Education and Health Services in Madagascar: Utilization Patterns and Demand Determinants

Peter Glick, Cornell University
Jean Razafindravonona, INSTAT
Iarivony Randretsa, INSTAT

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TABLE OF CONTENTS

LIST OF TABLES

ABBREVIATIONS

CEPE	Certificat d'Etudes Primaires Elémentaires (Primary Level Diploma)
CFNPP	Cornell Food and Nutrition Policy Program
CSSP	Centres de Soins de Santé Primaire
EPM	Enquête Permanente auprès des Ménages (Permanent Household Survey)
FMG	Francs Malagashe (Malagasy Francs)
IMF	International Monetary Fund
INSTAT	Institute National de la Statistique (National Statistics Institute)
USAID	United States Agency for International Development

CURRENCY EQUIVALENT (1993)

US $ 1.00 = 1914 FMG

I. INTRODUCTION

This study examines the utilization of, and the demand for, education and health services in Madagascar. It is well recognized that the provision of schooling and health care plays an important role in economic development in general and in improving the welfare of the poor in particular. The benefits for economic development arise because better education and health raise the human capital of the population, insuring greater productivity and hence higher output and economic growth. In fact, the link between an individual's education and his or her productivity, represented by earnings, is one of the best-documented relationships in economics. Growing empirical evidence exists as well for the beneficial effects of improved health on productivity in agricultural and wage employment.[1]

From the point of view of improving the welfare of the poor, the provision of social services by the public sector is considered essential because private markets are unlikely to provide adequate levels of these services. This is due partially to standard problems of private underprovision of goods and services like education and health that have significant externalities. To give a common example, the benefits of curing an individual of a highly contagious disease extends beyond the improvement in his or her own health, so that the amount the individual will be willing to pay for the cure is less than the social value. But beyond this problem, many or most of the poor will simply not be able to pay for basic education and health needs. Hence there is a strong equity or redistributional rationale for governments to provide services targeted to the poor.

Unfortunately, in an era of tight budgets in many countries—particularly those, like Madagascar, that are undergoing structural adjustment—it is very difficult for governments to provide an adequate supply of these vital services. Hence there is increasing concern that these services be effectively targeted to those who are in the greatest need, that is, poor households that are unable to purchase them privately. To address revenue shortfalls, proposals have been made to institute new or higher user charges to defray the costs of providing existing services or to finance expansion of services or improvements in their quality.

These issues are of great relevance to Madagascar. In the education sector, enrollments at all levels have declined dramatically since the early 1980s, a reflection in part of the economic stagnation and increases in poverty marking this period in Madagascar. In terms of efficiency indicators such as grade repetition and completion rates Madagascar compares poorly with the averages for Sub-Saharan countries (World Bank 1996). Quality in public schools is said to very poor and declining, reflecting Madagascar's low share of education in total government spending. Apparently in response to these quality declines, the share of students attending private school has been rising sharply.[2] However, whether the poor are able to take advantage of private alternatives is an important question.

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[1]Strauss and Thomas (1995) review developing country evidence of the effects of better schooling and health on productivity. For Madagascar specifically, Glick (1999) looks at the effects of education on the earnings of urban wage employees.

[2] For example, the share of total primary enrollments accounted for by private students rose from 15 percent to 22 percent in the period 1987 to 1992 (World Bank 1986).

There are significant unmet needs in the heath sector as well. In terms of indicators of health status such as infant and under-five mortality rates, life expectancy and vaccination coverage, Madagascar ranks at or below the already very low averages for Sub-Saharan Africa. Budgetary allocations to health are inadequate to meet essential needs. For example, basic health care facilities are said to be able to meet only 25 percent of their patients' drug requirements (World Bank 1996).

The research reported in this study has two parts.[3] The first part is descriptive and investigates the utilization of education and health services—both public and private—by different segments of the population of Madagascar, with a particular focus on whether these benefits are reaching the poor. Although not *per se* a benefit incidence analysis of public expenditures, this section encompasses aspects of such an analysis.[4] In addition, using unique community-level data on local schools and health care providers, we examine the level of and variation in indicators of the quality of services and of the availability of services.

While important and informative—particularly in determining whether services are reaching those most in need—descriptive analysis is less useful for evaluating the effect of many potential policies, or more generally, for understanding the factors that act to constrain households' use of services. For example, descriptive analysis may show that poor households (or rural households, or females) receive a less than proportionate share of a given education or health benefit. However, it cannot tell us how various policies, such as changes in price, quality, or distance to providers, will affect the level and share of the benefits going to the group in question. This requires *behavioral analysis* of the responses of households to the policies, that is, analysis of the demand for the service.

The second part of this study, therefore, consists of such a behavioral analysis. Econometric techniques are used to estimate the demand for education and health services, using the community data just mentioned together with matching household survey data. We estimate the determinants of the choice of provider for primary schooling and curative health care, distinguishing most importantly between public and private alternatives. We also examine the determinants of secondary enrollment. The availability of community level information on education and health care providers adds greatly to the value of the demand analysis. It allows us to measure the relative importance of household factors such as income and education, on the one hand, and provider factors such as cost, quality, and location, on the other.

We then use the econometric estimates in simulations of a number of different policies in the education and health sectors, providing insight into the potential effects of these policies on the level and distribution of social services. The policies examined in simulations include (for one or more of the services considered): increases in user fees, quality improvements, infrastructure development, and subsidization of private service providers.

The data used for this report come from the Permanent Household Survey (l'Enquête Permanente auprès des Ménages or EPM), carried out in 1993-1994 by the National Statistics

[3] This study was conducted as part of USAID/Madagascar's Participation and Poverty Project.

[4] We do not attempt here a complete benefit incidence analysis for this report as such an analysis has already been done using the same dataset used here (World Bank 1996; see also Sahn and Younger 1998)

Institute (INSTAT). The EPM is a comprehensive, multi-purpose nation-wide survey of about 4,500 households. As such it contains information on a wide range of individual and household factors, most notably (for the purposes of this study) school enrollment, education expenses, and health care utilization and costs of treatment. We match these household data to information from the EPM's community survey. Carried out in mostly rural communities that were also sampled by the household survey, the community survey, as noted, provides information on a variety of characteristics of schools and health care providers used by local residents.[5]

The results discussed in this study are presented in two main sections, corresponding generally to the two aspects of the research just described. The first section presents descriptive findings on the utilization of public and private education and health services. We examine the distribution of these services along a number of dimensions, including household expenditure quintile, region, and gender. Data are also presented on household expenditures on these services, i.e., education expenses per student and spending on treatment for an illness. The second section presents the econometric analysis of the demand for services and the policy simulations, beginning with schooling (primary and secondary) and following with health care. This section also describes and reports the main descriptive highlights of the community survey data on schools and health care providers. The final section summarizes the main results and policy conclusions of the research.

[5] The principle results of the household survey are presented in INSTAT (1995), and a description of the community survey is given in INSTAT(1997) .

II. ACCESS TO EDUCATION AND HEALTH SERVICES

A. Education

1. The education sector in Madagascar

The history of the education system after independence in 1960 is one of substantial successes in expanding access to education followed in recent years by sharp declines. Education was made free for all students after independence. Together with increases in the share of the government budget allocated to education, this resulted in a rise in gross primary enrollment from 50 percent to over 100 percent by the early 1980s (World Bank 1996).[6] Similar dramatic increases were seen in secondary school and university attendance.

After the early 1980's however, enrollments at all levels began to decline. The decline was sharpest for primary school: gross primary enrollments fell from about 140 percent in 1980 to less than 80 percent in 1993/4. One reason for this was Madagascar's overall economic decline during this period, which raised the numbers of Malagasy living in poverty. This undoubtedly made it harder for many households to afford the costs of school, which include not only direct expenses but also what the child could have contributed to the household's income if not in school. However, it is likely that another contributing factor was the deterioration in the quality of public schools, a reflection of the inadequate and (since the late 1980s) falling share of education in the government budget (World Bank 1996).[7] Judging by the efficiency indicators noted in the Introduction, the quality of schooling in Madagascar is indeed poor both absolutely and in relation to other countries in the region.[8] These declines in quality would reduce enrollments by lowering the benefits of schooling—an issue we address later in this report in our analysis of the demand for primary schooling.

The education system in Madagascar is organized as follows. Primary school (not counting pre-school) consists of five grades. Upon successful completion of primary, resulting in attainment of the CEPE certificate, students take four years of lower secondary and three years of upper secondary, culminating in the Baccalaureate degree. Finally, university is also divided into lower and upper levels, of three and two (or more) years, respectively. As noted earlier, the private sector in education, while still relatively small, has been expanding steadily in response to quality problems in the public system. An interesting characteristic of the private education sector in Madagascar is that it is dominated by church-run (Catholic and Protestant) schools. Only 15 percent of private primary students and 30 percent of private secondary students attend secular schools.

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[6] The gross enrollment rate for primary schooling is the ratio of the total number of students of any age attending primary school to the number of children of primary school age.

[7] The authors of that study caution that the downward trend in the education share of the budget is not seen using other sources of expenditure data. It is clear, however, that as a share of GDP, government spending on education is low in Madagascar (for example, under 2 percent in 1996; IMF 1997). This is lower than the average for Sub-Saharan African countries and developing countries generally and reflects the relatively modest size of the government in Madagascar.

[8] A recent World Bank report (World Bank 1995) was devoted to the issue of quality in public primary and secondary schools and pointed to poor management, inadequate supplies for teachers, and insufficient local support leading to poor equipment provision and maintenance, as the main factors reducing school effectiveness.

2. Patterns in enrollments

a. School enrollment rates by expenditure quintile, gender, and zone

Table 1 presents for all Madagascar enrollment rates for each school level by household per capita expenditure quintile. Household expenditure per capita, or expenditure divided by household size, is a commonly used indicator of household welfare. The quintiles are constructed after ranking all individuals in the population based on their households' per capita expenditures. Thus the first quintile contains the poorest 20 percent of the population (in terms of per capita household expenditures) while the fifth quintile contains the richest 20 percent. The table therefore shows how enrollment status varies with the level of household income or resources.[9] We calculate two measures of the enrollment rate. The *gross enrollment rate* is the ratio of the total number of enrollments to the total number of school-age children for a given level, e.g., primary. The *net enrollment rate*, on the other hand, is the ratio of enrollments of school-age children to the total number of school-age children. "School-age" is defined as 6-11 for primary school, 12-18 for secondary, and 19-24 for university. The table also shows the percentage of enrollments that are accounted for by girls and by private students.

As seen in the last column (first two rows), the average gross and net enrollment rates for primary school are 73 percent and 51 percent, respectively.[10] While obviously far too low to be considered satisfactory—and well below the levels Madagascar enjoyed two decades ago—these rates compare somewhat favorably with the averages for Sub-Saharan Africa for which, for example, the gross primary enrollment rate is 66 percent. The table indicates, however, that there are very large differences by per capita expenditure quintile in children's primary schooling. Only 33 percent of primary age children in the poorest quintile are enrolled, compared with 72 percent in the highest.

It is noteworthy that girls account for exactly half of all primary enrollments both for the sample overall and by and large for each quintile as well. Therefore girls are not disadvantaged relative to boys in their access to primary school. The portion of primary enrollments accounted for by private students rises with expenditure level. It is especially high for the wealthiest quintile (45 percent). This no doubt reflects in large part the higher costs of private schools (even religious schools) compared with public schools. However, private schools may also simply be more accessible in terms of location to better-off households.

Secondary enrollment rates are much lower than primary enrollments but similarly increase with expenditure quintile. In fact, the disparity between lower and upper quintiles is

[9] Reported household expenditure is usually considered to be a more accurate measure of welfare than the reported income of the household. This because reporting or measurement errors in the income variable are usually more serious and because income is more subject to temporary fluctuations which could result in a misleadingly low or high picture of the household's actual long-term welfare.

[10] The EPM is a random stratified survey. In particular, urban areas were oversampled to insure adequate representation of urban socioeconomic groups. In the analysis for this paper, the sample was appropriately reweighted to generate a nationally representative sample.

even sharper than for primary schooling. The gross enrollment rate of 3 percent for the bottom quintile is a tiny fraction of that for the top quintile (49 percent). There is evidence of gender differences in the lower portion of the expenditure distribution, though these differences are not very large: girls make up 45 percent of secondary enrollments in the first two quintiles and 44 percent in the third quintile. The overall portion of secondary enrollments that are private is higher than for primary school: 42 vs. 23 percent. As with primary school, secondary students from higher quintiles are more likely to be in private schools than those from lower quintiles.

Finally, net enrollment rates for university (which was all public in Madagascar at the time of the survey) are very low. [11] More than for lower schooling levels, the university enrollments we do see are highly concentrated in the upper quintiles. 3.8 percent of individuals age 19-24 from the top expenditure quintile are attending university, while not a single individual (in the sample) of that age from the lowest quintile attends university. Overall there is no difference in the numbers of males and females enrolled in university.[12]

Next in Table 2 we examine primary and secondary enrollments separately for rural and urban areas. For this analysis we calculated separate expenditure quintiles on the rural and urban samples; this allows us to better assess inequalities within each zone. The differences between average urban and rural enrollments are very large. Overall gross primary enrollments of rural children are barely more than half those of urban children and the gap is much larger for secondary enrollments. These differences reflect, first, the lower average incomes of rural households, and second, the difficulties in access faced by residents of rural areas, where the average distance to schools is greater and the transportation network is poorly, or not at all, developed. Local availability of secondary schools in particular is rare in rural communities (as discussed below in Section IV) and this no doubt explains in part why the rural-urban enrollment disparity is so much greater for the secondary level than the primary level.

Even after accounting for the urban–rural gap, there are still significant disparities between the poorest and wealthiest within each zone, particularly in rural areas. For example, gross primary enrollments for the bottom rural quintile are just half those for the top quintile. This suggests that, while targeting rural areas for education expansion will generally be progressive—because rural households overall are poorer than urban households—there are also significant inequalities in schooling between income groups within rural areas that need to be addressed.

b. Provincial disparities in enrollments

So far we have analyzed the distribution of schooling (overall and public schooling specifically) by income strata, gender, and rural vs. urban residence. Here we disaggregate on the basis of Madagascar's six provinces or *Faritany*. The data in Table 3 point to the existence of large regional disparities in schooling. Enrollments at both primary and secondary levels are highest in Antananarivo, reflecting that province's relatively high wealth and greater urban density (it contains the capital city). Lagging far behind are Finarantsoa and especially Toliary,

[11] A private (Catholic) university has since opened in Madagascar.

[12] The gender ratios shown in the table for the second and third quintiles are not very meaningful because of the very small numbers of university students in these subsamples.

where primary and secondary enrollment rates are less than half those for Antananarivo. These differences correspond to differences in incomes and the incidence of poverty, as Fianarantsoa and Toliary are two of the poorest provinces in the country.

This correspondence of regional education and income disparities has implications for targeting. It suggests that regional targeting of education spending will be a relatively simple criterion for targeting the enrollments of the poor.[13] It is perhaps unexpected, therefore, that the calculations in World Bank (1996) show that Fianarantsoa and Toliary (in 1994) received the *highest* public spending per student at both primary and secondary levels. However, as the authors of that study note, this reflects the low population density and low incomes in these regions, both of which tend to reduce enrollments per school and per teacher, raising the cost per enrolled student. Therefore, the apparent higher public expenditure per student does not mean that spending in these two provinces is "too high" relative to other provinces; on the contrary, they are a sign of lower than average enrollments and of the need to do more to raise schooling in these provinces.[14]

c. *Incidence of public schooling*

The foregoing tables showed the distribution of schooling across expenditure quintiles. This is not the same thing as the incidence of public education expenditures, for which we need to focus on the distribution specifically of public enrollments. Both types of analysis, of course, are of interest to policymakers. The distribution of schooling overall—including both public and private enrollments—is an indicator of the distribution of investments in human capital and ultimately, in opportunities or "capabilities" (Sen 1987).[15] This is what policymakers presumably are ultimately trying to influence, that is, make more equal. On the other hand, the main way for government to do this is to target public education spending toward the poor. Therefore we also need to analyze the incidence of public schooling benefits, in particular to see how well they are being allocated to poorer households.

We do this in table 4, which compares enrollments in public primary and secondary school for different expenditure quintiles. The table shows the number enrolled per capita in each quintile, that is, enrollments divided by the number of people in the quintile. Thus we are comparing each quintile's share of the total benefits (enrollments) to its share of the population. Higher enrollment per capita for a given quintile relative to the average indicates that the quintile enjoys a disproportionate share of total public enrollments. A progressive (or more simply, "pro-poor") distribution of public schooling benefits would be one in which the quintile shares of the benefits decline as expenditure quintile rises, implying that the poor receive a disproportionate share of the benefits. [16, 17]

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[13] Since the poorest Faritany are also the most rural, targeting poor provinces is to an extent the same as targeting based on rural location.

[14] As we would expect, when expenditures are calculated on a per capita rather than per enrolled student basis, the picture changes. (World Bank 1996 p. 74). The per capita public subsidy for primary education is similar for all provinces, while the per capita secondary subsidy favors Antananarivo.

[15] Of course, quality differences in public and private education need to be taken into account.

