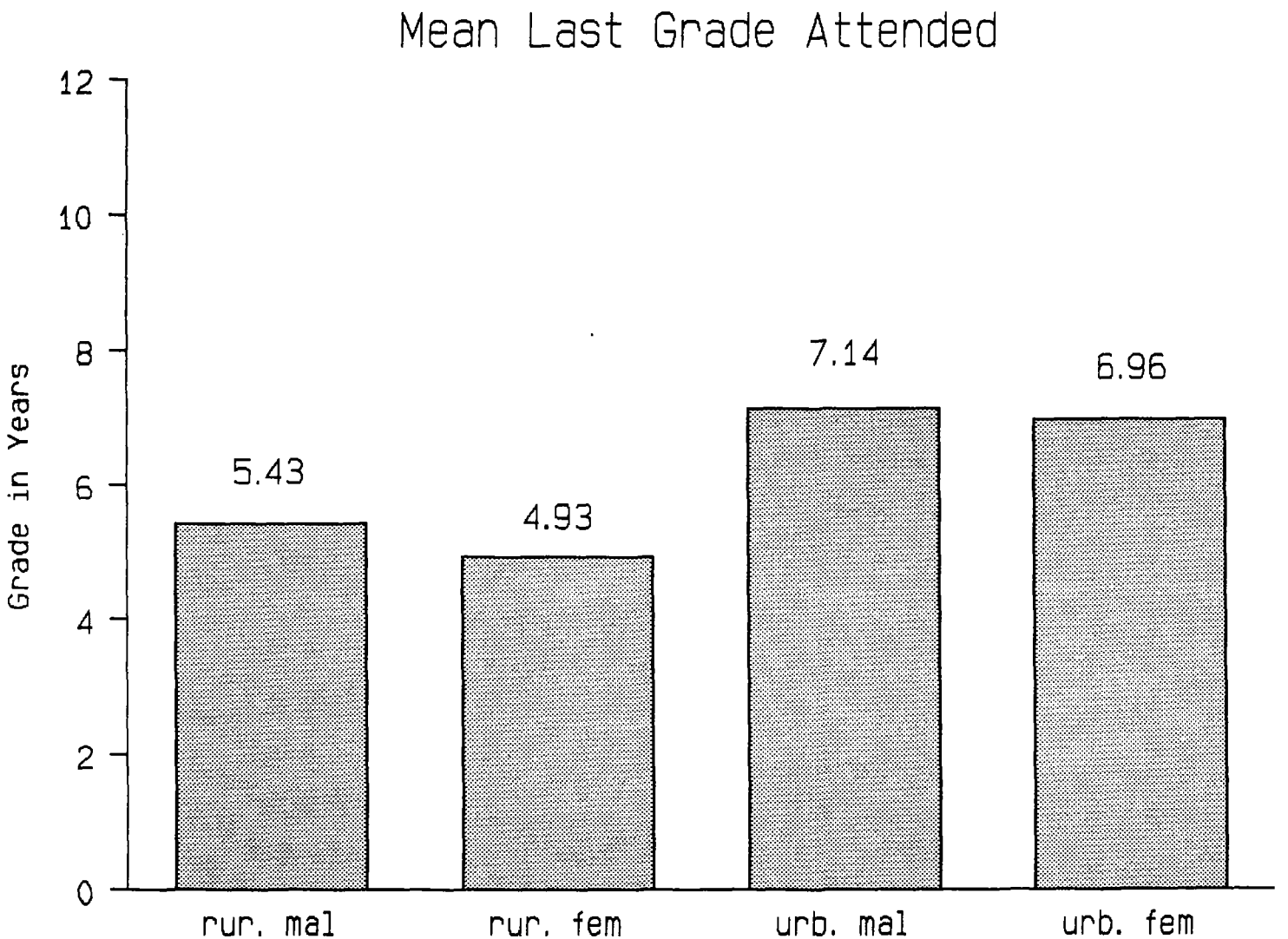

Mean Last Grade Attended
Grade in Years
12
10
8
6
4
2
0
5.43
4.93
7.14
6.96
rur. mal
rur. fem
urb. mal
urb. fem

Figure 3

Percent Still In School by Age

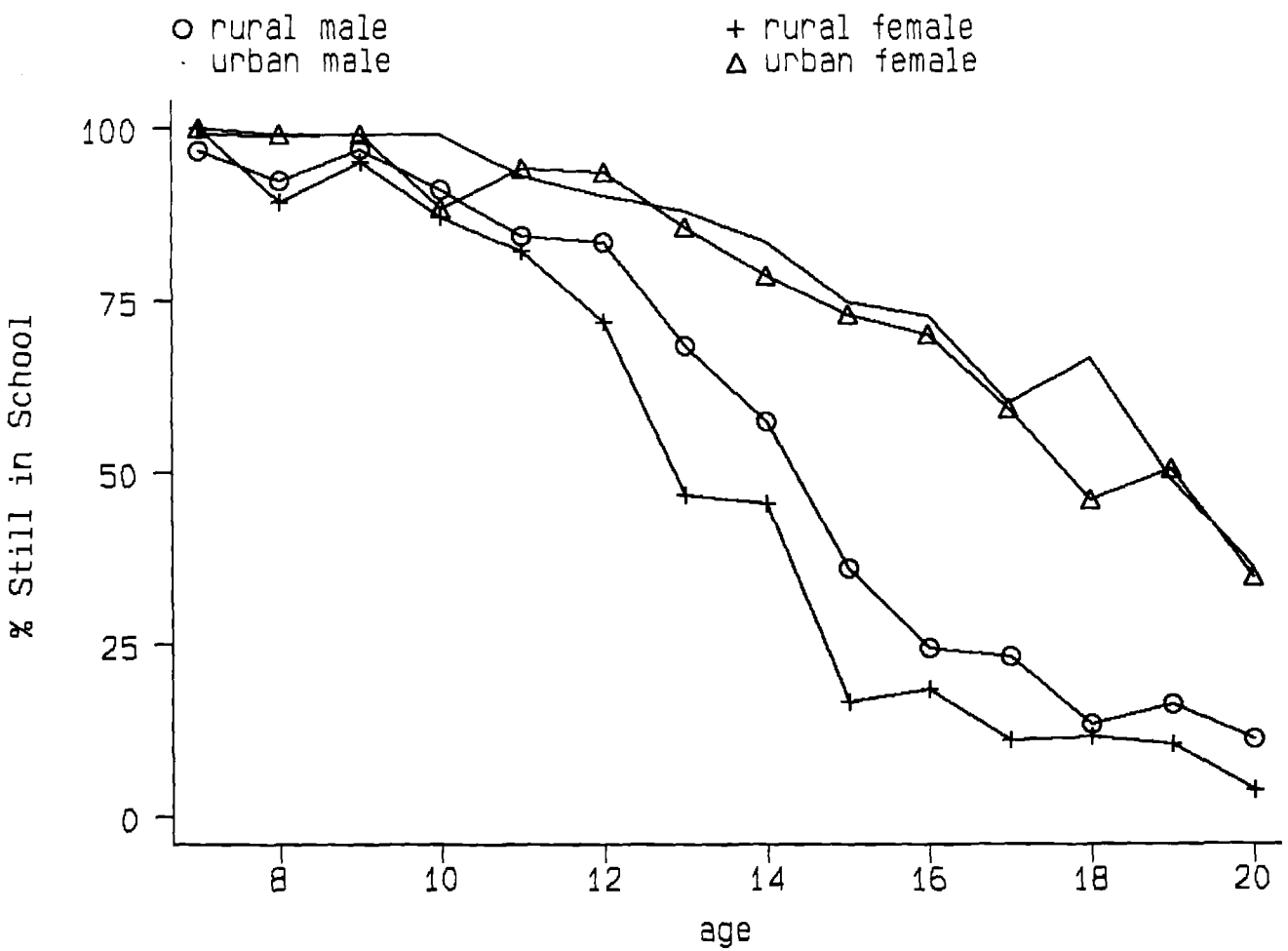


Figure 4a

Kaplan-Meier Survival Curves: All Regions

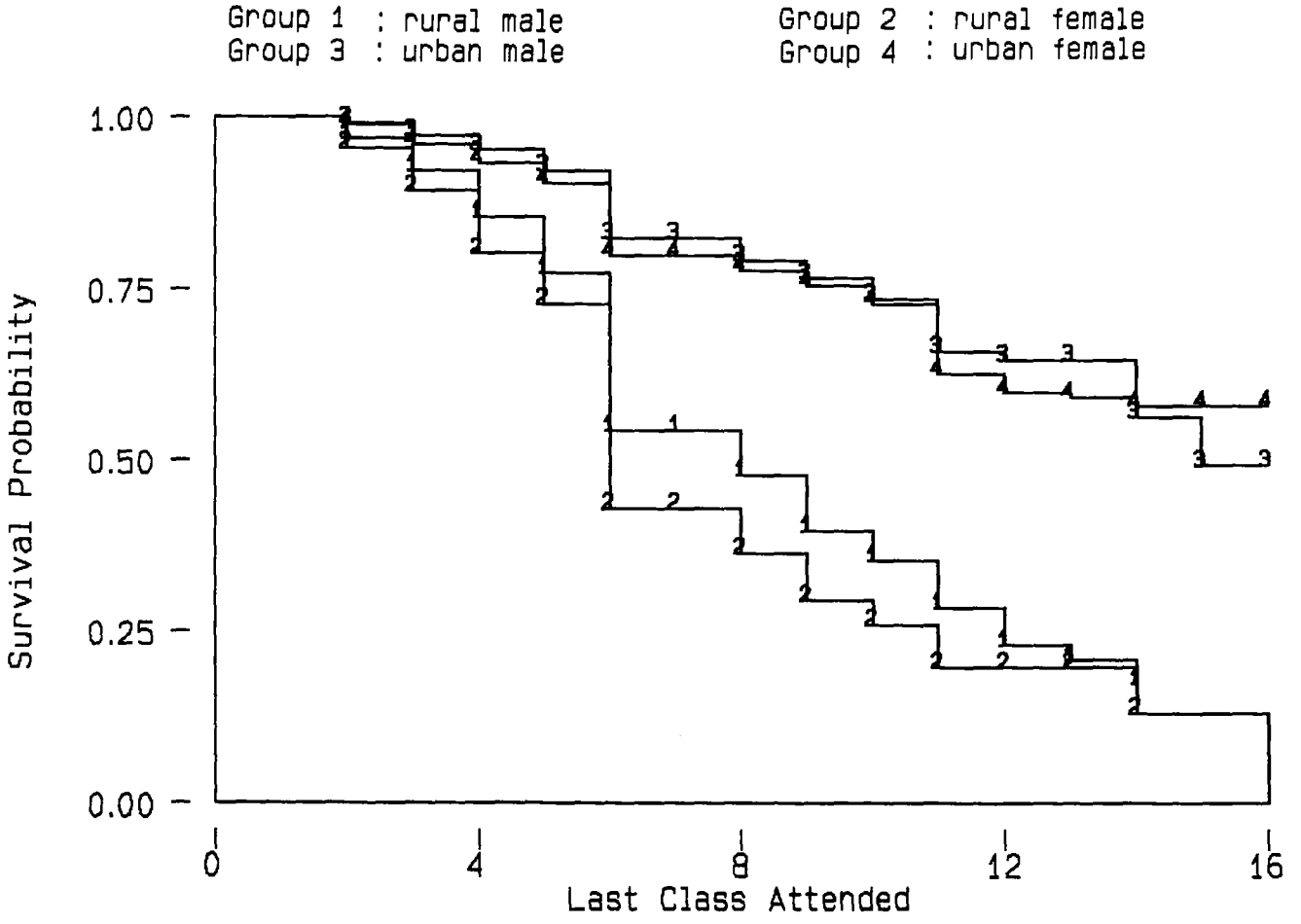
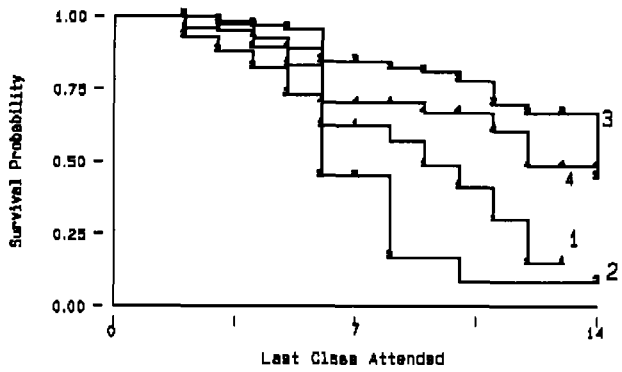


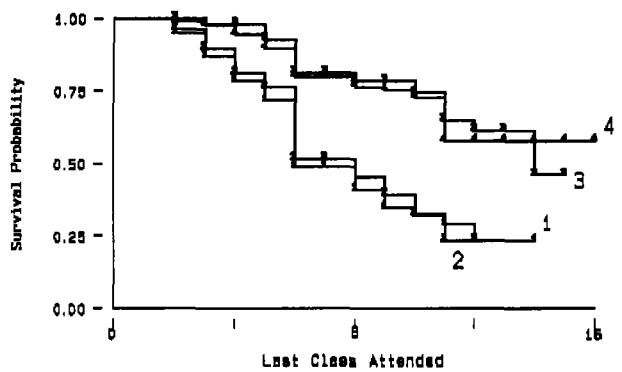
Figure 4b

Kaplan-Meier Survival Curves by Region

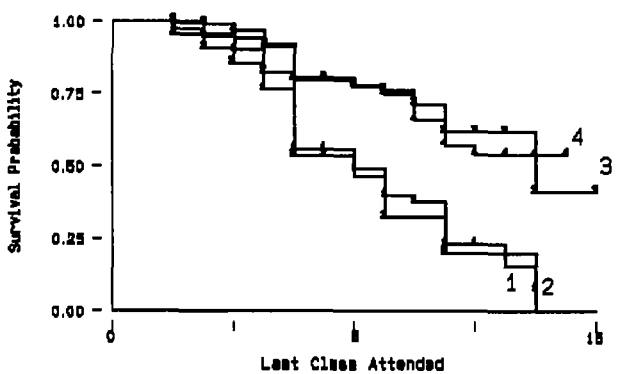
Group 1: rural male
Group 2: rural female
Group 3: urban male
Group 4: urban female



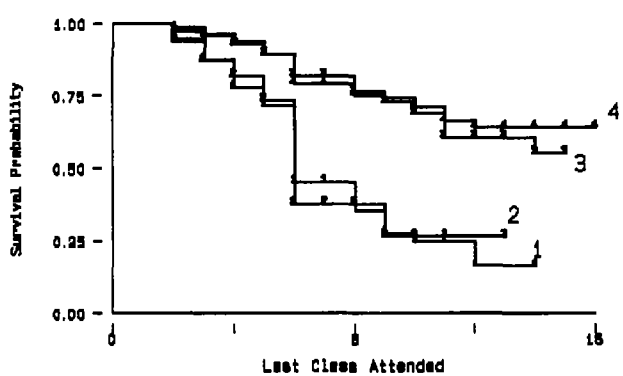
South



Tensift



Center

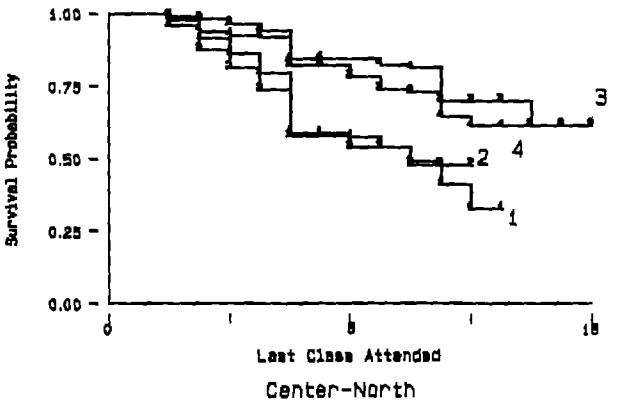


North-West

Figure 4b (Cont'd.)