[16]There is an alternative, and less demanding, criterion for the progessivity of a benefit: that the poorer quintiles receive a share of the total benefits that is greater than their share in total *income* (or expenditures)—as opposed to

We should note that this is a particularly simple approach to analyzing benefit incidence. The benefit is represented simply by a value of 1 for the 0,1 public enrollment indicator variable. This implicitly assumes that the benefit is the same for all enrolled children. An alternative would be to value the benefit using the government's education expenditure per student (the public subsidy), which varies by region. This in principle is more accurate, though it depends on the reliability of the government's education cost data. We do not apply this method here since it has previously been carried out using the EPM data combined with government expenditure figures (see World Bank 1996 and Sahn and Younger 1998).

The table also shows for each school level and quintile the public enrollment rate on a per child basis. This is the proportion of school age children in each quintile (as opposed to all people in the quintile) receiving the benefit. Although not the standard way to analyze benefit incidence, the per child focus is useful for analyzing the distribution of education benefits, especially if one is concerned about the future opportunities of the children themselves rather than the current benefits their schooling brings to their households (see Selden and Wasylenko 1995). The two measures of incidence will diverge because poorer households have more children on average, i.e., there is a higher ratio of children to the total quintile population in the lower quintiles. This means that for these quintiles a low per child enrollment rate may correspond to a relatively high per capita rate. Thus the distribution of public enrollments will tend to look more progressive using the normal per capita focus than using a per child focus.

The second row of the table shows enrollments per capita for public primary school. The lowest enrollment rates are among the bottom and top quintiles. Overall, however, the incidence of enrollments is mildly progressive: calculated as shares, about 66 percent of total primary enrollments are accounted for by the first three quintiles (which account by construction for 60 percent of the population). On a per child basis, the distribution appears, as expected, somewhat less favorable to the poor (second row). Note that the very low public enrollment rate of children in the highest quintile is explained by the fact that these children are the most likely to be in private school.

In contrast, the benefits of public secondary education are highly concentrated among the top expenditure groups, both on a per capita and per child basis. The wealthiest two quintiles account for 70 percent of all public secondary enrollments. University enrollments (fifth row) are even more skewed in favor of the wealthy: 82 percent of current university students are drawn from the top quintile alone.

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per capita progressivity which as indicated involves comparing benefit shares against population shares. The former is a relative measure of the distribution of the service, in contrast to the absolute criterion of per capita progressivity. It implies a less strict definition of progressivity because, giving the extent of income inequality in Madagascar, the poor's share of total income or expenditure is well below their share of the population. For such an analysis of public education (and health) services, see World Bank (1996).

[17]About 70 percent of the population of Madagascar is estimated to fall below an absolute poverty line (World Bank 1996). By this criterion, all those in the first three quintiles and half those in the forth would be characterized as being in poverty. In view of the fact that this comprises the vast majority of the population, policymakers may also want specifically to help the worst off among the poor.

Therefore while the incidence of public primary schooling appears to be somewhat favorable to the poor, this is far from the case for higher levels of schooling which instead are strongly biased toward the well-off. Although these conclusions are derived using binary enrollment indicators as the benefit measure, they are consistent with previous analysis using government spending per pupil to value public schooling benefits (World Bank 1996).

3. Household education expenditures

Table 5 shows by school level and type (public and private) the median annual household expenditures on education per enrolled child. These costs, which are reported in the education module of the household survey, are also shown in proportion to total household per capita expenditures. For public primary schools (which technically are free), reported fees and charges make up only a small portion – 14 percent—of total annual school expenses. Fully 71 percent of expenses are taken up by supplies such as books and uniforms. As we would expect, fees account for a much larger share—about 40 percent—of private primary school expenses.

Looking first at public primary school costs, there is a very large difference between what the poorest and wealthiest households pay to send a child to public school. The median amount for the highest quintile, Francs Malagasy (FMG) 14,352, is three times that for the lowest quintile (4,717 FMG)[18]. The difference reflects higher levels among affluent households of both non-fee school expenses and fees themselves; reported fees are about 60 percent higher for the richest quintile than the poorest. As a share of household per capita expenditures, expenditures per public primary student, while low overall, are more significant for poorer households. The ratio falls from 0.046 for the poorest quintile to 0.027 for the richest. Measured in relation to household resources, therefore, the burden of educating a child in public primary school is higher for poor families. This occurs in spite of the fact that richer households spend much more in absolute (FMG) terms per student than poor households. Although the percentages may not be high, to a household at or near the subsistence level, allocating even a small portion of a child's annual "allotment" of family resources to his or her schooling may be difficult.[19] It is important to note as well that these figures do not include the indirect costs of schooling—the household revenue or output that is given up when a child attends school rather than working in the home or on a family farm or business. The work of primary age children is not trivial, particularly for poor families or for rural households for which family agriculture is the most important source of income.[20] Therefore the indirect or opportunity costs of schooling as a share of household income may be substantial for these households.

[18] All values reported in this study are in 1993 Malagasy Francs (US $ 1.00 = 1914 FMG in 1993).

[19] We should stress that this "allotment" is rather crudely approximated by per person household expenditures. That is, it is implicitly assumed that household resources are divided up equally among all family members. In fact, in expenditure or quantity terms, food and clothing needs are greater for adults than for children. Therefore the ratios in the table underestimate—probably significantly--the cost of schooling relative to a child's actual (but unobserved) share of household resources.

[20] About 40 percent of boys and 30 percent of girls age 7 to 14 in rural areas were engaged in income earning activities in the week prior to being surveyed (Glick 1999). Including household labor as work would raise these numbers, particularly for girls.

Median per student expenditures for private primary school are more than four times greater than for public primary school (33,230 vs. 7,453 FMG). We see a similar—and even more pronounced than for public school—pattern of rising private school expenditures with quintile. On average, household spending per enrolled private primary student equals about 8.5 percent of annual household per capita expenditures compared with about 3 percent for public students. There is no noticeable pattern in this ratio across quintiles. The expense involved in sending a child to private primary school is thus a good deal greater than for public school and this may be deterring private enrollments of children from poor families.[21] We address this issue later in this report, where simulation exercises based on estimates from the primary school choice model examine the impacts of private primary school expansion on enrollments among the poor.

Household per student expenditures on secondary school are much higher than for primary school. This reflects both higher fees and higher expenses on other school items: in fact, for both public and private schools, fees and school expenses increase more or less proportionately as one moves from the primary to the secondary level. Again, the private school alternative is much more costly: the median annual expenditure per student on private secondary schooling is 66,598 FMG compared with 29,764 FMG for public schools. Also as seen for primary schooling, per student expenditures rise sharply with quintile. As a portion of household expenditures per capita, the costs of secondary schooling can be significant, especially for poor households. For public secondary schools, per student annual costs equal 15 percent of average household per capita expenditures for the first quintile compared with only 6 percent for the fifth quintile. The equivalent figures for private secondary schools are 22 percent and 11 percent.[22]

B. Health

1. The health sector in Madagascar[23]

Public health care in Madagascar is organized around approximately 1,900 basic or primary care facilities supported by a network of hospitals that includes 70 first and second level referral hospitals, four regional hospitals, two national university hospitals, and seven specialized institutions. There is a variety of types of basic care facilities, including *Dispensaire, post sanitaire, post d'infirmerie,* and *Centres de Soins de Santé Primaire (CSSP).* It is evident from the EPM data presented below that hospitals also serve as sources of basic care for those who have access to them. Administratively, as a result of changes instituted in 1994 (after the survey used for this report was carried out), the public health sector in Madagascar is organized around 111 health districts, corresponding to the Fivondronana administrative units. Each health district

[21] Note that the figures show the school expenses of households that actually enroll their children. Some school-related expenses may be discretionary, and parents who choose to enroll their children may also have a propensity to spend more on these non-obligatory school related items. Therefore the expenses that would be incurred by a typical household in each quintile may be lower than the figures shown.

[22] Caution is called for in interpreting the figures for the lower quintiles as they are based on very small numbers of secondary enrollees. For the first quintile, for example, only 21 public and 10 private secondary students are used to derive the school expenditure medians.

[23] The following description draws in part from a more detailed presentation in World Bank (1996).

typically contains 10-15 basic care centers and a hospital. The supply of private formal health care is growing, though primarily in urban areas. This category consists primarily of doctors but also includes private clinics, some dispensaries, and pharmacies. Informal private providers—traditional healers—remain an important source of care in rural areas.

Perhaps the major shortcoming of public health facilities is the lack of medicines. This reflects inadequate spending on health care overall, which remained at about 1 percent of GDP during 1990-1996 (IMF 1997), as well as the small share of the health budget allocated to drugs and pharmaceutical supplies. Consequently, as noted earlier, basic health care facilities are said to be able to meet only 25 percent of their patients' drug requirements. In response to these shortages, the private supply of drugs has risen in recent years, but these drugs may be too expensive for poor households who previously depended on free provisions from public facilities.

2. Rates of reported illness/injury and treatment

a. Illness and consultation rates by expenditure quintile, zone, and gender

The health module of the household survey records information on whether an individual experienced an illness or injury in the two weeks prior to the interview and the treatment sought, if any. Table 6 reports the incidence of illness/injury and type of treatment by household per capita expenditure quintile. This table refers to all ages and all Madagascar. Overall, 0.14 percent of the sample was reported to have had some kind of illness or injury in the last two weeks. The percentage ill increases with expenditure quintile, a standard pattern in developing countries that reflects the subjective nature of self-reported illness data. It does not mean that the poor are actually healthier, but rather that the better-off are more likely to recognize and report their own illnesses.

The next row of the table shows the percentage of ill individuals in each quintile who seek some sort of professional care. Note that this includes both formal care (from hospitals, basic care facilities, or private formal providers) and informal private providers, i.e., traditional healers. The percentage seeking curative care rises with quintile, from 34 percent for the lowest to 45 percent for the highest. More affluent individuals therefore are more likely both to report an illness and to seek treatment if they are ill. Further, the table shows that when seeking treatment they are somewhat more likely than those who are poor to seek formal care, i.e. less likely to consult a traditional healer.

There are also income-related differences in the type of formal care sought. Most importantly, individuals in the top quintiles who seek formal care are much more likely than those in lower quintiles to consult a private formal provider. Among the poor, the vast majority of those seeking treatment rely on the public sector (hospitals or basic care facilities).

In Table 7 we present the same information separately for rural and urban areas. In both areas, poor individuals who are ill are less likely to seek care than the well-off, though this difference is much less pronounced for rural areas. Overall, rural residents are far less likely

than urban dwellers to seek care when ill: the average percentages of ill individuals consulting a provider are 34 and 53 percent for rural and urban areas, respectively.

The table also indicates that the type of provider consulted tends to differ between rural and urban locations. Basic care facilities are by far the most important source of curative health care in rural areas, accounting for almost half of all visits to health care providers. Note as well the much higher percentages for formal private care, and lower percentages for informal private care, for urban residents compared to rural residents. Since private doctors are generally located in urban centers, the greater frequency of private formal provider consultations in urban areas is not surprising. We should note that hospitals, in urban as well as rural areas, serve mainly as a source of outpatient services, including basic or primary care: only about 5 percent of all hospital visits are inpatient visits, that is, involving an overnight stay.

Finally, we performed additional calculations on the data, segregating by gender. These calculations (not shown) did not reveal any pattern of male-female differences in either the propensity to report an illness or the likelihood of treatment if ill. Therefore there is no evidence of gender differences in access to health care.

b. Incidence of public health care services

Next we briefly look at the incidence of public health services. Although the preceding tables show the quintile mean percentages of individuals seeking care at each type of facility, these means are conditional on reporting an illness. Since the likelihood of reporting an illness is itself a function of income, the conditional mean percentages do not provide an accurate picture of incidence. To assess the shares of heath services benefits accruing to different income groups, it is better to compare utilization rates per capita, i.e., relative to the entire quintile population. Hence in Table 8 we show the per capita utilization rates for public (as well as private) providers. Also in contrast to the previous table, this table includes visits for both curative as well as non-curative care, though it does not include pre- and post-natal care or vaccinations for young children.

Utilization per capita of public facilities increases with expenditure quintile. Individuals in the poorest quintile are only about half as likely as those in the richest quintile to seek care at any public facility (third row); this reflects differences in the use of basic care facilities more than hospitals. Hence the distribution of public health care services, far from being well-targeted to the poor, is per capita regressive.[24] Further, since the rich are also more likely to receive care from private formal providers, the overall distribution of formal care (public or private), and thus presumably also health status, even more strongly favors the well-off.

[24] This accords by and large with the analysis in World Bank (1996) that used government expenditure data rather than simple utilization indicators to value the health care benefits. However, that study found that among public providers, the hospital subsidy rather than the basic care subsidy was the more regressive per capita. Note again that we are considering only *per capita* incidence, that is, the benefit shares of different quintiles relative to their shares in the population (see note 16). Relative to the distribution of *expenditures* rather than population, the World Bank study finds that public health services are somewhat progressive.

3. Household expenditures per illness

Table 9 shows by provider type and expenditure quintile the average expenditures on treatment per illness. These expenditures, which are collected in the health module of the household survey, include the cost of the visit (or visits) plus transportation costs. To put these costs in perspective the table also shows the quintile means for household monthly expenditures. Looking first at the average for all quintiles in the last column, the ranking of providers by cost of treatment follows the expected pattern. In particular, among formal providers, private formal care (mostly doctors) is by far the most expensive (5,480 FMG per illness), followed by hospital and basic care (2,222 and 1,367 FMG respectively). Expenditures per illness appear to be higher for the wealthy in the private care categories (both formal and informal) but this is less evident for hospital and basic care. For the latter this means, of course, that in relation to household income the poor incur a substantially greater burden. However, even for the lowest quintile, the costs appear quite small in relation to monthly expenditures. For example, the costs for (outpatient) hospital treatment of an illness amounts to only 4 percent of mean monthly household expenditures for this quintile. Further, the averages disguise the fact that in the majority (almost 60 percent) of cases of hospital care the reported costs of treatment, including transportation, are actually zero. Fees are not usually charged at public health facilities, so this is not surprising. The same holds for basic care, also largely public, for which reported treatment expenses are zero for 62 percent of cases.

However, there is little doubt that these reported treatment costs underestimate the true financial burden to households of treating an illness. The survey only gathered information on the "costs of consultation" and transportation expenses. It is common for patients at public facilities to pay for their own medicines and other supplies, and they often also make an informal payment to the medical personnel involved in their care. It is likely that some or most of these expenses (particularly for medicines) are excluded from the reported consultation cost. Equally significant, as with the education expenses discussed above, indirect costs are not included. In rural areas in particular, health care facilities (especially hospitals) may be some distance away from an individual's place of residence. Combined with a very poor road system and lack of easy means of transport, this can translate into a significant amount of time to travel back and forth to receive care.[25] Since this is time that could potentially have been applied to productive work in the home, on the farm, or in a wage job, there is an additional cost in terms of lost output or income. The EPM community survey conducted in conjunction with the household survey, discussed in detail in a later section, does provide information on distance and time to health care providers in rural areas. As discussed in that section, for public providers the estimated indirect costs of treatment are indeed quite significant, and substantially larger than the direct costs.

C. Access to education and health services: summary

The descriptive analyses in the previous two sections lead to a number of general observations about access to education and health services.

[25] The lack of reported transportation expenses does not indicate that travel to seek care is not a factor; rather, it is common for people walk to health care facilities.

First, there are significant differentials by household income (or expenditure) level and location in the use of these services. Poorer individuals are less likely than the well-off to seek treatment for an illness and poor children are significantly less likely to be in school. With regard to location, school enrollments and rates of curative health care consultations are much lower in rural than urban areas, reflecting rural-urban differences in average incomes and possibly, in provider availability. Since rural households are generally poorer, a strategy of targeting public expenditures in education and health to rural areas would disproportionately benefit the poor. Note, however, that more than three-fourths of the Malagasy population is rural. Within rural Madagascar itself there are significant disparities in income, and the gaps in school enrollments in particular between the poorest and richest quintiles of the rural population are very large. Therefore inequalities in access to services within rural areas (as well as within urban areas) also need to be recognized and addressed by policy.

Second, with the exception of primary school, the incidence of public education and health services is currently per capita regressive. That is, public school enrollments and curative care consultations per person are higher for upper expenditure quintiles than lower quintiles, sometimes extremely so (as for secondary and university schooling). Even the distribution of public primary schooling is not well targeted to the poorest Malagasy as it is only mildly progressive. Questions of benefit incidence of public services by income group cannot be separated from questions of location and placement of services: many key public services, such as secondary schools and hospitals, tend to be located in urban centers, where households are relatively well-off.

Third, private alternatives to public services, for both education and health, are used disproportionately by wealthier households. Based on this static analysis, we might conclude first, that private providers are not a viable alternative for the poor, and second, that continued expansion of the private education and health sectors will disproportionately benefit the well-off, making the distribution of human capital even more unequal. However, while plausible, these conclusions cannot be inferred with certainty from purely descriptive analysis. In particular, the current low utilization of private providers by the poor may reflect a lack of local access, not just the higher costs of private providers. If private expansion occurs in areas not currently served by the private sector, the poor may benefit. As described below, for primary schooling and health care, the data and behavioral (demand) model estimates permit us to address this question through simulations of the impacts of private sector expansion on the level and distribution of enrollments and health service utilization.

Fourth, the financial burdens associated with enrolling a child in school and treating an illness (measured in relation to household per capita expenditures and total monthly household expenditures, respectively) are generally much higher for poorer households. This is the case both for public education and health care providers and more expensive private providers, and it occurs despite the fact that the rich pay substantially more in absolute (i.e., FMG) terms.