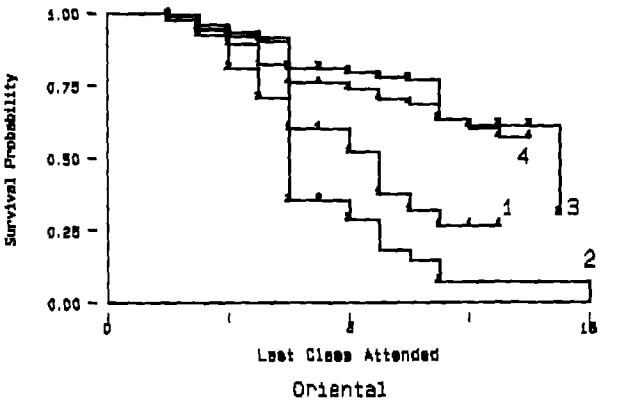
Kaplan-Meier Survival Curves by Region

Group 1: rural male
Group 3: urban male

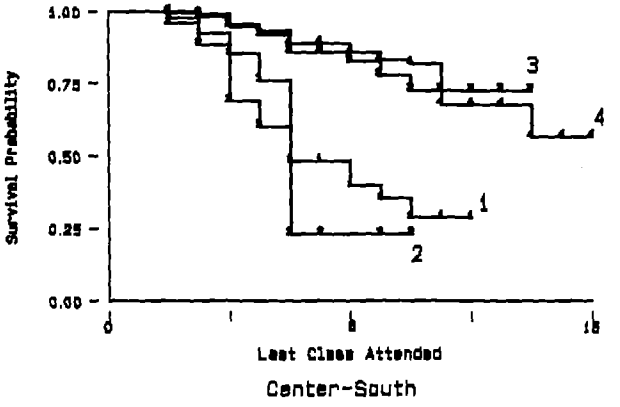


Center-North

Group 2: rural female
Group 4: urban female



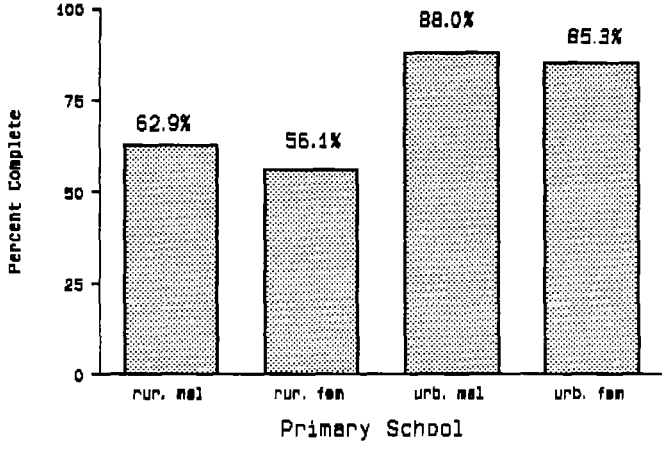
Oriental

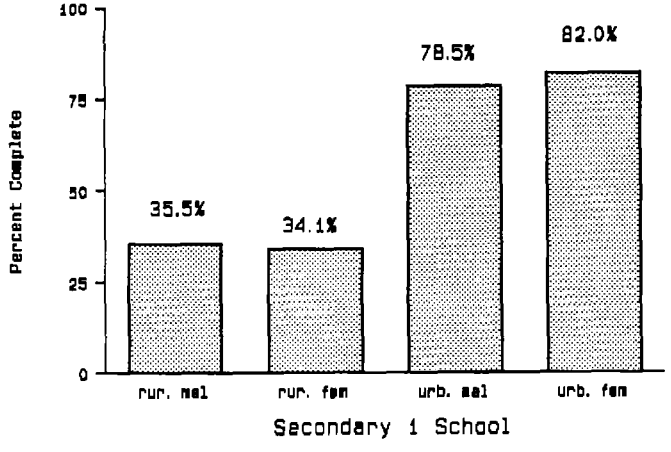


Center-South

Figure 5

Completion Rate by Schooling Level





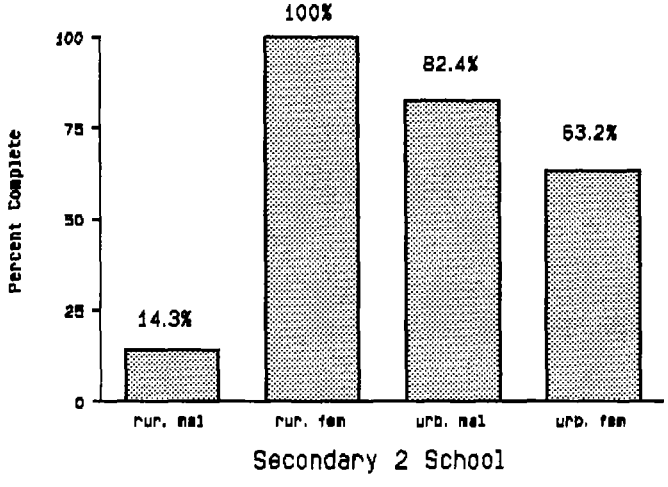
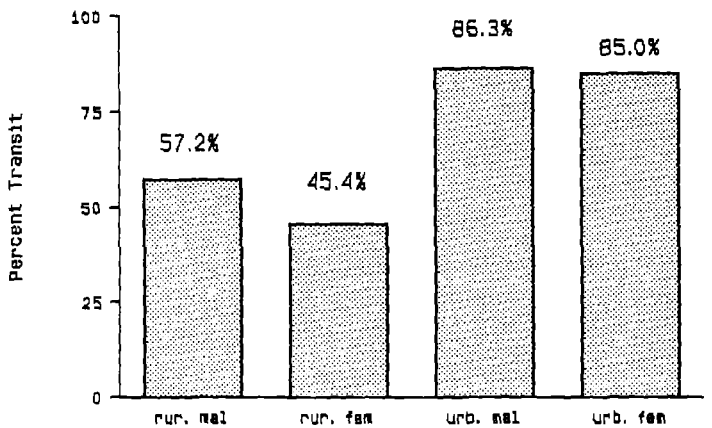
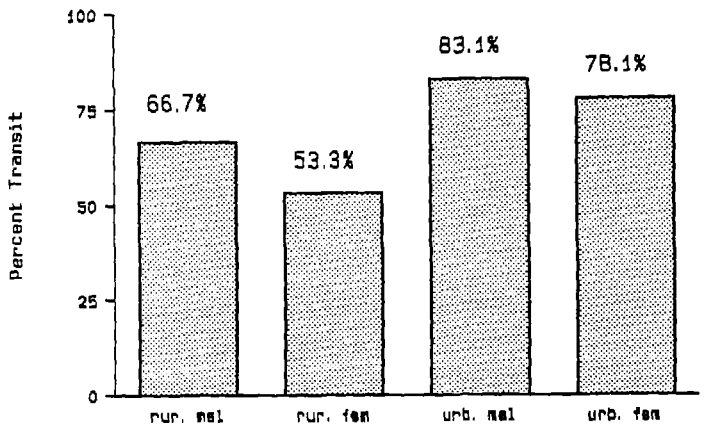


Figure 6

Transition Rates by Location-Gender Group



Transition Rate Primary --> Secondary 1



Transition Rate Secondary 1 --> Secondary 2

Figure 7a

Mean Math Test Scores

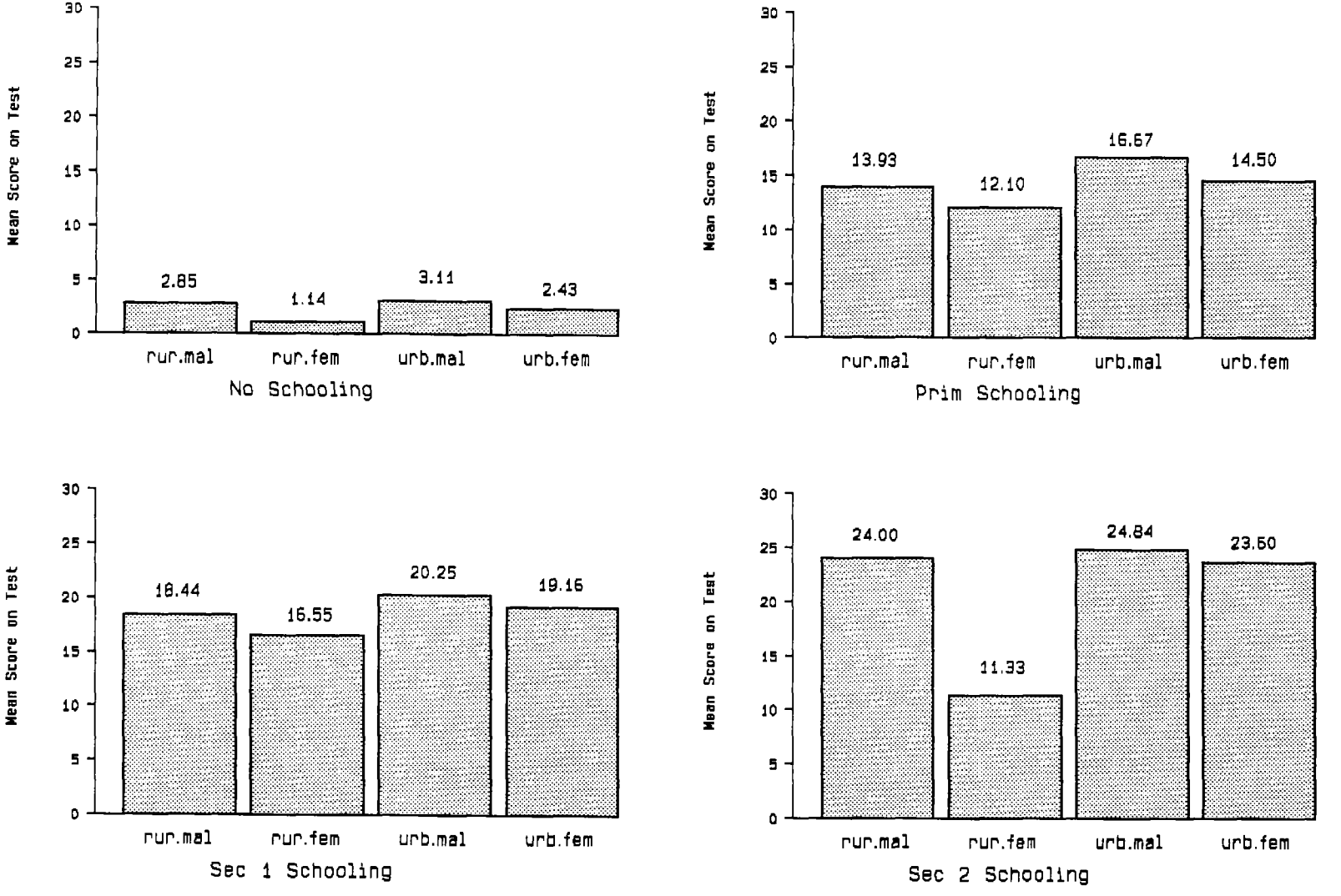


Figure 7b

Mean Arabic Test Scores

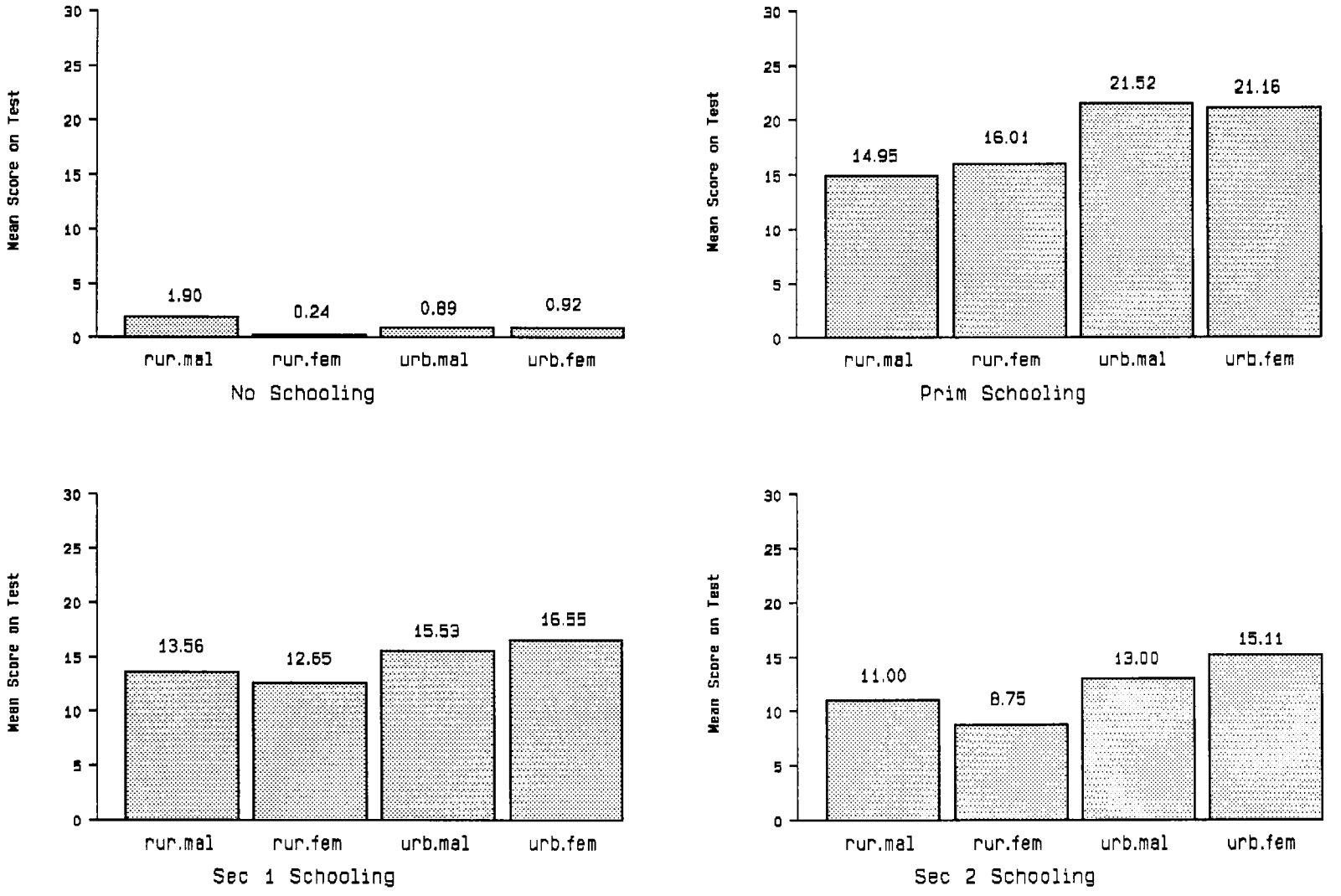


Figure 7c

Mean French Test Scores

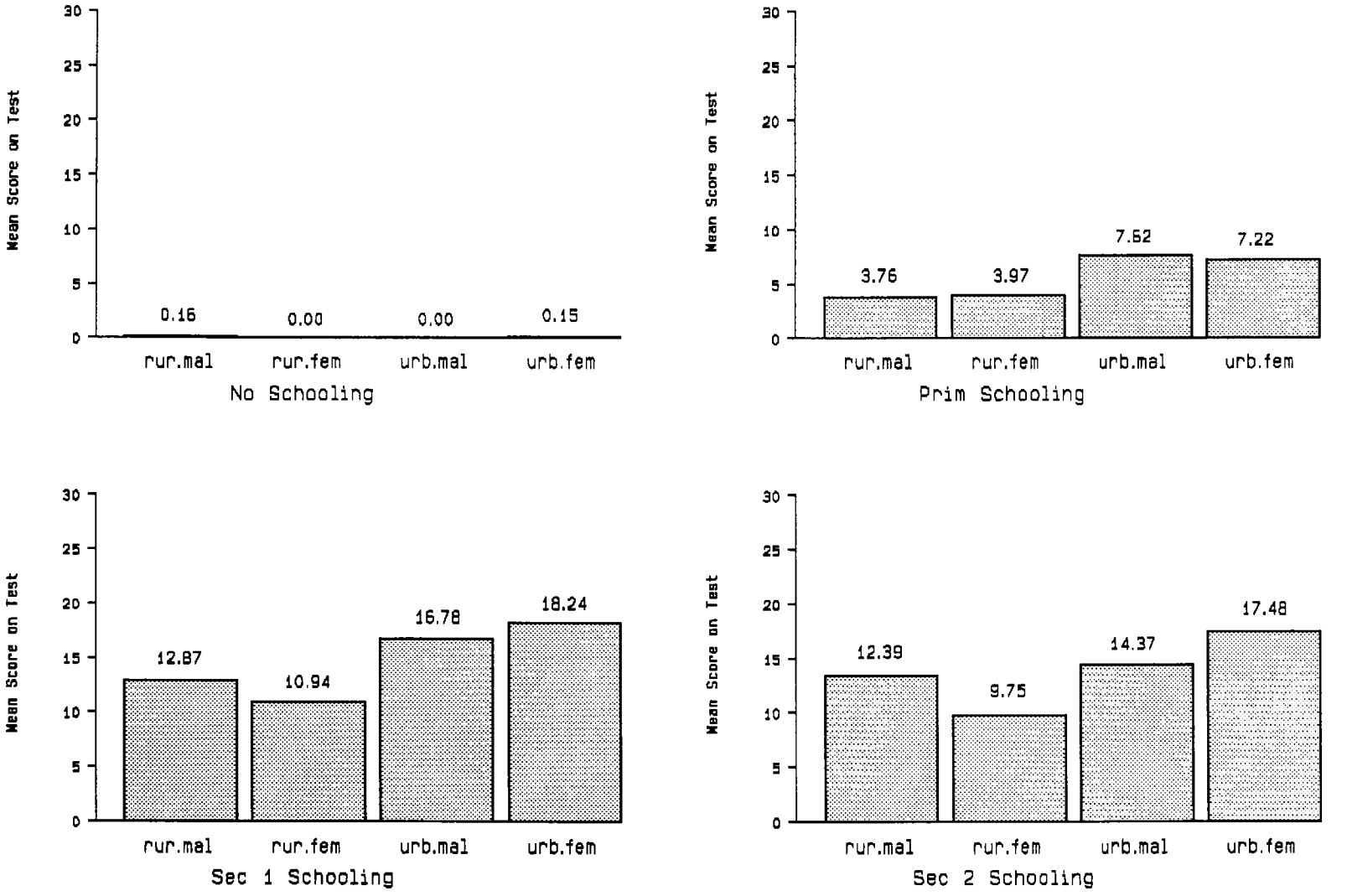


Figure 8