Finally, and favorably, few gender differences were found either in school enrollment rates or the likelihood of treating an illness. Unlike in many developing countries, therefore, girls and women in Madagascar in general are not disadvantaged with respect to access to these

social services. One exception is that among the poorer quintiles, girls are somewhat less likely than boys to attend secondary school.

III. DEMAND FOR EDUCATION SERVICES: PRIMARY SCHOOL CHOICE

A. Introduction

The remainder of this study is devoted to the econometric analysis of the demand for public services, beginning with education. We first estimate the determinants of the choice of primary school, and in the next section turn to the analysis of secondary enrollment decisions. As noted earlier, the last two decades have witnessed declines in primary enrollments in Madagascar after earlier successes in expanding access to education. Given the importance of improving human capital as a means for increasing economic growth and reducing poverty, there is much to be gained from an understanding of the factors affecting enrollment overall as well as the choice between public and private primary school.

As seen earlier, primary enrollment rates are much lower among rural children than urban children. There are a number of possible explanations for low rural enrollment rates, including low household incomes, poor quality of schools, and the distance to schools. For our analysis, we are able to take advantage of a community-level survey, collected in (primarily) rural areas in conjunction with the 1993 EPM household survey, that includes information on primary school availability and a number of quality-related school characteristics. The descriptive analysis of these school data is of significant interest in itself as it provides a picture of the current condition of rural public and private primary schools. But further, the availability of school information offers an opportunity to formally (that is, econometrically) assess the role of factors such as distance to schools and school quality on primary enrollments. Given the informal evidence suggesting that deteriorating public school quality has played a role in recent enrollment declines, the effects of quality are of particular interest.

A number of solutions to declining enrollments (and to the problem of inadequate public resources for education) have been suggested for Madagascar and other countries. Among these are proposals to raise school fees to finance improvements in school quality or in access to schools (through construction of more schools), and allowing the private sector to fill the gaps in public school coverage. To assess these policy options, we use the estimates from the primary school choice model to perform a number of policy simulations. First, we simulate the enrollment impacts of fee increases for public primary schools. Second, we simulate the impacts of quality improvements, providing an indication of the scope for reversing enrollment declines by making improvements in public schools. We also address the feasibility of raising school fees to pay for these quality improvements. Third, we simulate an expansion of private primary schools to address the question of whether the growth of private (and more expensive) education alternatives will significantly raise primary enrollments, especially among the poorest rural households. Since distributional concerns are central to this analysis, all the simulations explicitly consider differences by (rural) household expenditure quantile in changes in enrollments.

B. Methodology

For the econometric analysis of the determinants of primary school choice, we match individual and household information from the EPM household survey to data on primary

schools from the community survey. We estimate the determinants of primary school choice, that is, the impacts of household characteristics and school factors such as price and quality on decisions to send a child to public primary school, private primary school, or not to enroll the child at all. We approach this problem using a now standard empirical methodology for analyzing discrete choice among competing alternatives; the method is essentially the same for the analysis of choice of health care provider in a later section of this report. We use a nested logit model to estimate the determinants of primary school choice. A generalization of the simpler (non-nested) multinomial logit model, the nested logit model is more flexible in that it allows us to group related choices together. For example, we would expect the public and private primary school options to be more closely related to each other than to the non-enrollment alternative. In more technical terms, the nested model allows the error terms for related choices to be correlated, whereas the simpler logit model assumes all error terms (i.e, all school choices) to be independent. Following standard practice in the literature on school choice, we group the alternatives so that the error terms of the schooling choices, which in the present case consist of public school and private school, are permitted to be correlated.

Another aspect of the estimation technique we employ is that it accounts for the fact that not all individuals have access to both types of schools. As discussed below, private primary schools are not locally available to the majority of rural children in the sample. Not taking this into account in the estimation would lead to misleading parameter estimates, as the estimates would conflate the effects of the independent variables with the effects of access to schools. For example, the demand for private schooling may be a positive function both of household income or expenditure and the proximity to private schools. The latter will be correlated with income if private schools tend to be located in more affluent communities. In assessing the role of changes in income on demand, therefore, it is important not to confuse this effect with that of access which is related to income.

Finally, the specification of the estimating equations in the model should be flexible enough to allow price responses to differ with income level. Such differences are usually empirically validated—specifically, the poor are usually found to be more sensitive to changes in prices than the non-poor. This will have important implications for the distributional outcomes of pricing policies. A number of specifications provide this flexibility; we choose a particularly simple one. The functions are linear in income, household, and provider characteristics, but interact the provider prices with dummy variables for each household's per capita expenditure quartile. The latter equal 1 if the individuals' household falls in the given quartile and zero otherwise. Thus the model allows price responses to differ across income groups. [26]

A complete technical presentation of the econometric method and the underlying theoretical model is presented in Appendix A.

[26] Note the use of quartile rather than quintile dummies for the interactions. While interacting price with quintiles (or even finer divisions of the expenditure distribution) would allow greater non-linearity in price responses, the estimates in such specifications proved to be sensitive to price outliers.

C. Data and Descriptive results

1. Data Issues

School costs

From a policy perspective, the costs of the school alternatives are among the most important variables in the model. However, it is often difficult to obtain an accurate measure of schooling costs from survey data. These costs include both direct expenses —on fees, transportation, books, and other school-related items—and the indirect costs of the schooling. Indirect cost, or equivalently, opportunity costs, is the income or output the household gives up when having the child attend school instead of doing work on the family farm or in the home (or more rarely, in wage employment). The EPM, like many other household surveys, collects information on direct costs, i.e, household education expenditures, for each enrolled student. These were examined in the descriptive section above. We use the community (Fokontany) median values of these costs for each school alternative to represent the direct costs of local public and private schools.

More troublesome are the opportunity costs of schooling. In rural areas of Madagascar some 40 percent of boys and 30 percent of girls age 7-14 participate in income-generating work, primarily in agriculture. [27] For girls of this age, household work is also significant. Therefore opportunity costs may be important for many children of primary school age. These costs are calculated as the hours of market or home production foregone when the child attends school multiplied by the price of the child's time (the implicit wage).[28] Foregone work time is usually estimated simply as the average difference in the hours of productive work performed by non-enrolled and enrolled children. The price of a child's time is typically obtained from wage regressions on the sample of children in the wage labor force or, more simply, is represented by the local agricultural wage rate for child labor. However, where few children actually work for a wage, obtaining an accurate measure of the value of time is difficult.[29] This was the case for our sample. Barely 100 rural children between the ages of 6 and 15 were reported to be working for a wage in the EPM survey. This sample was simply too small to obtain good measures of the cost of children's time.[30] Therefore we include in the model only the direct schooling costs

[27] See Glick (1999).

[28] That is, the annual indirect cost of schooling is $w_i * T_{ij,}$ where T_{ij} equals the annual hours of work of the child given up to attend school alternative *j* and w_i is the value of the child's time, i.e., the child's potential hourly wage or the marginal product of an hour's work in the home or on the family farm. Letting P_j represent the direct costs of school option *j* (fees, transportation and other schooling expenses), the total cost of the school option for individual *i* is therefore equal to $P_j + w_i * T_j$.

[29] In principle, the implicit value of time of children could be obtained instead from estimates from production functions for family agriculture, in which rural children are employed in larger numbers. However, this is a complicated task with a host of its own practical difficulties, and it is rare for schooling demand studies to attempt to get estimates of the cost of children's time in this way.

[30] The wage regressions had almost no significant coefficients other than for several of the dummy location (Faritany) variables. When opportunity costs were calculated using predicted wages and included in the cost variables used in the logit models, the coefficients on cost often had the wrong (i.e., positive) sign. Simply using mean child agricultural wages for the child's Faritany yielded similarly poor results.

(community median annual expenditures per student on fees, transportation, supplies and other school related items) of each alternative.

Missing data

As noted earlier, our econometric analysis matches individual and household information from the EPM household survey to data on primary schools collected as part of the community survey. In the latter, information was collected for each Fokontany on the schools (up to a maximum of three) used most frequently by children in the Fokontany. For each of these schools the following was reported: distance and transportation costs, maximum class size, numbers of students and teachers, sharing of rooms by different classes, and several indicators of facility condition. Since three schools could be listed, the survey was able to capture the relevant public schools as well as private providers in the Fokontany.

However, it can be inferred from the household survey data that at least some rural children are attending private primary schools that are not enumerated in the community survey. Presumably these schools were not enumerated because they were relatively "unimportant" compared with the listed schools. This is borne out by the fact that in communities where no private primary schools are listed in the community survey but in which we nevertheless find private students in the household data, the number of private students is low: in fact, in about half of such cases the community has just one recorded private student.

Still, for our econometric estimation of primary school choice, which uses school characteristics gathered from the community survey, these cases obviously represent a missing data problem: we lack information on the schools attended by some (if very few) members of the community. In other cases we faced essentially the opposite problem, this one also usually involving private schools: the school type was listed in the community questionnaire, but none of the households interviewed in the community had children attending it. Hence we were not able to use the household survey data to construct a local price (community median school costs) for these schools. For the estimations, we exclude communities with either of these data problems. This results in a sample reduction from 2,675 to 1,820 children age 6 to 12.[31] As always when dealing with sample reductions for data reasons, it is necessary to be aware of the potential for selectivity bias in the parameter estimates. This will occur if the dropped communities differ systematically from those that are included in the estimation in terms of unmeasured characteristics that affect schooling demand.[32]

[31] This does not include a prior sample reduction of 145 children in communities where school characteristics could not be matched to information on school type, typically because a different number of schools were recorded in the separate files for school type and school characteristics. The sample also excludes children still in pre-school and those who have already graduated primary school by age 12.

[32] Note that we do not simply drop the *individuals* who attend non-listed schools (to handle the first data problem) or exclude listed but "non-attended" schools from the set of school choices (to handle the second problem). This would almost certainly involve more serious selectivity problems. In the first case we would be eliminating individuals who, given that they find it worthwhile to travel some distance to a presumably better non-local (typically private) school, likely differ from the remaining sample in terms of their preferences for education. In the second case, we would be misrepresenting the actual choices available to individuals in the community. Instead of dropping individual observations (and schools) in this way, therefore, we exclude the communities that had partial information for either of the reasons described.

2. Enrollment rates and school availability

Table 10 shows non-enrollment and public and private primary enrollment rates for the estimating sample of children age 6 to 12 by rural household per capita expenditure quartile. Since the sample is largely rural, the quartile divisions used are those generated from the sample of all rural households. Similar to what we saw earlier in the descriptive section on education, there are large differences by income level in primary enrollment status. 59 percent of the children in poorest quartile do not attend school, compared with just 31 percent in the richest quartile. Private primary enrollment is far less prevalent than public enrollment, accounting on average for only about 18 percent of all enrollments for this sample. However, this ratio rises sharply with expenditure quartile. For the richest quartile, the ratio of private to total enrollments is 0.26 compared with only 0.14 for the poorest.

The table also shows the percentage of individuals with public and private primary schools locally available. A school type is considered to be "available" if such a school is listed in the community survey as one of the schools (out of a maximum total of three) most frequently used by residents of the community. The table indicates that although public primary is almost always available, the portion of the sample with a private option in this largely rural sample is generally low—23 percent on average.

These figures refer to the estimating sample. As just explained, this sample excludes communities for which private schools are not listed but for which one or more private primary students are found in the corresponding household data. If we included such communities in the sample and defined private primary school availability to mean either that the school is enumerated in the community survey *or* that a local child is reported to attend a private school, the portion of the sample with a private school available is substantially larger—44 percent—though still well below public school availability. However, "availability" is a relative term. The broader definition includes many communities in which, as noted, there is a single private primary student attending a school not listed in the community survey. In such cases the private school is presumably not local and realistically may not be a feasible alternative for most households in the community. Hence in practical terms the difference in private school availability in the full and estimating samples is most likely not as dramatic as it appears from the numbers just cited.[33]

Private school availability, while low overall, rises sharply with household expenditure level, especially after the third quartile. In other words, the well-off enjoy superior access to private primary schooling in that they tend to reside in communities served by a private school. Of course, it is not surprising that private schools, which are more expensive than public schools, would be located in areas where household income, hence potential demand, is high.[34] The table suggests that the poor may be less likely to attend private schools in part because they are not easily accessible, rather than because they could not afford them. We will return to this issue

[33] In fact, the ratios of private to public *students* in the full and estimating samples are much closer: 0.21 vs. 0.18.

[34] However, an alternative explanation is that because aggregate demand for private schools is lower than for public, to attract enough students private schools must be located in more densely populated areas. These areas are also wealthier, leading to the observed correlation of expenditure per capita and private school availability.

below, where we simulate the effects on enrollments of an expansion of private schools into areas not currently served by the private sector.

3. The EPM community survey: characteristics of primary schools

Table 11 presents data on primary school costs and other characteristics by type of school and household per capita expenditure quartile. As described above, costs are represented by the community median per pupil education expenditures for each school type, calculated from the household survey. Reflecting in large part the much higher tuition or fees at private schools, these costs are about three times greater for private primary schools than public schools, a relationship that is consistent across the expenditure distribution. However, for both school alternatives, median school expenditures increase with household expenditure quartile. In part this reflects higher fees charged at schools in more affluent communities, but other school expenditures are higher as well.

In the community survey, information on school characteristics was collected for up to three primary schools used by residents of the Fokontany. The table shows the means of the characteristics of the nearest[35]schools of each type (public or private); these are the school attribute measures used in the estimation. First we compare the sample averages for public and private schools, shown in the last column. To the extent that these indicators are proxies for school quality, the figures imply that private primary schools are of higher quality than public schools, though the differences are not always large. The average student-teacher ratio in the nearest local private school is 45, compared with 55 in the nearest public school. Use of the same room by different classes occurs in 56 percent of private schools compared with 67 percent of public schools. Indicators for facility condition show more of a difference. For example, 40 percent of the nearest private schools have windows in "good" condition (none or few broken) compared with just 6 percent of public schools. The condition of the school building is reported to be "good" or "fair" in 87 percent of private schools but only 40 percent of public schools.

With regard to variation in characteristics by household expenditure level, better-off households appear to enjoy access to slightly higher quality public primary schools. With the exception of the student-teacher ratio and maximum class size, the public school quality indicators generally improve as the expenditure quartile rises, though the differences are not very dramatic. For example, among the first two quartiles, the average for the classroom sharing variable is about 0.69 compared with 0.62 for the top two quartiles. In addition, the nearest public school is somewhat closer for wealthier rural households: the average distance is 0.14 kilometers for the highest quartile compared with 0.35 kilometers for the lowest.[36] For private

[35] In a minority of cases there was more than one school of a given type listed in the community survey. In all of these cases the nearest school of each type was also the first one listed in the community survey, hence also (given the structure of the questionnaire) the one most frequently used by residents of the community. An alternative would be to use averages of the multiple schools of each type, though this would probably assign too large a weight to the second (or very rarely) third school listed. The estimation results using averages were in any case similar to those using the characteristics of the nearest schools.

[36] We should note that the reported distance to the nearest public school is zero for the large majority of cases for all quintiles, that is, most communities are served by a public school located right in the village.

schools as well, the table shows that school characteristics by and large improve with expenditure level; these differences are somewhat more pronounced than for public school.

This table, combined with the previous one, therefore indicates the following. First, wealthier rural households enjoy superior access to private primary schools, which our school attributes data suggest are of higher quality than public schools. Second, though here the evidence is weaker, wealthier households also appear to have available to them slightly higher quality local public schools than those available to poorer households. In this sense, well-off rural households are doubly advantaged when it comes to primary schooling options. These differences in availability and quality should affect the relative enrollments of the poor and non-poor quite apart from any direct effects of income.

The data presented in Table 11 also highlight the overall poor condition of primary schools in rural areas, especially public schools. In about two-thirds of the public schools in our sample, different classes must share the same room. Further, the indicators for building condition for public schools suggest that these schools generally are in a state of disrepair, which also may have detrimental effects on the quality of the education children receive. Hence these descriptive results accord with widely expressed concerns about low and declining quality of public schools. [37]

D. Estimation Results

The results of the nested logit model of primary school choice are show in Table 12. Because of normalization, the estimates in the model are to be interpreted as showing the effect of the explanatory variables on the utility from a particular school alternative (public or private) relative to the utility from the base option, non-enrollment.[38]

The estimates for the price variables in the model—annual school costs interacted with per capita expenditure quartile—are generally negative, as expected, and by and large statistically significant. For public school, the price coefficients fall sharply in absolute value as the level of household expenditures rises, indicating that poorer households are more sensitive to price. A noted, this is a typical finding in studies of provider choice in developing countries. A similar pattern is seen for private school—in fact, the estimated private school price effect actually turns positive for the highest quartile, though the coefficient is not significant.

The distance to the nearest school has the expected negative effect for public school but no effect for private school. This may indicate that parents are less sensitive to variations in distance to schools of higher perceived quality (i.e., private schools). However, the lack of a result for private school may reflect in part the way information on providers was collected. Schools that were far away (which would tend to be the case more often for private schools) were more likely to be excluded from the list of the most important schools recorded in the community survey, hence from the set of choices in the model. If information was available on

[37] Unfortunately, the EPM community survey did not collect data on other measures of quality such as availability of supplies and teacher education.

[38] See Appendix A for further details.

the distances to these far away schools, we might find more of an estimated impact of distance to private schools.