Percentage Ever Attended by Expenditure Quintile

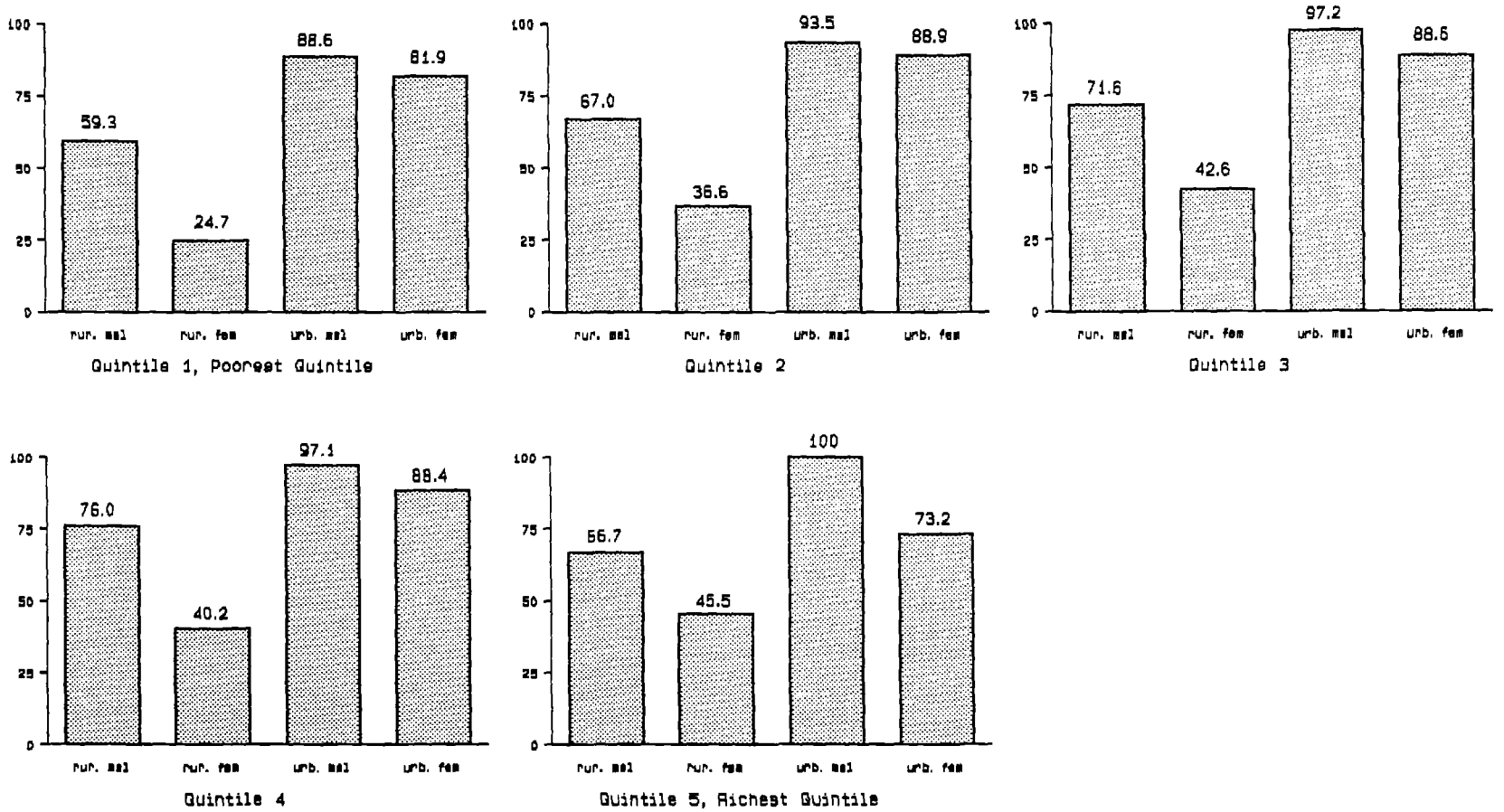


Figure 9
Mean Last Grade Attended by Expenditure Quintile

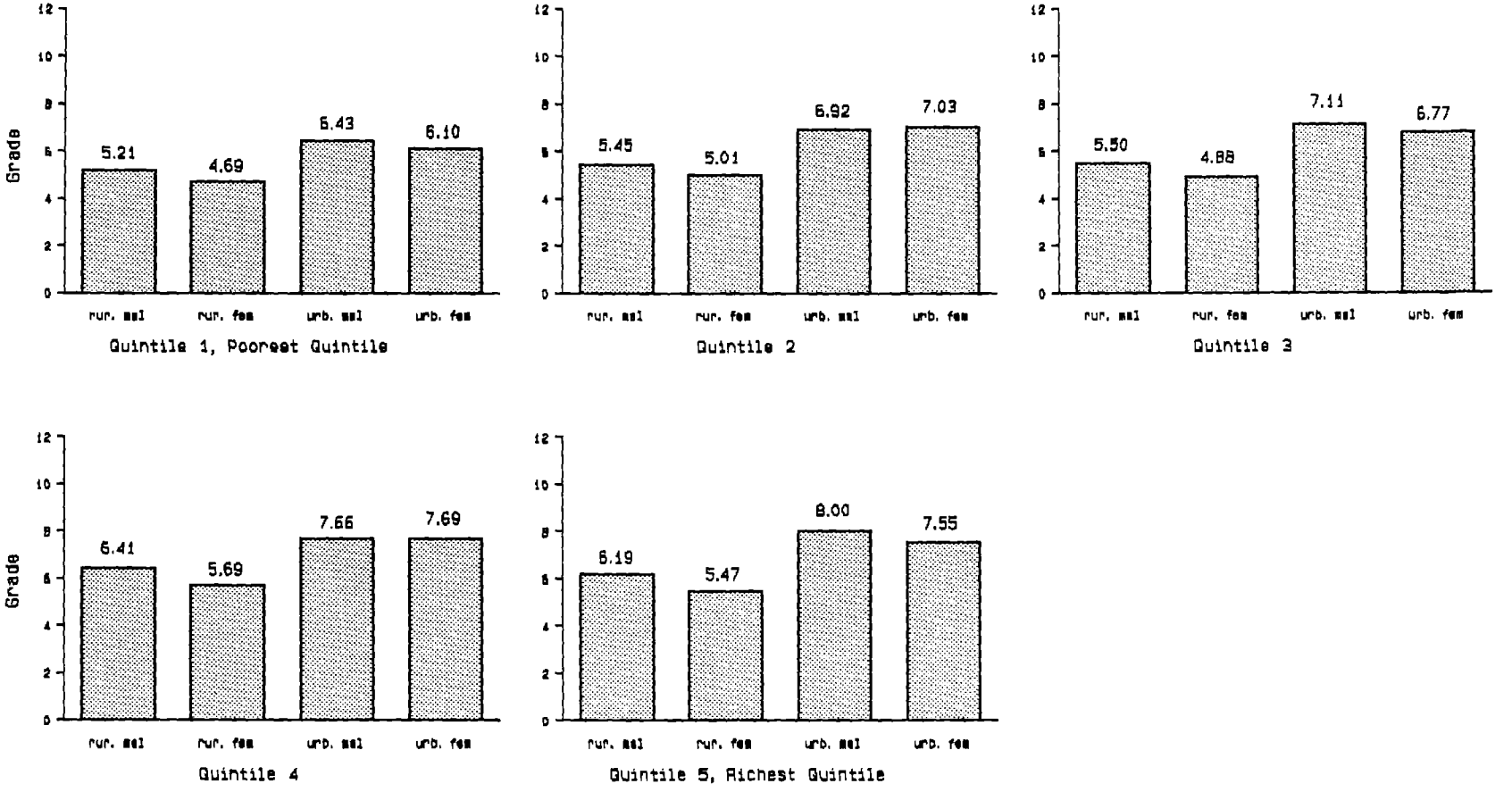
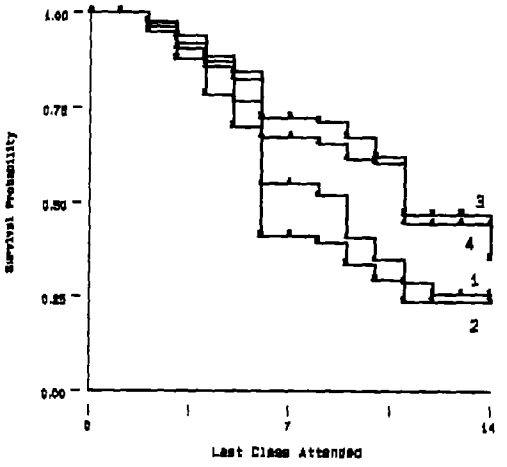
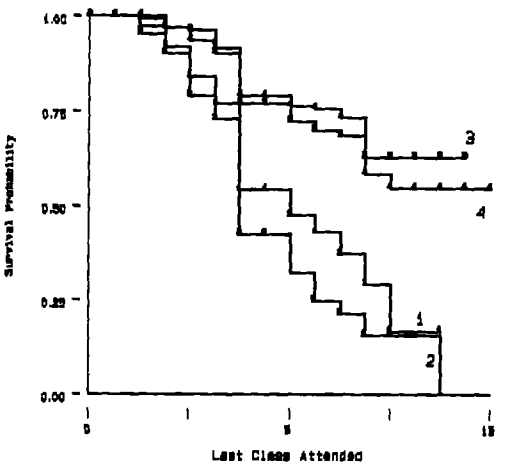


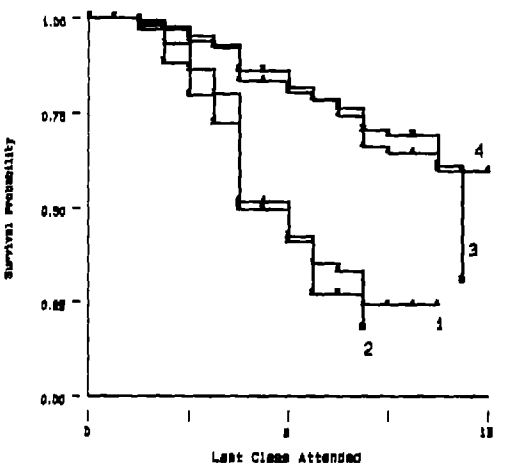
Figure 10
Kaplan-Meier Survival Curves by Expenditure Quintiles