The estimates for the school attributes indicate that—for public primary school—school quality plays a significant role in parents' decisions about schooling for their children. The use of the same classroom by multiple classes has a strongly significant negative impact on utility from public school. Classrooms in most rural primary schools are small while classes are large (as seen in Table 11 the average maximum class size is 45 in public schools), so it is not hard to imagine a negative effect of room sharing on children's ability to learn, hence also on the demand for public schooling.[39] Good condition of windows, which may be acting as a proxy for overall facility quality, has a significant positive impact. For private school, on the other hand, these characteristics do not have significant effects. It is possible that incremental school improvements have larger effects on student achievement when quality is low, in which case the effects on demand of such improvements will be larger for the lower quality alternative. Hence the difference in the effects of school characteristics on public and private school demand may reflect lower quality in the public schools.[40]

Although our results for school quality are in line with expectations, it is possible that the coefficients on the school attribute variables are picking up the effects of unobserved community factors that affect both local school quality and the demand for schooling. This is a concern in part because the quality of a Fokontany's public primary school may be a function of the level of local financial support coming from parents, hence of preferences for schooling. If the errors in the individual utility functions incorporate community level preferences that are correlated with local school quality, the estimates will yield upwardly biased measures of the impact of school quality. To assess this possibility, we added several variables to the model to control for the community environment (hence the determinants of overall schooling demand), including the average education of household heads, median Fokontany household per capita expenditures, and an indicator of urban location. The introduction of these additional variables had only minor impacts on the estimated effects of school characteristics, including distance (results are not shown). Therefore the endogeneity of school quality does not seem to be a serious problem in our estimates.

The coefficient on the dummy variable for being female is not significant, indicating that gender has no impact on the choice of public or private primary school. Since the estimates measure the effects of the variable on utility from each school choice relative to non-enrollment, this is equivalent to gender having no impact on overall primary enrollment, consistent with the similar enrollment rates for boys and girls reported earlier. As expected, parents' schooling raises the demand for both public and private primary school relative to non-enrollment. For

[39] The estimate reported here is consistent with the results of Michaelowa (2000) who, using a pooled sample from four African countries (including data from Madagascar that are different from the data used here), finds a negative effect on learning outcomes of a similar room-sharing indicator.

[40] Initial specifications also included the ratio of the total number of students to the number of teachers, which had no effect for private school but for public school gave the "wrong" — i.e., positive—sign. The latter result may simply be a reflection of the fact that high local demand for a school results in larger class sizes. Hence this "quality" indicator is particularly susceptible to simultaneity problems. For this reason, and because of missing or unreliable data (e.g., zero students or teachers reported for the school) for a number of cases, we dropped this variable from the final specification.

both parents and for both school choices, secondary school attainment (which is rare in rural areas) has stronger effects than primary school.

With regard to the effects of income, initially a more general specification was estimated that allowed the effects of household income (represented by household per capita expenditures) as well as price to vary by expenditure quartile. In this specification, household expenditures were entered in linear spline form. However, a log-likelihood ratio test could not reject the equality of the expenditure effects for different quartiles. Therefore the equality restriction was imposed in the estimation; that is, per capita expenditures of the household was entered in simple linear form in the model.[41] Still, to assess the effects of the level of household expenditures on school choice, it is necessary to account for non-linearities arising from the interactions of the expenditure quartile dummies with prices. A straightforward way of doing this is to compare predicted enrollment probabilities for different expenditure quartiles. In calculating these probabilities, the household per capita expenditure variable was set to the mean for the quartile and all other variables were set equal to the overall sample means.

These calculations indicate that the level of household expenditures has large impacts on overall primary enrollment probabilities: controlling for other factors, the probability of enrolling in primary school for a child in a household with mean expenditures of the richest quartile (429,005 FMG) is almost double that for a child with mean expenditures of the poorest quartile (100,844 FMG).[42] The calculations further show that where the private school option is available, the increases in enrollments come largely though changes in private rather than public schooling.[43] This indicates that there is a strong effect of income on private schooling that is independent of the association of income with private school availability.

Among the household composition variables, increases in the number of children in the household reduce the demand for private schooling but not public schooling. A negative effect of the number of children is a common finding in empirical work on schooling in developing countries and is usually attributed to the fact that, all things equal, there are fewer resources available per child in larger families.[44] Location matters as well. Relative to Antananarivo, residence in the province (Faritany) of Toamasina raises the demand for either primary school type while residence in Fianarantsoa and Toliara lowers it. These Faritany dummies may be capturing income or wealth differences (even with household expenditure entered directly into

[41] We obtained a similar test result in the case of the health care provider choice models reported below. Hence in that case also the household's expenditures per capita were entered linearly.

[42] For example, considering the sample with only public schools available and holding all other variables at the means for this sample, the predicted primary enrollment rate rises from 0.31 to 0.57, an 84 percent proportional increase. For the sample with both public and private schools available, the proportional increase in the overall primary enrollment probability is not as large, in part reflecting the fact that the predicted probability for the lowest quartile is higher for this sample.

[43] For the sample with both private and public schools available, 80 percent of the predicted increase in overall primary enrollments come from increases in private enrollments.

[44] Alternatively, rather than causality from family size to schooling, it may reflect heterogeneity among households: "traditional" parents who prefer larger numbers of children may also have low preferences for schooling. On the other hand, the fact that that the negative effect is seen only for the more expensive private option supports the explanation based on lower resources per child in larger families.

the model): in particular, Toliari is the poorest province in Madagascar. Alternatively, they may be reflecting unmeasured regional differences in school quality.

Finally, the value of σ is between 0 and 1, indicating that the nested logit model structure grouping public and private choices together is appropriate (see Appendix A) . However, σ is not significantly different from 1, meaning that the errors of the public and private school alternatives are (in a statistical sense) uncorrelated.

Price elasticities

Because the nested logit model is nonlinear in the data and parameters, it is not possible to gauge the magnitude of the price effects directly from the parameter estimates themselves. Instead, these must be computed from the estimates and the data. This is done in Table 13, in which we calculate price elasticities for public and private schooling by expenditure quartile. Since the responses to price changes will depend on the availability of alternative choices, we calculate the elasticities for the full sample (for which a public school but not necessarily a private school is available) and the subsample of observations in communities with both a public and private school option.[45] The table shows the quartile means of the own (direct) and cross-price elasticities for each school alternative.[46]

Columns 1 and 2 show the public school price elasticities calculated for the full sample. Overall, the demand for public school is relatively price inelastic. The mean elasticity is -0.25, meaning that a doubling of cost would lead to a 25 percent proportional decline in the probability of enrollment (i.e., in the predicted enrollment rate).[47] However, there are very large differences in the quartile means, reflecting the pattern in the parameter estimates. The elasticity declines from -0.51 for the poorest quartile to essentially zero for the richest. Thus the poor are far more sensitive than the well-off to changes in the cost of public primary school, a pattern with implications (brought out in the simulations to follow) for the distributional effects of an increase in public school fees. The cross demand effects on private school enrollment shown in the second column appear to be very small, but this reflects the fact that for most of this sample private school is unavailable.

Columns 3 and 4 show the same elasticities for the smaller sample for which both school options are available. Here the cross-price effects are larger, indicating that households will switch to private schools—if available—in response to increases in public school costs. For this sample the private price elasticities are also calculated (last two columns). These are larger on average than those for public school, but as with public school, they decline in absolute value

[45] Actually, the first set of calculations exclude one community (containing about 2 percent of the sample observations) which lacks a local public school.

[46] The own price elasticity for a school alternative shows the percentage change in demand for the alternative (the enrollment probability) from a 1 percent change in its price. The cross elasticity of alternative j with respect to alternative k shows the percentage change in demand for j from a percent change in the price of k.

[47] This in part reflects the use of direct costs rather than total (direct and indirect) school costs in the elasticity calculations. The elasticity is the derivative of probability with respect to price times the ratio of price to probability. If the elasticities were calculated instead using the full cost of schooling, the price level would be higher and so would the calculated elasticities.

with expenditure quartile. The positive calculated elasticity for the top quartile reflects the positive, but insignificant, price coefficient for this quartile in the nested logit model.

E. Policy Simulations

1. Fee increases for public primary schools

As noted earlier, higher fees for public schooling (or the institution of fees for schools that are currently free) have been proposed as means of dealing with tight education budgets as well as funding much needed quality improvements. Later simulations will address the possibility of cost recovery for quality improvements; for now we focus on the effects of price increases alone on enrollments.

The low mean price elasticity of demand for public school suggests the possibility of imposing modest increases in fees without serious consequences for average enrollment levels. On the other hand, the greater estimated responsiveness of the poor to schooling costs raises concerns about the potential distributional outcomes of such a policy. To examine this more closely, tables 14 and 15 report the results of simulations of public school fee increases of different amounts. The first table shows the effects of raising public school fees by 1,000 FMG (about US $ 0.50) over current levels. This is fairly modest as a fraction of overall annual household per child expenditures for public school, which amount to slightly over 6,000 FMG. However, that amount includes both fees and other household education expenditures. The average fee charged at public schools is only 586 FMG (758 FMG if we count only the 79 percent of the sample for which the community median public primary fee is positive). Hence a 1,000 FMG increase would correspond on average to more than a doubling of current fees.

The table shows for public, private, and overall primary schooling the quintile mean initial enrollment probabilities (i.e., the predicted probabilities at current school costs), the predicted probabilities after the change in price, and their difference, the change in probability.[48] We will also refer to the last of these as the absolute or percentage point changes in probability, to distinguish them from proportional changes. The bottom row of the third column indicates that public school enrollment rates decline by an average of 1.4 percentage points as a result of a 1,000 FMG increase in cost. The average proportional decline is about 3 percent (i.e., .014/.44).[49] The differences by expenditure quartile are significant. The enrollment rate falls the most for children in the first quartile (2.7 percentage points) while for those in the richest quartile there is almost no reduction. In proportional terms, the declines are also much larger for the lower quartiles.

[48]The simulated changes in enrollments in this and succeeding tables are based on the probabilities calculated using the estimated parameters of the nested logit model and the data. The probabilities are calculated for each individual in a quartile and the averages are taken to get quartile mean enrollment rates and the changes in them.

[49] This proportional decline of just 3 percent might seem small in view of the magnitude of the price elasticity reported above (-0.25), which implies that a doubling of cost would reduce the enrollment probability by a more than one-fourth. However, the experiment considers a doubling (or more) of *fees*, not total costs (all school expenditures). Fees constitute only a small portion of the household's total costs of sending a child to public primary school, so the actual percentage increase in costs is small.

The latter pattern derives directly from the higher public school price elasticities of poorer households, since a higher elasticity implies a larger proportional change in demand from a given percentage increase in price. There is further implication: mathematically, a greater proportional decline in enrollments for the poor than for the non-poor implies that the poor's share in total public enrollments falls. In other words, the incidence of public primary schooling becomes less progressive as a result of the price increase. [50] Note that in making this inference, we are assuming that the benefit from schooling can be measured in terms of 0,1 enrollment indicators.

Of equal – or even greater – concern as the impacts on public enrollments are the impacts of a public school fee increase on the level and distribution of *overall* (public plus private) primary enrollments. These will depend on the level and variation across quartiles in the cross-demand elasticities (the effect on private enrollments of a change in the public price) as well as the variation across quartiles in the availability of private alternatives. The increases in private enrollments, while small overall, are actually largest for the bottom quartile (column 6). This occurs despite the greater availability of private schools for wealthier quantiles and reflects the larger cross-price demand elasticities of poorer households. Nevertheless, the absolute and proportional reductions in overall primary enrollment rates from the public fee increase, like those for public school alone, are largest for the bottom two expenditure quartiles.

The changes in enrollments are quite small from the level of fee increase considered in the simulation. Because the demand for public primary schooling is relatively price-inelastic, modest increases in fees are possible without serious consequences for average enrollment levels, though as just seen they will have undesirable distributional effects. However, it should be pointed out that a 1,000 FMG increase would not go far towards effective cost-recovery, as it represents a very small percentage of the estimated 50,000 FMG the government spent per primary student in the year of the survey (World Bank 1996). [51] What then would be the effect on enrollments of more substantial price increases?

Table 15 shows the effect of instituting an across the board fee of 5,000 FMG per year, representing about 10 percent of the government expenditures per student. The total direct costs of public school are currently about 6000 FMG, so the imposition of a 5,000 FMG fee would represent somewhat less than a doubling of current direct costs. Even with such a policy, public schools would remain significantly less expensive than rural private primary schools; as seen above, the mean cost of the latter is about 17,000 FMG. Here we see more significant declines in demand. Public enrollments fall by about 6 percentage points, a 13 percent proportional decline. The increase in private enrollments does not compensate for the decline in public schooling; hence the overall primary enrollment rate drops from 52 percent to 46 percent. Thus a price increase of this magnitude would, at least in the absence of accompanying school improvements, have non-trivial impacts on primary enrollments in public school and overall.

[50] We should emphasize that this statement refers to *changes* in incidence, measured as quantile shares in total enrollments. It does not mean necessarily that "a fee increase is regressive" as that term is used (in the public finance literature) to indicate that the welfare loss from a price increase would be greater for poorer households; this does not follow logically from higher elasticities for the poor. See Dow (1995a) on this point.

[51] Note that this figure is the national average and probably overestimates the subsidy for rural areas.

The table also indicates that, as before, the enrollment declines would be greatest for children at the lower end of the expenditure distribution.

Before moving on to the other simulations, two points should be made. First, the foregoing conclusions (and subsequent conclusions) about changes in the level and distribution of school enrollments strictly apply to the rural population only; the rural focus is dictated by the scope of the community provider survey which, with some exceptions, sampled only rural communities. Of course, in a country that remains largely (almost 80 percent) rural this accounts for the majority of the population. Moreover, provided that behavioral responses are similar in rural and urban areas, we would expect the conclusions to generalize in a qualitative sense to the population overall.[52]

Second, it should be kept in mind that the tables report changes in quantile predicted enrollment rates—the number enrolled per number of primary age children—not the number enrolled per capita. The per-child focus is a logical way to look at schooling, as discussed earlier. Also as discussed, however, it contrasts with the approach of a standard benefits incidence analysis, which normally would calculate benefits on a per capita basis. Conclusions about the distribution of school enrollments—and the changes in them—are not necessarily invariant to the choice of a per-capita or per-child perspective; this arises from the fact that lower income households tend to have more children. For example, a smaller percentage point rise in the enrollment rate for the poor compared with the non-poor may coincide with a larger absolute number of poor, or number per capita, becoming enrolled.[53] For the case just discussed of a public fee increase, the ratio of the percentage point declines in the (per child) enrollment rates of the bottom and top quartiles reported in the tables is smaller than the ratio of the numbers of enrollments lost from the bottom and top quartiles. Again, this is because there are more children in the lower expenditure quartiles.

2. Quality improvements

To the extent that the public school characteristics in the dataset are good indictors of school quality, the results show that parents are indeed responsive to changes in quality. The implication for policy is that investments in quality improvements will serve to raise (or restore) enrollment levels. Hence we turn now to simulations of the enrollment impacts of changes in public school attributes. Table 16 shows the effects on public and overall primary enrollment probabilities of the elimination of classroom sharing in all public schools where such sharing currently occurs.[54] Public enrollment probabilities rise an average of 8 percentage points, from

[52] Another aspect of the rural focus is that "poor" and "non-poor" as used here must be considered relative terms. 70 percent of all Malagasy are defined in absolute terms as poor (World Bank 1996) and this designation would apply to almost 80 percent of rural residents. For the purposes of the discussion, "poor" and "non-poor" can be taken to refer to the lower and upper halves, respectively, of the rural expenditure distribution.

[53] In contrast, conclusions about the direction of the changes in incidence (i.e. changes in the shares of each quartile), which as noted are based on comparisons of proportional changes in quartile mean enrollment probabilities, are *not* dependent on the choice of a per capita or per child focus. This is because the proportional change is the same whether divided by the number of individuals or the number of school age children in the quartile.

[54] That is, the variable for sharing of classrooms is set to zero for these observations and the enrollment probabilities for each school type are recalculated

0.44 to 0.52. This is a substantial gain, especially considering that the table shows the averages for all observations, including communities that experience no improvement because classroom sharing does not occur in these communities' public schools. For the sample excluding these cases, the change in public enrollments is 12 percent, a 28 percent proportional increase.

The third column indicates that the public enrollment rates of children in the first two quartiles increase slightly more than those in the top two; in other words, the distribution of the increase in public enrollments, measured on a per-child basis, slightly favors the lower quartiles.[55] One factor contributing to this outcome is that poor households currently suffer from somewhat lower quality local public schools, proxied here by the room sharing dummy, so on balance they benefit most from the improvement. In proportional terms the differences between quartiles are much larger, reflecting the lower initial enrollment levels of the poor. Public enrollments for the poorest quartile grow by 21 percent compared with 12 percent for the richest. Thus the share of total public primary enrollments accounted for by children from poor households rises as a result of the improvement.

Since some households are induced to switch from private to public schools as a result of this improvement, the gains in overall primary enrollments (shown in the last column) are slightly smaller than for public school alone. However, the gains in overall enrollment probabilities, in both absolute and proportional terms, are more pro-poor than the equivalent measures for public school enrollments. This is because the predicted school transitions of poorer children consist largely of moves from non-enrollment to public enrollment, whereas the better-off (relative to the poor) are more likely to simply be switching from private to public school in response to the quality improvement.[56]

Table 17 simulates an improvement in facility condition, represented by the condition of windows. For this simulation we recalculate the choice probabilities after setting the indicator variable for good window condition to 1 wherever it is currently zero. In this scenario too there are large increases in public and overall enrollments—larger, in fact, than in the room share simulation. The public school enrollment rate increases are fairly evenly distributed across expenditure groups, though slightly smaller for the richest quartile. The proportional gains in public and overall enrollments are again especially large for the lower quartiles. However, a word of caution is warranted in interpreting these results. For only about 6 percent of public schools is the window condition dummy non-zero (though as in the case of non-sharing of classrooms there is a positive correlation with per capita expenditures). This may make these results somewhat less reliable than in the preceding case.

Still, a consistent picture emerges from these quality improvement simulations. Policies to raise public school quality will lead to large gains in public primary enrollment as well as overall primary enrollment. Enrollment rates for children at the bottom of the expenditure distribution will increase at least as much, and generally more, than for those at the top. In

[55] If measured on a per capita rather than per child basis, the distribution of the changes in enrollment would appear more favorable to the poor because there are more children in lower expenditure quartiles.

[56] Conversely, a worsening of public school quality implies that the poor will tend to withdraw from schooling entirely while wealthier households are relatively more likely to switch to more expensive private alternatives. This appears to be precisely the scenario that played out in Madagascar beginning in the early 1980s.

proportional terms, the gains are much larger for the poor, whose share in total enrollments increase as a result. This is the case for public enrollments specifically and for overall primary enrollment.

Of course, it is one thing for a policy to make the distribution of public primary schooling more progressive but another to actually eliminate or significantly reduce the large gaps in enrollment rates between the poor and the well-off. In the simulation above, the elimination of room sharing increased the predicted primary enrollment rate from 41 to 48 percent for the poorest rural quartile and from 69 to 74 percent for the wealthiest quartile. Therefore the enrollment rate of the poorest quartile as a fraction of that of the richest rises only modestly, from 60 to 65 percent. It would appear that an improvement in public school quality, despite the benefits demonstrated above, would not go very far toward eliminating the large disparities in schooling between children from low and high income households.

However, this conclusion may be too pessimistic. As we have stressed, these simulations consider rural areas only. Compared with their rural counterparts, urban households are both wealthier and more likely to enroll their children in primary school. It is very likely that they also enjoy better quality public schools, measured not just by facility and crowding indicators but teacher quality as well. Based on the responsiveness of parents to quality shown by the model estimates above, a reasonable inference is that improvements in school quality that target rural areas, or more generally areas where school quality is lowest, will lead on a national scale to a greater reduction in overall schooling inequality than seen in the simulations on rural households only.[57]

3. Fee increases to pay for quality improvements

In this section we address the feasibility of financing quality improvements in the public schools though increases in fees. We do this by examining the effects on enrollments of instituting quality improvements while also increasing school fees by varying amounts. These simulations show the range of feasible combinations of cost-recovery and enrollment increases for a particular quality improvement.[58]

We consider first the elimination of classroom sharing in public schools. Table 18 shows, for public primary and overall primary schooling, the initial quartile mean enrollment probabilities, the probabilities after making the improvement, and the probabilities when the improvement is combined with public school fee increases of 5,000, 10,000, and 20,000 FMG, respectively. Note that the sample for this simulation consists of children in communities for which the public school room share indicator initially equals 1.

[57] Policies of school construction in rural areas that effectively reduce the distance to schools will also be progressive on a national scale, since distance is much more of a constraint in rural areas, which are also poorer.

[58] This exercise can be compared to willingness to pay analysis, which has often been used to address the feasibility of raising fees to pay for quality improvements. Willingness to pay shows the maximum income households would be willing to give up to see a quality improvement made; this is the fee increase that would leave their level of utility the same as before the quality change. Our approach focuses on enrollment levels, not household utility of welfare. We ask, in essence, what fee increase combined with the quality change would leave the mean enrollment probabilities unchanged (and further, what are the possible combinations of enrollment increases and fee increases).

Looking first at public primary enrollments in the upper half of the table, comparison of the first and second rows indicates the large gains in enrollment that would result from the improvement in the absence of accompanying changes in fees. As expected, increasing public school fees reduces enrollments, offsetting some of the gains brought about by the improvement. However, even substantial increases in fee levels will not completely offset the average gains for the sample. As seen in the last column, even if fees rise by 5,000 FMG, the average public enrollment rate remains well above its initial, pre-improvement level. To put this in perspective, recall that this amount is close to the average of the total (fees and other expenses) direct costs households currently incur to enroll a child in public primary school in rural areas. It is also equal to a non-trivial fraction of the per student government expenditure on primary schooling of 50,000 FMG.

This figure pertains to the sample as a whole, however. As comparisons of the lower and upper quartile columns indicates, there is a lot of variation around the sample mean of the change in enrollments, reflecting the greater responsiveness of poorer households to the increases in fees. Fees could not be raised nearly as much for the poorest quartile as for the richest without reducing enrollments of the former to well below initial levels. Therefore the ideal policy of cost-recovery for public school improvements would be one of differential fee increases—i.e., price discrimination—in which fees are raised more for the non-poor (either individuals or communities) than the poor.

Overall (public plus private) primary enrollments are shown in the lower half of the table. The public school fee increase that maintains (overall) enrollments at initial, pre-improvement levels is higher than that which maintains public enrollments at initial levels since some households that are induced to leave the public system will switch to private schools. With regard to the total revenue received by the government, however, the higher fee will be offset by the loss of some fee-paying public students.

The results for improvements in window condition are shown in Table 19. The fee increases that can accompany such an improvement are even larger than in the previous case; the caution noted above about the window condition estimate applies here as well.

These simulations suggest that there is some scope for cost-recovery to finance quality improvements in public primary schools. Fees could be raised significantly to pay for improvements while maintaining average enrollments at least at pre-improvement levels. Of course, policymakers presumably would want both to raise school quality and increase enrollments.[59] In determining the appropriate level of cost recovery (what fee, in any, to impose), policymakers would have to weigh the benefits of the higher enrollments that quality improvements can bring against the need to have households help finance the improvements, which cuts into the gains in enrollment. In addition, as shown, the fact that the poor respond more strongly to changes in the costs of schooling raises a separate concern. In order for the

[59] It is conceivable that in some contexts policymakers would actually accept an outcome involving constant, or even reduced, enrollments if those who are enrolled—those willing to pay the higher costs—receive a higher quality education. This may be plausible for secondary or university levels, but for primary schooling in Madagascar it is clear that raising enrollments—if only to restore them to earlier levels—is an important policy objective.

policy to avoid undesirable distributional outcomes, the additional fees would need to be lower for poor households (or poor communities).

The limitations of these exercises should be made clear. We do not have data on the costs of making the indicated improvements, and these will certainly be significant. For example, a reduction in the need for classes to share rooms implies the expansion of existing facilities, if not the construction of new ones. Further, the estimated impacts of changes in the measured school characteristics may be capturing a range of correlated quality factors. This may in part be behind the very large estimated effects on demand, particularly for the window condition indicator. The expenditures on improvements needed to achieve the estimated enrollment increases may therefore be larger than the cost of remedying just the observed deficiencies.

4. Expansion of private schools

Next we address a very different "policy": the expansion of private primary schools into communities that currently are only served by public schools. It is sometimes suggested that the private education sector in developing countries be encouraged as a way to fill shortfalls in coverage or quality of the public schools (see, for example, Alderman *et. al*.) Indeed, in Madagascar, private primary education has expanded in recent years, apparently reflecting dissatisfaction with the declining quality of public schooling (World Bank 1996). Although private schooling would seem by definition to be a market phenomenon rather than a tool of public policy, governments can have a major impact on the growth of the private education sector. At the extreme, it can simply outlaw private education, or, less drastically, restrict it to varying degrees through regulation. Alternatively, governments can (and usually do) subsidize the private sector directly or indirectly, through, for example, publicly funded teacher training or infrastructure development. Hence our simulation of a private sector expansion can be thought of as coming about through a government effort to expand access to education by subsidizing the development of new private providers.

In this simulation we assume that the new private schools have characteristics, including fees and other direct costs, equal to the means of these variables for existing private schools. We use these "data" and the model parameters to calculate new enrollment probabilities for each school type.[60]

As shown in the last column of Table 20, overall primary enrollment probabilities would increase by an average of 5.7 percent (an 11 percent proportional increase) if private schools were to become available in all communities. This is really quite a modest change given that for about three-fourths of the sample the simulation is expanding the set of choices to include a private alternative. There is, however, a significant reallocation from public to private schools. Predicted private enrollments as a share of total primary enrollments rise from about 15 percent to 40 percent. If quality is higher in private schools, the shift into the private system would mean

[60] This is accomplished by adjusting the probability formulas shown in Appendix A for observations lacking a private school option. Specifically, the quantity $\exp(v_1/\sigma)$ is replaced by $(\exp(v_1/\sigma) + \exp(v_2/\sigma))$. The private school characteristics in V_2 take the mean values for existing private schools.

a larger improvement in educational outcomes than suggested just by the small rise in overall primary enrollments.

An expansion of private schooling would not appear to be a means for increasing overall educational equity. As shown in the next to last column, the primary enrollment rate rises 7 percent for children in the richest rural quartile but only 2.8 percent for those in the poorest. This occurs in spite of the fact that the private expansion disproportionately improves the schooling options of poorer households, who initially were the least likely to have access to a private school. Since the proportional increases in enrollments are also greater for the upper quartiles, we can infer as well that the distribution of overall primary enrollments will become less equitable.

On the other hand, there is a greater proportional reduction in the public enrollments of higher income households, who are more apt to leave the public sector when private schools become available. This means that the share of the poor in *public* primary enrollments rises—that is, the incidence of public primary schooling becomes more progressive. Hence these results support the notion that the growth of the private education sector will make public education spending, if not overall primary enrollment, better targeted to the poor. Of course, this would not be assured if the private expansion itself was not purely market driven but instead relied on government subsidies.[61]

Although primary enrollments of the poor would benefit in absolute terms from the growth of the private education system, larger absolute as well as relative gains for the poor (and larger absolute gains for all) were seen above for quality improvements in public schools. Obviously, a full assessment of either strategy would require information on the relative costs of public school quality improvements and private sector subsidization.[62]

F. The Demand for Primary Schooling: Summary and policy implications

The estimates of the nested logit model indicate that demand for primary schooling and the choice between public and private schools are responsive to changes in household income, school costs and (for public schools) school quality. The results help put in perspective the sharp declines in primary enrollments experienced by Madagascar beginning in the 1980s, which have been attributed alternately to falling incomes and a deterioration in the quality of the public school system over the period. Both trends indeed emerge as plausible factors in light of our econometric estimates.

[61] Even if it did not, an improvement in the incidence of public schooling in the context of stagnating or worsening overall educational equity would not be considered an unequivocal policy success.

[62] Additional simulations indicate that the gains in overall primary enrollments would be similar for a quality investment that eliminated room sharing and a private sector expansion under which the annual costs (fees and other expenses) to households of the new private schools were only half the current mean private school costs. The latter would presumably require a large government subsidy to private providers or to households. In addition, the enrollment gains would not be as favorable to the poor as under the quality improvement.

The results have a number of implications for policy, some of which were brought out in the simulations. First, households are moderately sensitive to changes in the costs of public schooling. There appears to be some scope for instituting small fees or increases in fees in public primary schools. Even a more than doubling of current fee levels will have very small impacts on enrollments. However, fees are currently very low, representing just a fraction of household school expenditures, not to mention of the government per student subsidy. More ambitious attempts at cost recovery—that is, fees that would account for more than a small percentage of current government expenditures per pupil—will have detrimental impacts on enrollments, at least in the absence of accompanying school improvements.

Furthermore, the foregoing only refers to the average enrollment impacts; there are distributional factors to consider as well. The estimates and simulations show that primary school fee increases will lead to larger percentage point and proportional declines in enrollment rate of children from lower income households. This is the case for both public school and overall primary enrollments. The larger proportional demand reductions of the poor, a consequence of their higher price elasticities, imply that the distribution of public primary schooling and primary schooling overall will become less equitable as a result of the fee increase. Policymakers need to keep these distributional consequences in mind as they contemplate the prospects for cost recovery in the public education sector.

Second, improvements in the quality of public schools—represented in our model by variables for classroom sharing and window condition—are likely to have substantial beneficial impacts on public enrollments and on overall primary enrollment. Enrollment rates of poor children would rise as much as or more (and in proportional terms, substantially more) than those of well-off children as a result of these improvements. There also appears to be scope for financing at least part of the costs of improvements though increases in fees.

Third, a simulated expansion of the private school system to rural areas not currently served by private schools (under the assumption that new private schools would have the mean costs and other characteristics of existing ones) suggests that such an expansion would have only modest impacts on overall enrollments. Furthermore, although poorer rural households currently are less likely than better-off households to have a private primary school available in or near their communities, a private school expansion would not be pro-poor.

Fourth, in view of the negative impact of distance to schools on public enrollments, a program of school construction that targets areas where schools are sparsely distributed would raise primary enrollments. Alternatively, investments in infrastructure that reduce the time and costs of transportation to and from schools may have similar beneficial effects.

Finally, among household factors, both household income and parental education have positive impacts on children's primary schooling. Policies that lead to improvements in rural incomes will therefore have the additional beneficial effect of raising household investments in children's schooling.[63] With respect to parental schooling effects, policies that raise enrollments

[63] There is one qualification to this conclusion. Such policies generally will increase the returns to agricultural labor, which potentially could induce some families who otherwise would have sent their children to school to put them to work instead.

today will have positive intergenerational effects on schooling by raising the investments these children will eventually make as adults in the education of their own children. By the same token, however, the recent declines in primary (and secondary) school enrollments in Madagascar are especially troubling. That is, just as increased enrollments set up a virtuous cycle of even greater schooling in succeeding generations, a pattern of declining enrollments can lead to a vicious cycle of further declines in the future. This provides a further rationale for efforts to raise primary enrollments.

IV. DEMAND FOR EDUCATION SERVICES: DETERMINANTS OF SECONDARY ENROLLMENT

A. Introduction

Secondary schooling is far less prevalent than primary schooling in Madagascar, especially in rural areas. As seen earlier, net enrollment rates for secondary school are only 8 percent and 38 percent in rural and urban areas, respectively. This is the case despite large estimated returns to earnings from a secondary education.[64] Given the potential benefits of a secondary education, it is important to understand the factors that determine secondary enrollment, particularly among rural households.

For this analysis we do not have the comprehensive provider information that was available for the analysis of primary schooling. The only community data available on secondary schools are found in the general questionnaire on local infrastructure, which records the presence or absence in the village of lower and upper secondary schools, and the distance to the nearest secondary schools if they are not local. We include these distance measures together with individual, household, and other community data in a model of secondary school enrollment decisions. The decision to enroll is estimated using a binary probit model, in which the dependent variable takes the value of 1 if the child is currently attending secondary school; it is zero if the child is not in secondary school. The probit model is estimated on the (primarily) rural sample of children age 12-18 living in Fokontany that are covered by the community survey. We exclude children who are still enrolled in primary school as well as those (very few) who have already graduated secondary school by age 18.

The estimation setup just described treats children the same way whether they have completed primary school, dropped out of primary school, or never even enrolled in primary school. Obviously, only those in the first group—primary completers—are actually able to go on to secondary school. Thus the simple current secondary enrollment model does not account for the sequential nature of education decisions. While, as desired, it shows the effects of the independent variables on secondary enrollment, some of these effects are indirect, operating through their impact on prior primary school completion. Therefore we might also want to focus on the group of primary completers alone: what factors determine whether they will go on to secondary school? To address this question we estimate a separate probit model on the sample of children 12-18 who have completed their primary schooling, that is, children whose last successfully completed grade is T5 or higher.[65]

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[64] Earnings regressions on the sample of urban wage earners in the EPM data (Glick 1999 fn. 42) indicate that an additional year of secondary education raises hourly earnings by 11 percent and 13 percent, respectively, for men and women. The effects of an additional year of primary schooling were much lower: 5 percent and 6 percent.

[65] About 14 percent of those who completed the last primary grade (T5) did not obtain a diploma (CEPE). It could be argued that only the group possessing the CEPE can go on to secondary school, so only they should be included in the estimation of school continuation. However, the decision to take the exam for the primary diploma may be a function of the intention to go on to secondary school, in which case it clearly would be endogenous to our dependent variable—secondary enrollment—in the probit model. If this is the case, then our model of the secondary enrollment decision should include all those who have completed their primary schooling, whether they have the CEPE or not. In any event, the estimation results for the sample with a CEPE and the larger sample including all those with completed grade T5 were very similar.

A look at the means in table 21 makes it clear that relatively few households in this generally rural sample enjoy access to local secondary schools. Only 24 percent of children in the sampled communities have a lower secondary school located in their village or town. The figure for upper secondary schools is slightly less than 10 percent. The average distances to the nearest lower and upper secondary schools (whether local or not) are substantial: 15 and 41 kilometers, respectively. We might expect, therefore, that secondary enrollments of rural inhabitants are constrained by the difficulties and time involved in getting to and from school.

B. Estimation Results

Table 22 presents the probit estimates of the determinants of secondary school enrollment. Column 1 shows the results for the full sample of boys and girls age 12-18. Distance to school is indeed a factor in secondary enrollment decisions. In particular, the coefficient on distance to the nearest lower secondary school is negative and highly significant. The coefficient on distance to the nearest upper secondary school is also negative but not statistically significant. This can be explained by the fact that most children in this age range who are in secondary school are still at the lower secondary level. Therefore it is the distance to lower secondary schools that is more directly relevant to enrollment decisions for this sample.