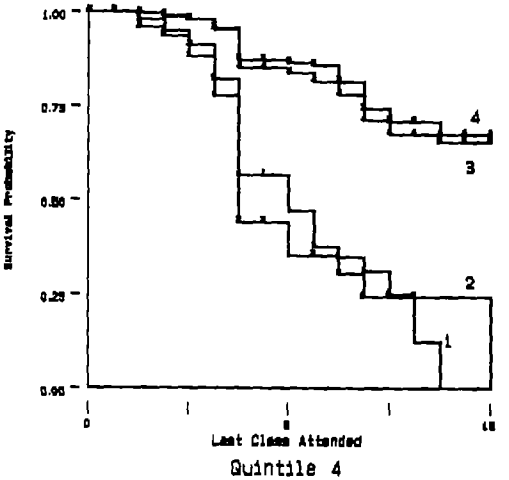
Quintile 1: Poorest Quintile



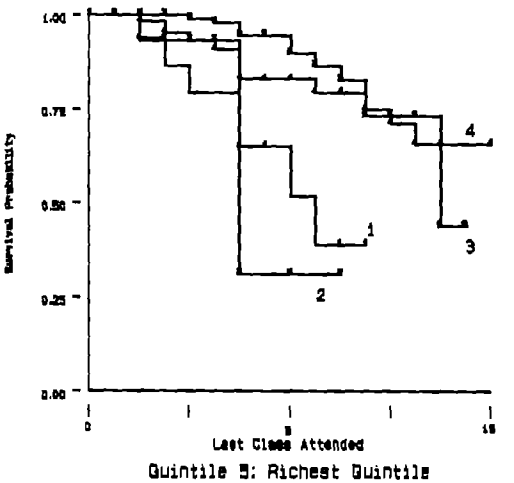
Quintile 2



Quintile 3



Quintile 4



Quintile 5: Richest Quintile

Group 1: Rural Male Group 2: Rural Female

Group 3: Urban Male Group 4: Urban Female

Figure 11a
Primary School Completion Rates by Quintile

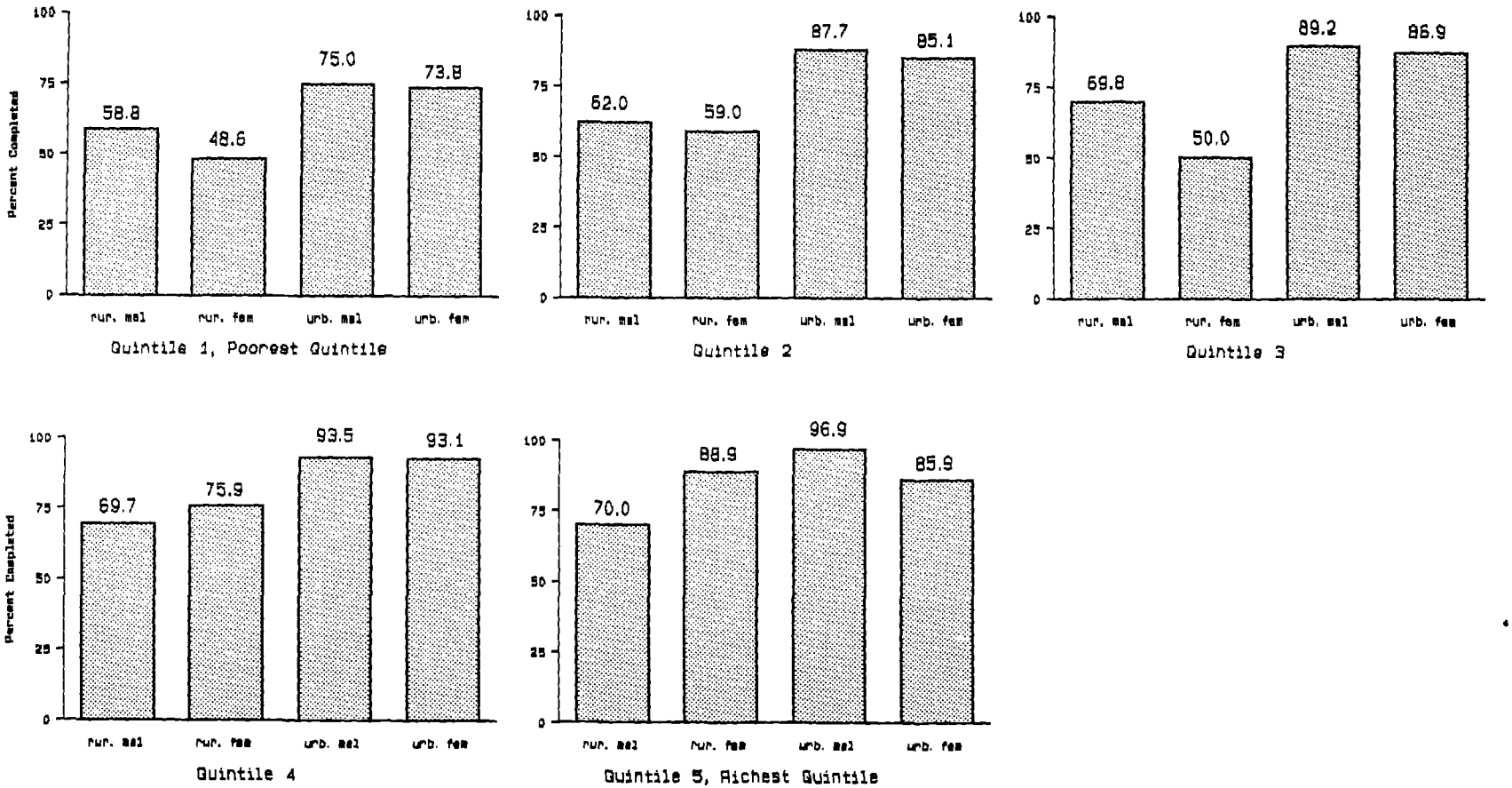


Figure 11b
Secondary 1 School Completion Rates by Quintile