The model also includes a dummy variable for the presence of a paved road in the village or town. Only about 20 percent of the children in the sample live in a village served by a paved road; the figure is 15 percent if observations not categorized as rural are excluded. As indicated in the table, this variable has a positive and significant effect on secondary enrollment. Given the typically large distances to the nearest school, this result accords with expectations. Access to a paved road should make a significant difference in the time and effort involved in traveling back and forth to school.[66]

Among other variables, parental education has large positive effects on a child's secondary school enrollment. As with the demand for primary schooling, for both mother's and father's schooling, the coefficients on secondary or higher schooling are much larger than for primary completion. Thus while parental schooling at either level is beneficial, children of parents with relatively high educational attainment are at a particular advantage when it comes to their own possibilities for advancement beyond the primary level. However, this is a small group: only 5 percent and 8 percent, respectively, of mothers and fathers in the sample have completed secondary school.

The level of household resources, represented here by expenditures per capita, does not have a significant impact on secondary schooling.[67] Nor is the variable for being female

[66] As one form of evidence of this, the community survey shows that 40 percent of villages with a local paved road also have a taxi-bus (*taxi-brousse*) stop, compared with just 3 percent of villages not served by a paved road.

[67] Interestingly, if the model is estimated only on the rural observations (all but 7 percent of the full sample), the effect of household expenditures becomes larger and statistically significant. The distances to schools are typically much greater in rural areas, meaning that the costs related to travelling to school (both direct and indirect, due to more lost work time) are higher. All things equal, therefore, secondary schooling is likely to be more costly for rural households all things equal, reducing non-schooling consumption by more than for urban households. This may make income a more important factor in rural household's decisions to enroll a child in secondary school.

significant. Some of the household composition variables are significant, however. A greater number of children under 5 years of age reduces secondary enrollment probabilities. This could reflect a competition for resources between the schooling needs of older children and the nutritional and other needs of young children, or that older children are obligated to stay at home to care for younger siblings and thus are unable to attend school. On the other hand, a greater number of females age 15 to 20 raises secondary enrollments, perhaps because girls in this age group can substitute for the child's time in household chores, allowing him or her to go to school. The number of men age 21 to 65 also raises secondary enrollment probabilities. This too may reflect time allocation effects, since there would be more family workers to substitute for the child's time in farming activities or other income-generating work. Alternatively, the presence of more men of prime working age implies a higher potential level of household income, so the estimate may be capturing an income effect.

How do these results compare with those for the sample of primary completers? The results for the latter are shown in column 2. Note that the sample is much smaller—just 480 of the 1,979 12-18 years olds in our full sample have completed the highest primary grade. In general, the results are similar to those for the full sample. In particular, distance to the nearest lower secondary has a strongly significant negative impact on secondary attendance for those who have finished primary school, and access to a paved road has a positive effect. Household composition effects are weaker, as are the effects of parental education, though father's secondary education remains significant. This is not surprising as much of the effect of parents' schooling on secondary enrollment will be felt indirectly, through the effects on primary enrollment (and completion). Since the sample includes only those who have completed primary school, these indirect effects are purged from the estimates. [68]

One notable difference with the results for the previous sample is that, among primary completers, being female is negatively associated with the probability of enrollment in secondary school. Thus there does appear to be a gender effect once we control for the selection into the group of primary completers: girls in this group are less likely to continue on to secondary school.[69] This is consistent with our finding reported above that girls are underrepresented among current secondary school students.

[68] One statistical issue should be kept in mind when interpreting these results. Our sample of primary completers is a self-selected, not a random, sample. Those who have completed primary school may differ in important but unobservable (to the researcher) ways from the rest of those in their age group: they may have more natural ability, may have parents who value educational achievement more highly, etc. This means that, strictly speaking, it is not valid to use the estimates to make inferences for the entire population about the probabilities of continuing on to secondary school: the estimates pertain only to the subsample who have actually completed primary school.

[69] "School continuation" – that is, the probability of entering secondary school upon primary completion—might be better examined by looking at the determinants of whether the primary completer was *ever* enrolled in secondary school, rather than looking at current secondary enrollment determinants. This is because some students who did make the transition to secondary school may have dropped out by the time of the survey, hence not be currently enrolled. Therefore we also estimated a model on our sample of primary completers with a dependent variable equaling 1 if the child was ever enrolled in secondary school. The results were very similar to those for the current secondary enrollment model reported in the table.

C. Policy Simulations: effects of changes in distance to schools and road infrastructure on secondary enrollments

The probit results point to the importance of access—the distance to schools—as a constraint on secondary enrollments in rural areas. To explore this issue further we use the estimates and data to simulate the effects on secondary enrollment probabilities of reducing the distance to schools. In addition, we simulate the effects of infrastructure investments, namely, the expansion of paved roads to villages that are currently not served by a paved road. We do this for both of the samples used in the estimations: all 12 to 18 years olds, and 12 to 18 year olds who have completed primary school.

The results for the first group are shown in the first column of table 23 . The first row gives the current sample mean predicted probability of secondary enrollment. In the second row we simulate the impact of reducing by half the distances to the nearest lower and upper secondary schools (for cases where the schools are not local). This raises the mean probability of attending secondary school—that is, the predicted enrollment rate—to about 13 percent, up from 11 percent in the base case. Reducing by half the distance to lower secondary alone (third row) gives approximately the same results, reflecting the small effect of upper secondary distance in the probit models. The fourth row simulates the effect of reducing the distance to lower secondary to zero, that is, providing local access to lower secondary for all communities. The improvement in enrollments is more dramatic: the mean probability of secondary enrollment increases to about 17 percent, representing a proportional increase of more than 50 percent over the base.

Next the effect of putting a paved road in each community is simulated, holding distances to schools at current values. This raises the predicted secondary enrollment rate from 11 percent to 14 percent. Note that this represents a very major improvement in infrastructure, since only about one-fifth of the surveyed communities are currently served by a paved road. Finally, the last row of the table shows the combined effect of halving the distance to the nearest lower secondary school and constructing paved roads to each community. The new predicted secondary enrollment rate is about 17 percent, similar to the effect of reducing to zero the distance to lower secondary schools. Although a policy of building paved roads to all rural communities is obviously not currently feasible for Madagascar, the exercise nonetheless illustrates the type of impacts that improvements in the transportation network can have on secondary schooling.

The second column shows the results for the same policy simulations on the sample of primary completers. Note first that the initial enrollment rate (i.e., the mean predicted secondary enrollment probability evaluated using the actual data) is much higher than for the whole sample. The improvements in secondary enrollment probabilities are also greater, in absolute terms, than for the larger sample. For example, halving the distance to lower and upper secondary schools raises the mean enrollment probability 4 percent, from 0.58 to 0.62. Providing paved roads in combination with halving the distance to lower secondary school would raise the secondary enrollment rate to 0.74, an increase of 16 percentage points. These changes in school and transportation infrastructure therefore have potentially large effects on the probability of

continuing on to secondary school. Of course, since the base enrollment rate is fairly high for this group, the proportional increases are not as large as for the full sample of children 12-18, for whom the current secondary enrollment rate is very low.

D. Demand for secondary school: summary and policy implications

The estimates and simulations highlight the important role played by school location and the transportation infrastructure in household decisions to enroll children in secondary school. Building more schools and improving the transportation network will potentially have substantial benefits for secondary enrollment in rural areas. However, it is equally important not to overstate the benefits. Secondary enrollment rates would remain too low even with these improvements. Other factors, not adequately captured in our data, undoubtedly are also determinants of secondary schooling for rural children. These might include household poverty, poor quality of secondary education, the unfavorable employment outlook for graduates, and possibly also a perception that schooling beyond primary level is not useful in agriculture.

One should also keep in mind that the most important determinant of entry into secondary school is getting through primary school: more than half of the primary graduates in this rural sample continue on to secondary school. Hence it is likely that the most powerful means of raising secondary schooling is to insure that more children enter and complete primary school. Note, however, that since primary completion is a prerequisite for entry into secondary school, the decision to enroll and finish primary school may itself be influenced by the perceived benefits, or lack of benefits, of secondary schooling.

Another result of interest is that among rural children who finish primary school, girls are less likely than boys to continue on to secondary school. This will put girls at a disadvantage in the labor market with respect to access to formal employment and earnings, since a secondary education has been found to have positive effects on both (Glick 1999). It is noteworthy that this gender differential occurs in a sample of rural households (i.e., the sample of primary school completers) that is relatively well-off and in which parents are relatively well-educated. Additional research is necessary to investigate the reasons why parents are more likely to send sons than daughters on to secondary school.

V. THE DEMAND FOR HEALTH SERVICES: HEALTH CARE PROVIDER CHOICE

A. Methodology and data issues

For the analysis of health care provider choice, we use the same estimation approach as in the analysis of the choice of primary school. As before, the specifications include individual and household factors, household per capita expenditures, provider cost, and provider characteristics. The provider characteristics are measures of personnel availability, drug availability, and facility characteristics. We estimate nested logit models of health provider choice. As with education demand, the model specification allows for the fact that not all providers are available to all communities.

However, the wide range of health care alternatives dictates some adjustments to the approach. The community survey module on health care providers asks respondents to list up to four of "the most important" health care providers consulted by the inhabitants of the Fokontany. There are 10 possible provider types, ranging from informal healers to primary hospitals. Given this large number of choices, it is necessary for the estimation to group the alternatives into broader categories. We use the following groupings, familiar from the descriptive analysis in Section II: hospital (primary or secondary hospitals); basic care facilities (*Dispensaire, post sanitaire, post d'infirmerie, CSSP*), private formal care (doctors, private clinics, and pharmacies), and a base category consisting of self-care and informal private care (e.g., traditional healers). The first two categories, hospitals and basic care facilities, are generally public in Madagascar. The only exception, in the basic care category, is *dispensaire,* some of which may be private.[70]

Since only a maximum of four individual providers could be listed in the community survey, in most cases there is just one provider for each category for a Fokontany (for example, it is rare for a rural community to have a choice among two hospitals). Cases of multiple providers within a category are not uncommon, however, especially for the basic care category, which includes a large number of different provider types. In these cases we use the category means of the provider characteristics in the model. These means—for cost as well as presence of personnel, availability of medicines, and facility indicators—are necessarily approximations to the true constraints facing individual households, a fact that should be kept in mind when interpreting the results.

Missing data

Two other data issues need to be addressed. The first is that, in the household survey, many ill individuals report consulting a provider that is not listed in the community survey. This is not surprising in view of the four-provider maximum. For example, an individual will report a consultation with a private doctor, but "doctor" is not among the providers listed in the community survey, presumably because doctors are less frequently consulted than the listed provider types. Since someone in the community is consulting a doctor, this provider is

[70] We should note that individuals in rural areas who visit hospitals almost always are doing so for basic care, that is, for outpatient services; only a tiny percentage of such individuals report staying overnight in a hospital.

presumably a feasible health care option for all members of the community. Hence for our analysis we consider a provider type to be "available" to the community if either the provider is listed in the community questionnaire *or* someone in the community reports seeking care from that provider type, whether it is listed or not.

However, the second possibility presents a problem for the estimation since, if the provider does not appear in the community survey, we have no information on that provider's characteristics. This problem occurs frequently in the data, even after we aggregate the choices into the broader provider groupings as just described. For example, of the 197 Fokontany in the community survey that are matched to the household survey, 122 have "hospital" (i.e., a primary or secondary hospital) available by the above definition. In 20 of these cases, no hospital is listed in the community survey. The percentage of missing data cases is similar for the basic care group, but larger for the private formal care group. In the latter, in almost half the cases where this alternative is "available", there is no information on the alternative in the community survey.

For the education analysis, we dealt with this kind of problem by dropping from the sample all cases of communities where the problem occurred. For health care choice the problem is more common and this solution is not feasible. Dropping all communities where the missing data problem occurs for at least one of the provider categories would mean eliminating close to half the sample. Hence we take a different approach that avoids the need to lose so many observations. We create a dummy (0-1) indicator variable for missing provider data. This variable equals 1 if the provider characteristics data for provider category *j* are missing from the community survey, and zero otherwise.[71] Where the data are missing, the provider characteristics variables are set equal to the sample means for the provider type in order to permit estimation.[72]

Since the factors in the decision to seek health care (including the type of illness) may differ for adults and children, we estimate separate provider choice models for adults age 15 and older and for children under 15. The samples consist of 828 children and 1229 adults who reported an illness or injury in the past two weeks.

Estimating provider costs

For each provider, the community questionnaire records the fee, if any, for the first consultation as well as the typical cost of transportation to the facility. The sum of fees and round trip transportation equals the direct costs of the service. Note, however, that in Madagascar as in many other developing countries, services at many public health facilities are provided free of charge. For example, in less than 10 percent of communities with hospitals is

[71] There was also a smaller number of cases for which provider information was collected but could not be used because it could not be matched to the provider code (which indicates the provider type). For the estimation these cases were also considered to be "missing" the provider data.

[72] Alternatively, one could assign the missing data a value of zero, or any other value. Other than the coefficient on the missing indicator variable itself, the estimates will be the same as long as the same assigned value is used for each missing case for a given variable. See Cohen and Cohen (1988) for a detailed discussion of this method of handling missing data.

there a positive (average) hospital fee.[73] The percentage for basic care facilities is also small (17 percent), but as we would expect, almost all private health care providers charge a consultation fee.[74]

In addition to direct costs, there are indirect or opportunity costs of seeking treatment. Health care facilities may be some distance away from an individual's place of residence. This is especially the case for hospitals. The average recorded distance to a hospital is about 10 km; the maximum is 118 km. This applies only to the sample for which distance information is available, that is, Fokontany for which a hospital is listed in the community survey as a major source of care for local residents. The distances would almost certainly be greater on average for communities where a hospital was not listed. The average distance to a basic care facility, where such a facility is listed, is 5 km. Given the very poor condition of the road network in rural areas, even a modest distance of several kilometers may involve a significant amount of travel time back and forth. Poor rural residents may have to walk to the provider. Since this is time that could potentially have been applied to productive work in the home, on the farm, or in a wage job, there is an additional cost in terms of lost output or income.

For our adult sample, we follow a standard procedure for estimating these opportunity costs. First, we estimate a wage regression on the sample of wage employees (mostly in agriculture) in rural areas. We use these estimates to derive a predicted or expected hourly wage for all adults over 15 in the sample. This wage is multiplied by the average reported round trip travel time to the provider group reported in the community questionnaire to obtain an estimate of foregone earnings.[75] The cost variable used in the provider choice model is the sum of these indirect costs and the direct costs of treatment (fees and travel expenses). [76]

Although the majority of developing county health care demand studies employ this procedure for imputing opportunity costs (which often are the only significant element of provider costs), it involves a number of assumptions that should be made explicit. First, it is assumed that the potential wage in the labor market is an accurate representation of what the individual could earn in non-wage (agricultural) activities, which are far more prevalent in rural areas.[77] Second and equally important, it assumes that hours travelling to and from the provider equal lost hours of work. However, this need not be the case. If there is substantial underemployment or periods of slack labor demand (e.g., the post-harvest period), an individual

[73] Note, however, that the consultation fee presumably does not include costs for medicine that may be incurred by the patient.

[74] More precisely, recall that the cost figures are actually the means for the providers in each category (e.g., the mean costs for the basic care facilities in the Fokontany). As long as just one such provider in the category has a positive cost, the average for the category for the Fokontany will be non-zero. Therefore the percentages of Fokontany with a positive average fee for a provider category calculated in this way—the figures cited in the text—will be higher than the percentage of individual providers in the category that charge a fee.

[75] We assume a maximum lost work time per day of 8 hours.

[76] The total cost of provider *j* for individual *i* can therefore be represented as $C_j = P_j + w_i * T_j$, where P_j equals the direct costs (fees and transportation expenses), w_i is the predicted hourly earnings of the individual, and T_j is the estimated work time given up to travel back and forth to the provider. $w_i * T_j$ is therefore the indirect cost of care.

[77] In principle we could estimate agricultural returns to labor directly, using an agricultural production or profit function. As already mentioned (see note 29), this involves numerous complexities and imposes strong data requirements and so is rarely attempted in studies of this type.

need not be giving up work to visit a health care provider. Similarly, a sick individual may not be able to work anyway because of his or her illness or injury. Thus the opportunity cost of time may be significantly lower than implied by the calculations just described. These potential shortcomings need to be kept in mind when interpreting the empirical results.[78]

For children under 15 it was more difficult to calculate the opportunity cost of time. As noted in the section on demand for primary schooling, the sample of rural wage-earning children under 15 was too small to obtain reliable estimates of predicted wages. The youngest children in this age group will not be working, of course, but opportunity costs are still relevant because young children must be accompanied to the health care provider by an older relative. That person's opportunity cost is the relevant indirect cost, but his or her identity is not known from the survey. For these reasons we do not attempt to calculate indirect costs for children under 15, and instead just use the direct (fee plus transportation) costs. The disadvantage here is that for both hospital and basic care, the direct costs are zero in about three quarters of the cases, even when transportation costs are added to fees. This reduces the variation in the cost variable, making it harder to detect price effects. However, in the children model we also include the distance to each provider explicitly (rather than implicitly, though the travel time variable in the opportunity cost calculation). The coefficient on this variable will capture in part the effect of opportunity costs incurred by the household in seeking treatment for the child.