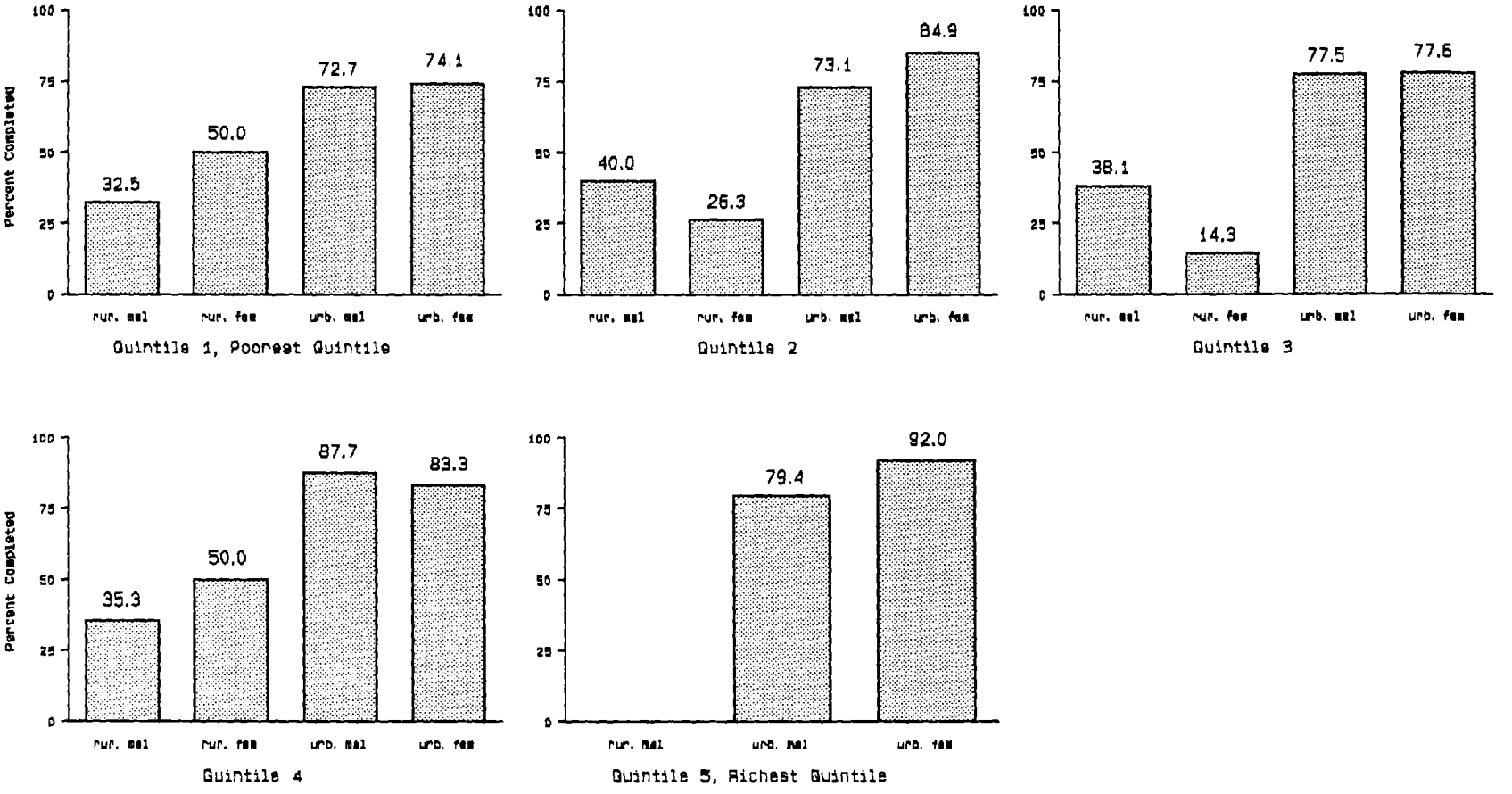


Figure 12
Primary to Secondary 1 Transition Rates by Quintile

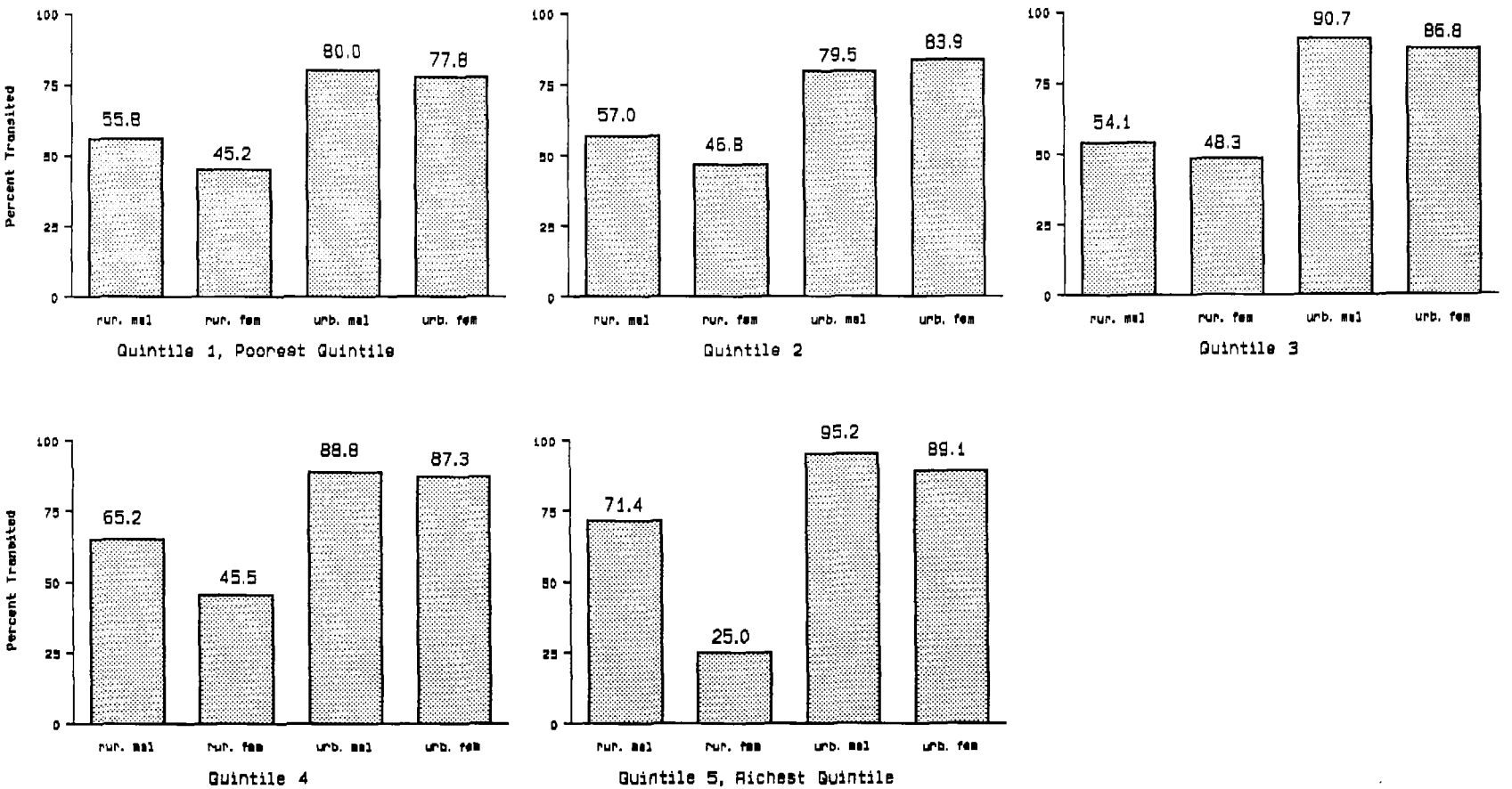
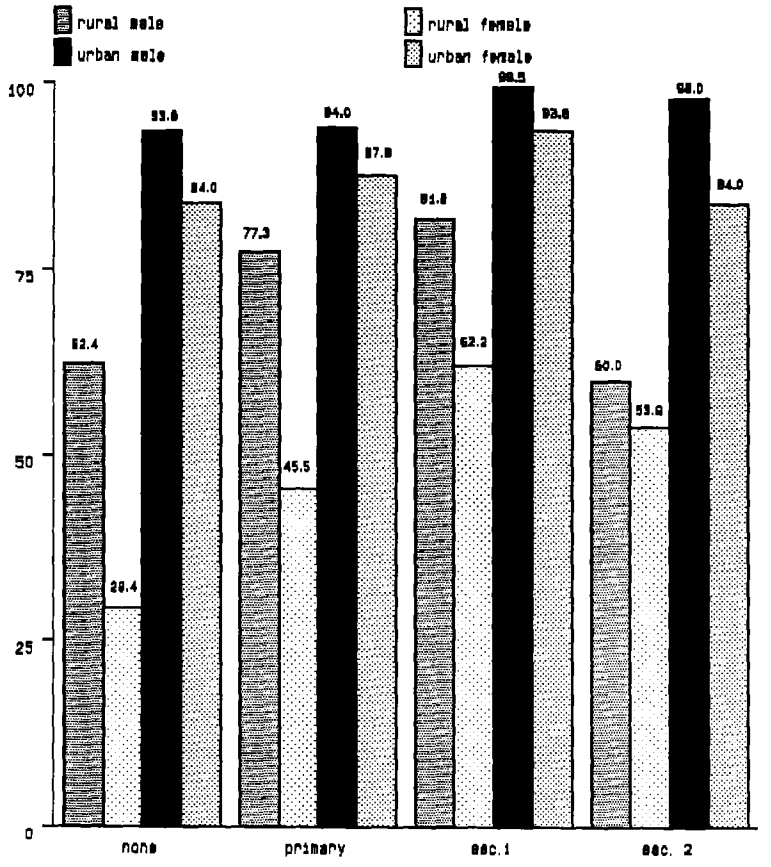
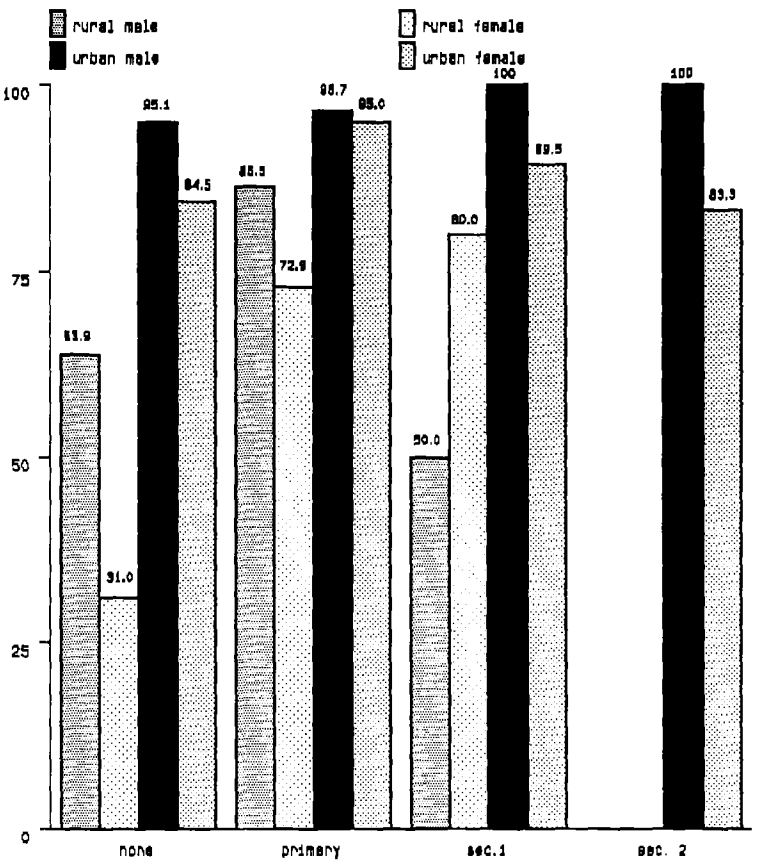


Figure 13

Percent Ever Attended by Head and Spouse Schooling



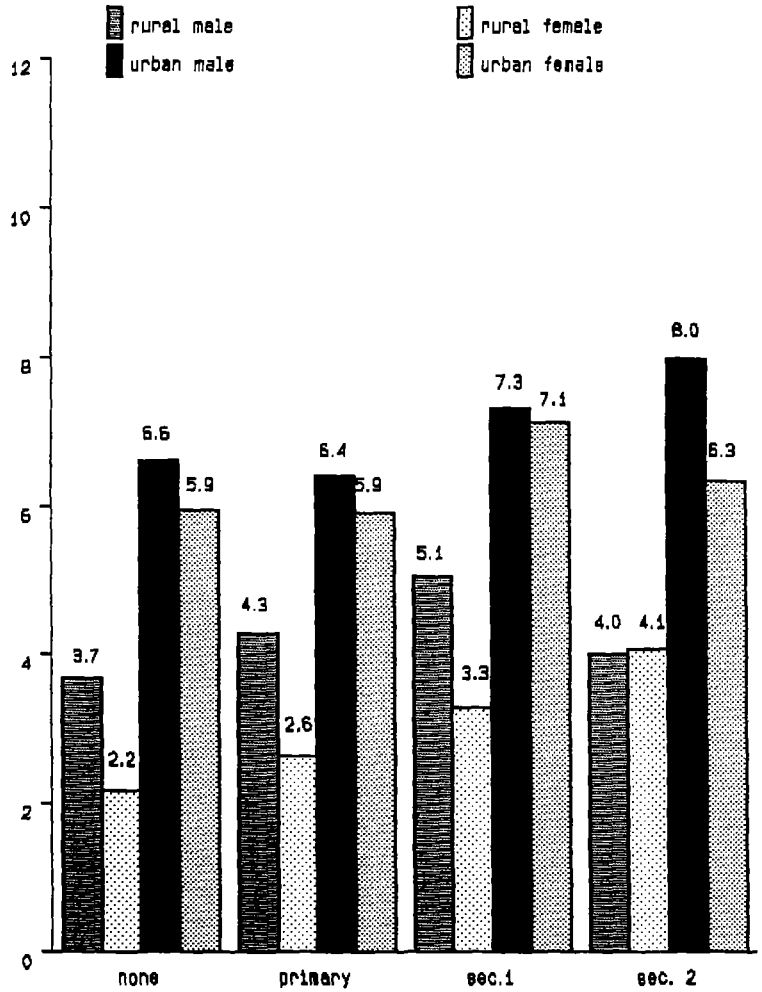
Percent Ever Attended by Head Schooling Level



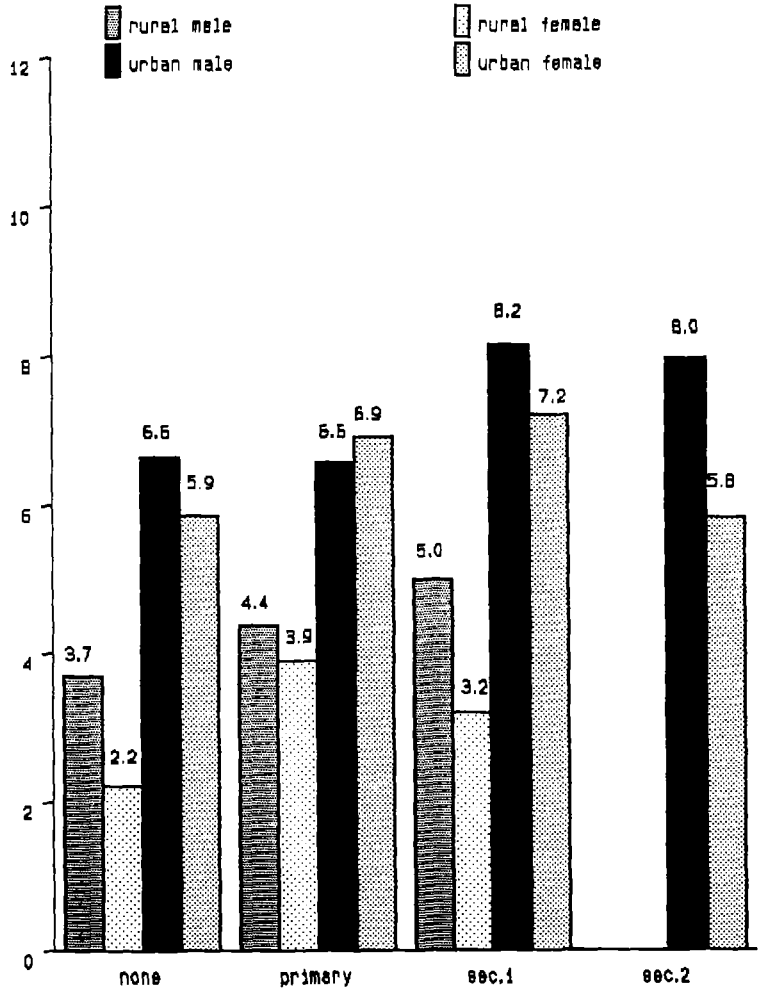
Percent Ever Attended by Spouse Schooling Level

Figure 14

Mean Grade Attended by Head and Spouse Schooling



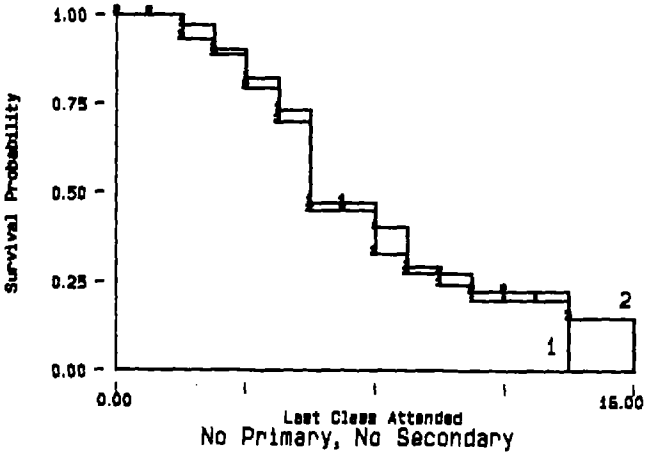
Mean Grade Attended by Head Schooling Level

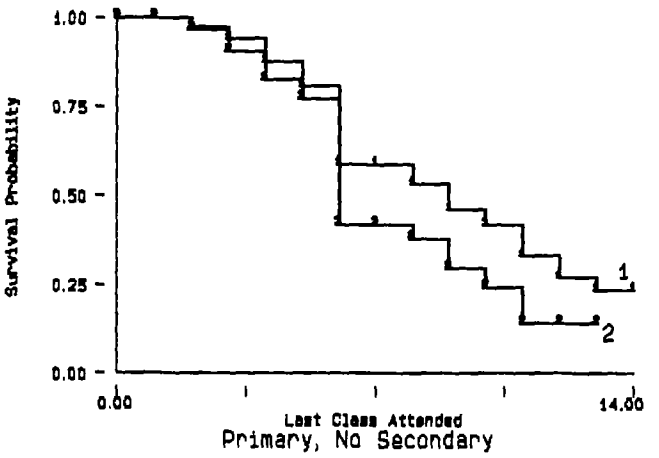


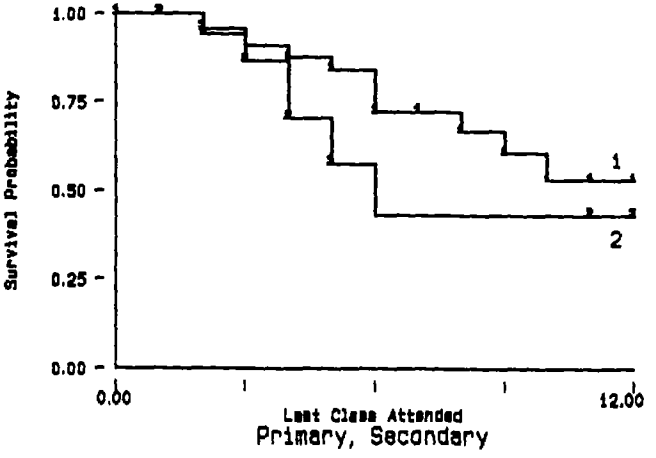
Mean Grade Attended by Spouse Schooling Level

Figure 15

Kaplan-Meier Survival Curves by Schools Present in Douar





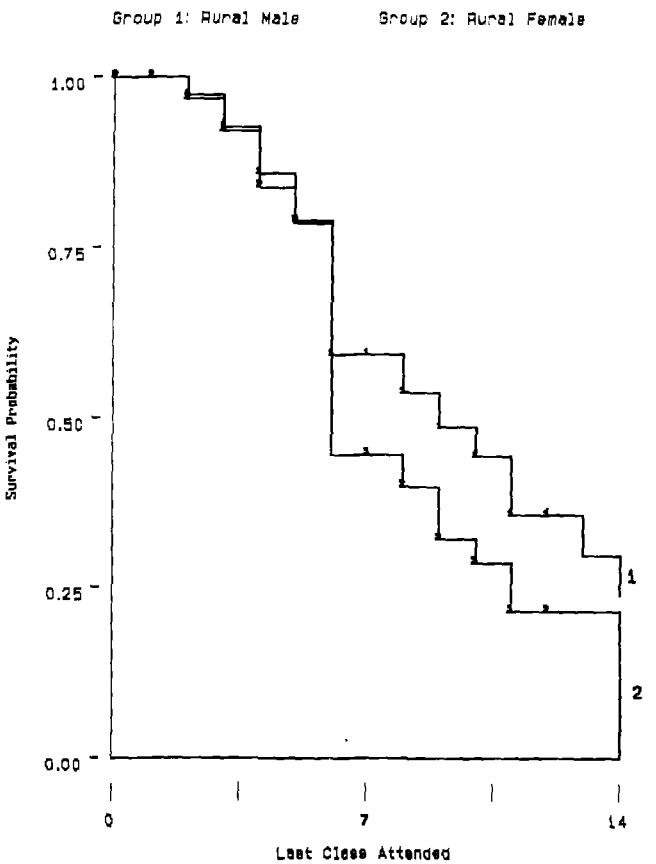


Group 1: Rural Male

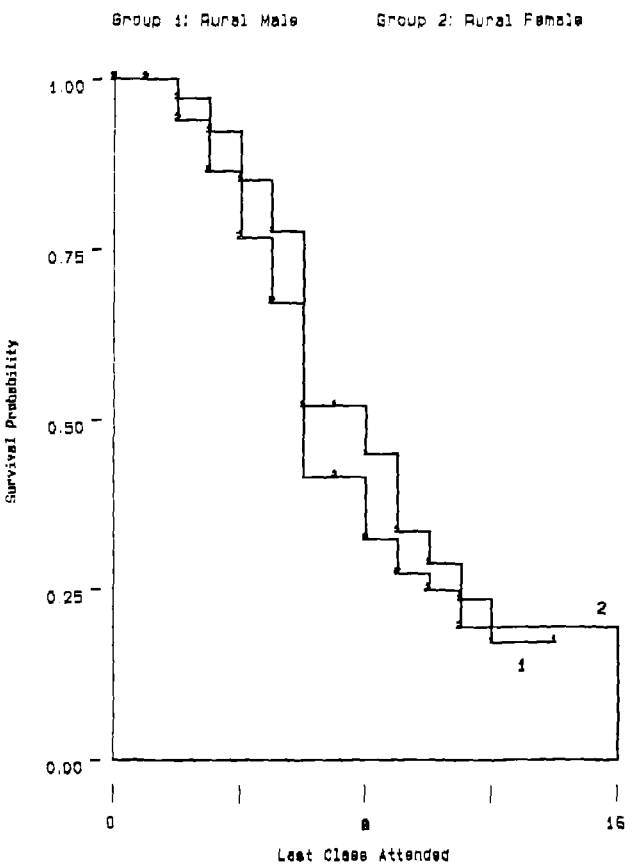
Group 2: Rural Female

Figure 16

Kaplan-Meier Survival Curves by Presence of Road in Douar



Road Present



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