Table 24 shows the mean costs per visit for each provider group. Mean fees are very low for hospitals and basic care facilities, reflecting the fact that for the large majority of cases fees equal zero. Transportation expenses are a more important component of costs. These are largest for hospitals, which tend to be located furthest from the community. For adults, indirect or opportunity costs make up a large portion of total costs, particularly for the basic care facilities, where they comprise well over half the total cost. Overall, private formal care is by far the most expensive form of treatment, reflecting the high fees for this category.

B. Descriptive Results

1. Choice of provider and provider availability

Table 25 shows the type of treatment sought (including non/informal care) by rural expenditure quartile for our estimating samples of children and adults reporting a recent illness or injury. The samples consist of individuals from households in Fokontany that were sampled in the community survey, which are largely rural: only about 7 percent are in urban or semi-urban areas. Therefore the average consultation rates for formal treatment overall and the type of treatment are similar to the rural means shown above in table 7. About 70 percent of the ill or injured adults in the sample do not seek any type of formal care. For the adult ill sample overall, those who do seek care are more likely to go to a basic care facility than elsewhere. As seen earlier, the percentage of individuals seeking formal care rises with expenditure quartile (that is, the percent not seeking care falls). In addition, the importance of private formal care relative to the other provider options increases with household expenditure level; for adults, it accounts for

[78] In an attempt to control for seasonal variation in the opportunity cost of time (as well as seasonal variation in community health conditions and transport conditions) we include dummy variables for season in the models.

about 30 percent of the formal provider consultations of the richest quartile compared to 19 percent for the poorest.

Children who are ill are slightly more likely overall than adults (about 34 percent compared with 29 percent) to receive care; the difference is seen in the basic care category. Also, for children the likelihood of seeking care rises more sharply with expenditure level than for adults: 45 percent of ill children in the richest quartile receive formal care compared with only 28 percent from the poorest quartile.

Table 25 also the shows the means for provider category availability for the total sample used in the estimations (all sick or injured adults and children). Following the discussion of data issues above, a provider category is considered to be available if either a provider in the category is listed in the community survey or one or more individuals in the community report seeking treatment from the provider, whether listed or not. The large majority of individuals in this largely rural sample live in communities where there is access, so defined, to some form of basic care (last column). However the average availability of hospital and private formal care is smaller: 61 and 45 percent, respectively. The availability indicators for these categories rise with expenditure quartile, particularly for private formal care. This is not at all surprising: we would expect private providers such as doctors to practice primarily in communities where households can afford their services.

2. The EPM community survey: characteristics of health care providers

In Table 26 we present the mean characteristics of health care providers by provider category and rural per capita expenditure quartile. We first compare the overall means for different provider categories, shown in the last column. For the personnel availability variables the responses are coded as 1 for never present, 2 for present part of the time, and 3 for always present. As expected, hospitals generally have both doctors and nurses on staff full-time (the mean availabilities are 2.75 and 2.87, respectively). However, doctors (but not nurses) are less common at basic care facilities.

The free medicine availability measures (for malaria medicine, antibiotics, and vaccines) are similarly coded 1 to 3 for never, sometimes, and always available. With the exceptions of vaccines in hospitals, drugs are not typically available at all times at public health care facilities (hospitals and basic care facilities); more commonly they are available only part of the time. Naturally, private formal providers do not generally offer free medicines. These data from the EPM community survey thus concur with reports of problems of drug availability in the public health care system. [79] Although modern medicines may in some cases be obtained through the private sector, these undoubtedly would be too expensive for many rural residents.

[79] As noted in World Bank (1996) the government budget for medicines and pharmaceuticals fell five-fold in real terms between the 1977 and 1985. By the time of the survey (1993) the share of drugs in public health expenditure had begun to rise again but remained inadequate. As noted earlier, public primary health care centers are said to be able to cover only 25 percent of patients' drug requirements.

The data on facility indicators similarly suggest the existence of constraints on the delivery of effective public health services in rural areas, especially for basic care facilities. Only 22 percent of these facilities have electricity; 43 percent have a refrigerator, and only a fourth have running water. The figures for hospitals, as we would expect, are better, but still far from satisfactory: for example, some 30 percent of hospitals (a category that includes secondary as well as primary hospitals) lack running water. Private formal providers do not fare well in this category either. Obviously, these figures on the use of electricity and running water reflect the very poor state of rural infrastructure in Madagascar.

With regard to variation in provider attributes by expenditure quartile, the most significant differences are seen for basic health care facilities. The basic care centers to which wealthier individuals have access are more likely to have full time doctors and nurses on staff as well as having electricity and running water. The differences by quartile in the last two indicators presumably reflect, at least in part, the fact that rural communities in which higher income households are found have better developed infrastructure.

In sum, the descriptive analysis of health care provider characteristics yields a picture for public health care services in rural areas that is similar to that for public primary schools examined earlier, in the following two respects: first, provider quality, to the extent that it is measured by the indicators available in the community survey, is generally poor; second, better off households tend to have access to higher quality providers.

C. Health care provider choice model results

1. Adults

The estimates from the nested logit model for the adult sample are shown in Table 27. With regard to the grouping of choices in the model, we distinguish between formal care categories (hospital, basic care, private formal care) on the one hand, and informal or self-care on the other. This specification allows for correlation of the error terms in the utility functions for the formal care alternatives. The informal alternative is used as the base choice. As with the school choice model, we let the effects of provider cost and other factors vary over alternatives rather than restricting these effects to be equal. Also, as mentioned earlier, the setup of the model incorporates the fact that not all provider categories are available in each community.

The cost of treatment has negative and generally significant effects on hospital care (column 1) and basic care (column 2). As in the case of primary schooling, for hospital and basic care the estimates show that individuals from poor households are more sensitive to price; this pattern is clearer for basic care than hospital care. For private formal care, the small number of observations on private provider prices for the lower expenditure quartiles made it necessary to enter price linearly rather than interacted with the quartile dummies. Even in linear form, however, no price effect for private care is found.

Household income, represented here by household expenditures per capita, has particularly strong effects on choosing private formal care (relative to the self-care/informal care base category). That is, better off individuals are more likely than the poor to consult a private

doctor, visit a private clinic, or use a private pharmacy.[80] The dummy variable for gender is not significant, i.e., women are not less likely than men to seek care when ill.

For the non-price provider characteristics, multicollinearity problems arose as a result of the high correlations of some of these variables. To deal with this, one could collapse the number of provider attribute regressors through principal component analysis, or more simply, drop certain variables from the model. The latter approach was taken here, resulting in the exclusion of the nurse and running water availability indicators. We also dropped the hours open per week variable from the final model. For each provider category this variable was not at all close to being significant (this was the case for children as well).

The results for these provider characteristics are mixed; they are certainly not as unambiguous as in the case of primary schooling. Drug availability has selective impacts on provider choice. Availability of free vaccines increases the demand for hospital care while the availability of malaria medicine raises the demand for care at basic health centers. The availability of a doctor does not have significant effects on choosing a hospital or basic care. Hospitals generally have a full-time doctor on staff so the lack of a significant effect for the hospital category, at least, is expected. We do see a positive effect of doctor availability on the probability of private formal care. This indicates that ill adults are more likely to turn to private formal care when this category consists of a doctor (instead of just a clinic or pharmacy).

There appears to be little effect of facility quality, measured here by the use of electricity and refrigeration. The only notable result is an anomalous one—a negative and significant coefficient on the refrigerator variable for hospital care. In sum, we find effects of provider "quality" only for some indicators for some alternatives. However, it would be rash to conclude from the lack of impacts of the other provider characteristics that households do not respond to these aspects of quality. One should bear in mind the problems inherent in aggregating multiple providers into broad provider categories. Moreover, for the drug availability indicators, supply and demand interactions may be influencing the results along the lines suggested by Mwabu et. al. (1993). All things equal, where demand is high, it is more likely that shortages of free drugs will arise, hence that the provider survey will record drugs as being unavailable at least part of the time. This can lead to a lack of a positive estimated effect, or even a negative estimate, of drug availability on demand.[81]

The model also includes a number of individual, household, and community variables. The duration of an individual's illness raises the likelihood of hospital care as well as private formal care (though the latter effect is only significant at the 10 percent level) but not basic care.

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[80] It bears emphasizing that this positive effect of income on private formal care is not simply a reflection of the fact that doctors and private clinics are more likely to be available in areas where wealthy individuals live; the model, as noted, accounts for differences in the availability of a given provider.

[81] A somewhat different form of supply and demand interaction may explain the unexpected negative effect of the use of a refrigerator on the demand for hospital care. The presence of high quality health facilities (proxied by the refrigerator variable) may over time improve the health of the local population. In these areas, there will be fewer illnesses and those that are reported may be less severe than elsewhere. The latter would imply a lower demand for hospital care as opposed to more convenient self-care or basic care, hence a negative association of the quality measure and use of hospitals. The same result could occur if better quality providers make the local population more knowledgeable about health and health care, with the effect that individuals become more skilled at self-care.

That is, for more serious or long-term conditions, hospital or doctor care is sought. An individual's years of schooling does not seem to affect the choice of care, but note that this variable captures only direct effects. Schooling may affect demand indirectly through its effects on income (or household expenditures) or, for that matter, through its effect on entry into the sample of individuals reporting an illness. There are no gender differences in the choice probabilities: the coefficients on the dummy variable for being female are all insignificant.

In table 28 the direct and cross price elasticities are calculated by expenditure quartile for this sample. For each alternative the elasticities are calculated on the subsamples for which that alternative is available. Since the price estimates for private formal care were not significant (as well as being "wrongly" signed), we only show the calculations for hospital and basic care. For hospital care the own elasticity is low on average (the mean is –0.17). There is no clear pattern by quartile. The cross-elasticities of basic and private formal care probabilities with respect to the cost of hospital care are very low, but this reflects the fact that these alternatives are not available for much of the subsample with access to hospital care.

For basic care, the mean own price elasticity is larger but still modest (-0.36). Here, however, we see a sharply declining pattern by expenditure quartile, reflecting the pattern in the price estimates. The elasticity for the poorest quartile is a substantial –0.63 compared with just -0.17 for the wealthiest. Therefore price increases for basic care will tend to reduce demand for this alternative proportionately more for poorer households.

The elasticity calculations thus indicate a low or moderate average responsiveness to changes in the cost of care at public health provider alternatives (hospitals and basic care), but with the elasticities declining with income in the case of basic care, the most widely used alternative. We should stress that these elasticities do not indicate the demand changes in response to percentage changes in fees, but rather to percentage changes in total costs, both direct (fees and transportation) and indirect (opportunity costs). Recorded fees for public facilities are usually zero, as indicated, and on average they make up only a small portion of total costs. Hence the impact of changes in fees—or, more typically, the introduction of fees—may be better understood through direct simulation of specific increases in the costs of care, as done below.

2. Children

Table 29 presents the nested logit estimates for children under 15. In contrast to the previous model, provider costs were entered linearly in this model rather than interacted with expenditure quartile. The relative lack of variation in the cost variable for children (which as discussed above includes only direct costs) made estimation of separate price effects for each quartile infeasible. Still, the estimates for the simpler linear specification show that increases in the cost per visit reduce the likelihood that an ill child is taken to a basic care facility (column 2). There is also a negative, but not significant, coefficient on cost for private formal providers (column 3). No effect is found for hospitals, though again, this should not be surprising in view of the data limitations just described. [82]

[82] Unlike for adults, we do not present price elasticities for the child sample. The fact that the price variable (direct costs) was zero in so many cases makes calculation of elasticities problematic.

This model also includes the distance to each provider.[83] Since this variable is related to the time required to travel to and from a consultation, it should capture in part the opportunity costs to the household of seeking care for the child.[84] Distance has a highly significant negative impact on the decision to seek basic care. This is an important result, since basic care is the most significant source of formal health care for rural children, accounting for more consultations than the other two categories combined. The estimate thus highlights the problem of access to basic health services for rural households.

As with adults, we see only limited effects of other provider characteristics. Availability of free vaccines increase the demand for hospital care but not for basic care facilities. In fact, the coefficient on vaccine availability is negative and significant for basic care. Such a result may reflect lingering collinearity in the data, or possibly supply and demand interactions of the kind mentioned above. Doctor availability and use of a refrigerator are associated with greater demand for basic care.

With respect to the other variables in the model, there are some interesting contrasts with the adult estimates. Unlike adults, duration of illness does not affect the choice of care. On the other hand, a greater number of adults in the household generally raises the likelihood of a given type of care relative to no care/informal care. This may be because in households with more adults there is more likely to be someone available to take the child to the health care facility. Alternatively, since such households contain more potential income-earners, the adults coefficients may be picking up the effects of greater household resources. The schooling of the head of household also has positive effects on seeking care relative to no care. This may be because educated heads of household (or parents) are more likely to appreciate the benefits of treatment; alternatively, as with the number of adults, the estimates may reflect a positive association of household income with head's education.[85] Finally, in common with adults, we find no evidence of a gender bias in health care decisions for children.

D. Policy Simulations

1. User fees for public health care providers

For the adult sample, two scenarios are considered: an increase in the costs per consultation at basic care facilities, and an increase in the costs for all public providers, that is,

[83] Cases of missing distance information and missing information on provider characteristics did not completely overlap, because information on distance was collected in a different section of the community questionnaire from other provider information. Specifically, there were numerous cases of providers for which distance information was available but for which the characteristics data could not be used or matched to the provider. Therefore we include separate indicator variables for missing distance and for missing other provider information.

[84] Note that distance (or more precisely, travel time) also appears implicitly in the adult model, through the calculation of opportunity costs.

[85] It would be of interest to include the education of each parent in the models. Unfortunately, the EPM collected information on mother's and father's schooling only for individuals age 4 and older, so for very young children this information is lacking.

for both basic care facilities and hospitals.[86] The latter scenario is relevant since the government may wish to maintain uniform (but higher) prices for similar services at all types of publicly-run facilities. In addition, a policy currently under consideration in Madagascar is the extension of the value added tax (TVA) to medicines. This will have the impact of raising the effective costs of treatment at all public facilities, since both hospitals and basic care providers are likely to prescribe similar drugs for a given illness.

Since treatment at most rural public providers at the time of the 1993 survey was nominally free, the simulations cannot consider, for example, a policy such as a doubling of current fees. However, 1000 FMG (about US $0.50), equal to about half the average fee at private formal providers, would probably be in the range of plausible levels for new fees at public facilities. This amount is a very small percentage of mean household monthly expenditures, even for the poorest rural quartile, but would constitute a significant increase in the total cost of care at public facilities: as seen in Table 24, the mean total costs per visit (direct and indirect costs) are 1,593 FMG for hospitals and 824 FMG for basic care facilities.[87] The simulations show the effects of policies of setting uniform fees of the indicated amount at all providers of a given type.[88]

The tables for these simulations have the same format as those for the schooling simulations, but one additional aspect should be mentioned. The initial expected consultation probabilities and changes in probabilities shown in the tables are not conditioned on being ill. That is, they show the means of the quartile per adult consultation rates and changes in them, not the equivalent measures defined on the sample of ill adults only (note that proportional changes in probabilities/consultation rates will be the same either way). While it might seem natural to condition on being in the ill subsample since only those who are ill will seek curative care, there is a problem in that, as noted earlier, the likelihood of self-reported illness is a function of the level of income. Since the poor are for subjective reasons apparently less likely to be in the sample reporting an illness, looking only at the quartile rates of treatment among those who do report being ill will tend to misleadingly inflate the benefits received by the poor—not just in per capita terms, but also in terms of the portion of the truly ill (objectively measured) who get care. Therefore the unconditional approach probably provides a more reliable indicator of the distribution of curative health care services.[89]

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[86] As indicated previously, dispensaries, one of the providers included in the basic care category, may be private as well as public.

[87] We should emphasize, however, that the direct cost components of these figures are very likely underestimates as they include only consultation fees reported by each provider. As noted earlier, this probably does not include the costs of medicines or other medical supplies involved in the treatment.

[88] This will involve a smaller increase in cost, or possibly even a reduction in cost, for the small percentage of cases where some level of fee is currently reported.

[89] Obtaining the desired measures is a simple matter of rescaling the estimated conditional probabilities of care, and the change in the probabilities, by the probability of being in the sample of ill individuals. Defining ILL and $CARE_j$ as 0,1 indicators of self-reported illness and care at provider j, the unconditional probability of consultation at provider j is $Prob(CARE_j|ILL=1)*Prob(ILL=1)$. In the calculation of the unconditional mean probability for a given quartile, the first term is the quartile mean conditional probability of care at provider j and derives directly from the nested logit model, which like most such estimations is performed on the ill subsample only (see Dow 1995b for an exception). The second term is simply the quartile-specific rate of reported illness.

The sixth column of Table 30 shows the changes in adult basic care consultation probabilities from the implementation of an 1000 FMG fee per visit for basic care.[90] The declines are twice as large for the poorest as for the richest quintile (recall the pattern in the logit price estimates). These changes appear overall to be very small, but it should be kept in mind that they are unconditional averages calculated over all adult observations in each quartile, not just the ill. Because of the large substitution response, the reductions in overall formal care probabilities are much less severe (last column), but are still sharply higher for adults in the lower expenditure quartiles.

Table 31 shows the effects of instituting a uniform 1,000 FMG fee at both hospitals and basic care facilities. In this table these two categories are combined ("public providers"). The reductions in adult consultation probabilities at public facilities are significant in proportional terms and, as in the previous simulation, they are greatest for those in the lower quartiles. The proportional decline in public care consultations is -0.44 (i.e., .012/.027) for the poorest quartile compared with only -0.14 (0.006/0.043) for the richest, implying a non-trivial change in the distribution of public health care benefits (measured here in terms of a binary consultation indicator) in favor of the well-off. Increases in private demand are not sufficient to prevent significant declines in overall care probabilities. For the adult sample overall, there is about a 17 percent proportional reduction. For the sample of ill adults, this corresponds to a reduction in the mean probability of care from 29 percent to 24 percent. Again, the reductions in the probabilities of care, both absolutely and proportionately, are largest for the poorest quartile: the mean probability of any formal care among ill adults in this quartile falls from 25 percent to 17 percent, a 31 percent proportional decline.

These simulations suggest that establishing relatively modest fees at public facilities may have strong negative effects on the probabilities that adults will seek curative health care, and further, will have undesirable distributional consequences. However, some caution is warranted in interpreting the results because of the manner in which costs have been imputed. The main component of cost per visit is opportunity costs. As discussed above, the estimation of these costs involves a number of possibly inaccurate assumptions. There are shortcomings as well in our measure of direct costs, since, as noted, these probably do not include important components such as expenses on medicines.[91]

Turning to the child sample, Table 32 examines the effects of implementing a 1,000 FMG fee per visit at basic care facilities. The average reduction in unconditional basic care probabilities is about 0.5 percentage points, equivalent to a 19 percent proportional decline. There is not much variation by expenditure quartile in the proportional changes in demand (hence little change in the incidence among children of basic care); recall that price was entered linearly in the logit model, thus ruling out variations in price response across the expenditure

[90] The unconditional changes in probability reported in the table are calculated as $\partial Prob(CARE_j|ILL=1)/\partial P_j$ *Prob(ILL=1) where P_j is the cost of provider j. This should be interpreted as showing the unconditional short-run effect of a price change on demand for curative care from provider j—unconditional because it is defined over the entire (quartile) adult sample, and short-run because any long-run effects of a price change on the probability of illness are not taken into account. The calculations, like the estimates themselves, assume statistical independence (in terms of unobservables) in the probability of illness and the decision to seek care once ill, i.e., an absence of selectivity bias.

[91] See note 87.

distribution. The mean unconditional demand for formal care falls from 0.044 to 0.042 as a result of the basic care price increase (last column), a proportional decline of 5 percent. We do see some differences in the changes in the overall probabilities of care in spite of the use of the linear price specification: there is a proportionately smaller reduction in overall care for the wealthiest quartile than for the other quartiles, reflecting the fact that this group is relatively more likely to switch to private alternatives when fees at basic care facilities are raised. Overall, the effects of a price change are much smaller than just seen in the equivalent exercise for adults, but this may reflect the relative lack of variation in the price variable for this sample.

2. Expansion of the private health care sector

This simulation proceeds along the same lines as in the education analysis. The probabilities of each health care choice are recalculated on the assumption that the private care alternative is available to all communities, with the new private providers having the mean characteristics of existing ones. The results for both adults and children are shown in Table 33. An expansion of the private sector has only very modest effects on overall care probabilities. This can be best appreciated by looking at the conditional probabilities, with allowance for the difficulties with this measure noted above. The initial average probabilities of formal care are 0.29 for ill adults and 0.34 for ill children. As a result of the private provider expansion, the conditional probabilities of care increase just 1.2 and 1.9 percentage points, which amount to proportional increases of 4 percent and 6 percent for adults and children, respectively. The allocations between public and private care change in favor of the latter, but by less than was seen in the primary education simulation.

Therefore an expansion of relatively expensive private providers (a category composed primarily of private doctors) would not significantly improve access to curative health care in rural areas. This simulation result is not surprising. As mentioned earlier, the absence of private providers in many poor communities no doubt reflects in large part the lack of demand for these more costly forms of care. Hence an expansion into these areas, at least at current prices, would not be expected to radically alter levels and patterns of treatment.

E. The Demand for Health Care: Summary and policy implications

Estimates of the health care provider choice models indicate, first, that in general households are moderately sensitive to the cost of care. For adults, higher costs of hospital care and basic health care reduce the demand for these options as well as reducing demand for formal care overall. For children, higher costs of basic care lower the demand for this alternative and for formal care overall, though the declines are smaller than for adults.

As stressed above, for both the adult and children models (but for different reasons) the provider cost variables used to estimate the price effects are not free of problems. Keeping these data shortcomings in mind, we would conclude that policies that raise the cost of treatment at public facilities will reduce the utilization of health care services. Some substitution of private for public providers will occur in response to the price increase, but this will not be adequate to prevent a net decline in overall (public plus private) rates of treatment. The imposition of even modest consultation fees (e.g., 1000 FMG, which constitutes a very small percentage of

household monthly expenditures) may lead to significant reductions in the demand for overall care for adults, especially if the fee is imposed at both public hospitals and basic care facilities.

Further, at least for adults (for which we were able to estimate a more flexible demand model), the absolute and proportional reductions in formal care probabilities would be greatest among the poor. This is a reflection of the larger estimated price responsiveness at lower incomes in the nested logit model.

As noted above, one policy currently under consideration that would raise the cost of treatment is the extension the value added tax (TVA) to medicines. We do not have direct information in the survey on the costs of medicine per illness or by provider. However, an increase in the price of drugs would in effect raise the overall cost of treatment from any public provider. As seen in the adult sample simulation of a simultaneous increase in the costs for hospital and basic care facilities, the reductions in utilization could be substantial. Obviously, the purpose of imposing a tax is to raise revenues. However, policymakers need to be aware of potential negative effects on the utilization of health services, which presumably imply reductions in health status. Our results show that utilization will decline, and that the declines will be greatest among the poor. Even where the reductions in overall care are not large (as for the children sample), they nevertheless need to be weighed against the fiscal benefits.

Another policy-relevant finding is that, for children, the distance to basic health care facilities has a strong negative effect on the probability of consulting this provider type. In fact, this is the case for adults as well, since distance (or rather travel time, with which it is correlated) is an important element of costs for adults. Investments in new health facilities in rural areas therefore will increase access to and utilization of health care services. Alternatively, one can view the results as a symptom of the poor state of the transportation system, which makes it difficult to travel to providers where they are presently located. Investments in road construction may therefore have unexpected benefits for health service utilization and health status in addition to the more obvious effects on agricultural incomes.

Finally, we simulated an expansion of private formal care providers to rural communities currently not served by such providers. Assuming that the new providers would be similar to existing ones in terms of quality and cost, such an expansion would have little effect on the overall level of demand for curative health services.

VI. SUMMARY AND CONCLUSIONS

1. Poor Malagasy and those in rural areas are less likely to enroll in school, or seek care when ill, than the wealthy and those living in urban areas.

Gaps between rich and poor are expected; it is the size of the disparity, at least for education, that bears emphasizing. Only 33 percent of primary age children in the poorest expenditure quintile are in school compared with 72 percent in the highest. The disparity is even larger for secondary enrollments. The differences between rich and poor in the probability of seeking care when ill or injured are smaller: 34 percent for the lowest vs. 45 percent for the highest. However, since the poor are less likely to report an illness in the first place, the difference between lower and upper quintiles in the number of people using curative care is larger than these figures indicate.

Rural-urban differences are also dramatic, reflecting both the higher incomes of urban households and easier access to services in urban areas. The primary enrollment rate for rural children is less than 60 percent that of urban children, and the differences are even larger for secondary schooling. Rural residents are far less likely than urban dwellers to seek care when ill: the average percentages of ill individuals consulting a provider are 34 and 53 percent for rural and urban areas, respectively.

Since rural households are generally poorer, a strategy of targeting public expenditures in education and health to rural areas would be progressive, that is, it would disproportionately benefit the poor. However, within both rural and urban areas there are significant disparities in income and in the utilization by the poor and well-off of education and health services. Therefore inequalities in access to services within rural areas (as well as within urban areas) also need to be recognized and addressed by policy.

2. Public services are not well targeted to the poor

The conclusions of our limited analysis of benefit incidence of public education and health services are consistent with previous analyses. With the exception of primary school, the incidence of public education and health services is currently per capita regressive. That is, public school enrollments and curative care consultations per person are higher for upper expenditure quintiles than lower quintiles, sometimes extremely so (as for secondary and university schooling). Even the distribution of public primary schooling is not well targeted to the poorest Malagasy as it is only mildly per capita progressive.

3. The financial burdens associated with enrolling a child in school and treating an illness are higher for poor households.

Whether using public or private providers, the wealthy pay more in absolute (FMG) terms to enroll a child in school or treat an illness. However, when measured in relation to household resources, the burden on poor households is usually substantially higher. That is, the poor pay more as a share of per capita household expenditures to enroll a child in primary

school, and the costs of treating an illness as a fraction of total monthly household expenditure are also higher for poorer households. This is the case both for public providers and more expensive private providers of education and health care. These shares of per capita and monthly household expenditures are not very high, even for the poor, but for various reasons the recorded costs are likely to be well below the total costs of schooling or health care.

4. The quality of education and health care providers in rural areas is poor.

Problems of poor quality of public education and health services in Madagascar are already widely recognized. The data on rural primary schools and health care providers in the EPM community survey provide additional evidence of the poor conditions in these sectors. High teacher student ratios and sharing of classrooms by multiple classes is the norm in rural public primary schools. Facility indicators suggest schools in disrepair. Private primary alternatives, where they exist, tend to score higher in terms of these attributes. An example is the condition of the school building, which is reported to be "good" or "fair" in 87 percent of private schools but only 40 percent of public schools.

For health care providers, the data from the community survey are consistent with reports of problems of drug availability in the public health care system. Free antibiotics, vaccines, and drugs for the treatment of malaria are typically available only part of the time at public health care facilities (hospitals and basic care facilities). This lack of adequate supplies is a constraint on the ability of public care providers to improve the health status of the population. When free drugs are not available, rural residents must either forego using these medicines or else purchase them on the private market (if they are available); however, medicines at market prices are undoubtedly more expensive than many poor households can afford. The data on facility indicators similarly suggest the existence of constraints on the delivery of effective public health services in rural areas, especially for basic care facilities. Only 22 percent of these facilities have electricity; 43 percent have a refrigerator, and only a fourth have running water. The figures for hospitals are better but still far from satisfactory.

5. Price increases for social services will reduce utilization by the poor more than by the non-poor.

A key policy issue, in view of severe revenue constraints facing the government, is the potential for cost recovery through user charges for public services. Simulations based on econometric model estimates indicate that public primary school fees in rural areas could be doubled or more without leading to significant reductions in average rates of public or overall primary enrollments. However, this in part reflects the very small levels of fee currently imposed; larger fee increases would be needed for effective cost recovery and, if not accompanied by quality improvements, these would have less benign effects on enrollment levels. For public health care facilities in rural areas, which at the time of survey generally did not impose explicit consultation fees, the potential for cost-recovery may also be limited. A simulation of the introduction of user charges of 1000 FMG (equal to about half of what it would cost to consult a private provider) at such facilities led to non-trivial declines in adult visits to formal care providers, even when substitution into the private sector was taken into account.

The above refers to changes in *average* rates of (rural) enrollments and health care consultations. Of equal importance are the distributional implication of pricing policies. Replicating a common pattern, the demand model results for both primary school and adult health care indicate that the poor are more sensitive then the non-poor to changes in prices for services. Simulated fee increases for public services resulted in larger percentage point declines among poor households in both children's primary enrollment probabilities and rates of adult health provider consultations. Because fee increases also lead to larger proportional reductions in demand for the poor, the incidence of these services will become less progressive (or more regressive) than initially, that is, less well-targeted to the poor.

Given public sector revenue shortfalls, there is a strong need to find alternate means to fund social services. These means include increases in fees for education and health services as well as the recent proposal to extend the value-added tax (TVA) to medicines. Although these goals are important and necessary, policymakers need to be aware of potentially adverse consequences of cost-recovery efforts for the utilization of education and health services overall and specifically by the poor.

6. Improvements in public primary school quality will have large, pro-poor effects on primary enrollments.

Our estimates of primary school choice indicate that parents in rural areas are more likely to enroll their children in public primary schools when quality, represented by school characteristics data in our community data set, is higher. The estimates support the belief that poor and deteriorating school quality has been a factor in the serious declines in primary enrollments in Madagascar in recent years. Simulations of improvements in public school quality show that these improvements will lead to large enrollment gains in public schools and in primary schooling overall. With regard to equity, enrollment rates for children at the lower end of the household expenditure distribution will increase at least as much, and generally more, than for children at the upper end of the distribution. In proportional terms, the gains are much larger for the poor. This is the case for public enrollments specifically and for all primary enrollment.

These simulations used a largely rural sample. Urban households on average are wealthier than rural households and probably also enjoy better quality public schools. Based on the responsiveness of parents to quality shown by the model estimates, a reasonable inference is that improvements in school quality that target rural areas, or more generally areas where school quality is lowest, will disproportionately benefit poor children.

Further simulations addressed the extent to which improvements in public school quality could be financed by households themselves, through increases in fees. These simulations showed the range of feasible combinations of cost-recovery and enrollment increases for a particular quality improvement. There does appear to be some scope for financing school improvements with user fees. For example, if classroom sharing were eliminated, annual fees could be raised by 5,000 FMG (about U.S. $2.50) or more while still yielding an increase in mean enrollments over their pre-improvement levels. However, since the demand of the poor is more sensitive to changes in price, the appropriate policy of cost-recovery would be one of

differential fee increases—i.e., price discrimination—in which fees are raised more for the non-poor (either individuals or communities) than the poor.

7. Expansion of the private education and health sectors will not fill the gaps in public service provision

Currently, private alternatives to public services, for both education and health, are used disproportionately by wealthier households—a common pattern. Fees and related expenses for private education and health care alternatives are typically several times the costs of the corresponding public service. Still, in view of the resource limitations that make further expansion of public facilities difficult as well as the evidently poor quality of public services, it is worth trying to assess whether a more developed private sector would be able to compensate for shortcomings in public sector provision.

Our simulation results suggest that the private sector will not easily be able to fill this role. Even a major expansion of private providers (at current fee levels) in rural areas will not lead to large changes in overall (public and private) rates of primary enrollment or curative care consultations, and such changes as occur will not be particularly pro-poor. The changes were particularly small in the case of the health care simulations. In the primary school case, the simulation does support another hypothesis about private sector expansion: that the *public* service (public primary enrollments) will become better targeted to the poor. This happens because affluent households are the most likely to switch to the new private alternatives. Importantly, however, the improvement in the public schooling incidence occurs in the context of stagnating overall (public and private) educational equity.

For the private sector to have a more significant impact, substantial government subsidies would very likely be necessary for private providers to find it worthwhile to expand into unserved rural areas while offering their services at prices low enough to attract poor consumers. The key question, of course, is whether such a policy of government support would represent a rational use of scarce public funds for education and health; it could only be justified on the basis of a clear superiority of private provider quality to public quality, or as a more efficient use of public funds than improving the quality of existing public facilities. For primary schooling at least, the large estimated impacts of changes in public school quality indicators raise doubts on the latter score. Of course, a full assessment of either strategy—investing in quality improvements or encouraging the private sector through subsidies—would require information on the relative costs of each.

8. Rural secondary school enrollments are constrained by lack of access to schools.

Currently in rural areas only one fourth of communities have a local lower secondary school; the average distance to the nearest such school is 15 kilometers (it is 41 kilometers for upper secondary). Only about one-fifth of the surveyed communities are served by a paved road. Estimates of the determinants of secondary school enrollments highlight the important role played by these school location and transportation infrastructure factors in household decisions to enroll children in secondary school. The distance to the nearest lower secondary school and the presence of a paved road to the village have very strong negative and positive effects,

respectively, on the likelihood a primary school completer goes on to enter secondary school. Simulations show that building more (i.e., closer) secondary schools and improving the transportation network will have substantial benefits for secondary enrollment in rural areas.

In fact, difficulties in access are significant deterrents to utilization for all the types of social services analyzed in this report. Distance to the nearest public primary school has a negative effect on the probability of primary school attendance. Similarly, distance to basic health care facilities has a negative impact on consultations at such facilities for children, and (through its association with the opportunity cost of care) distance also reduces hospital and basic care consultations for adults. These results are not surprising given the very poor state of rural roads and the transportation network in general in rural Madagascar. Therefore it is likely that a policy of investments in construction of local schools and health care facilities *or* improvements in the transportation network—or both—will serve to raise primary enrollments and rates of treatment for illness among rural residents.

9. Gender does not, for the most part, play a role in determining access to education and health services

A general lack of gender bias was seen both in the descriptive analysis and the education and health care demand estimations. In both urban and rural areas, girls and boys were equally likely to be attending primary school and equally likely to be taken for treatment if ill. Similarly, the likelihood of care was about the same for ill men and women. The econometric analyses of primary schooling and health care confirmed these findings. Overall, the results are consistent with the view that, at least relative to many other developing countries, women enjoy a favorable position in Malagasy society.

The exception to this lack of gender differences—the reason for the phrase "for the most part"—is education as the secondary level. The descriptive data show that fewer girls than boys are enrolled in secondary school, though the gap is not large. The econometric results show that among primary school completers in rural areas, girls are less likely than boys to continue on to secondary school. Strictly from a from a poverty reduction standpoint, this is of somewhat limited concern, because the small number of rural residents who attend secondary school are concentrated among affluent households. Nevertheless, the results are important. They suggest that girls will be at a later disadvantage in the labor market, since secondary schooling increases the chances of formal sector employment and also has large positive effects—larger than primary schooling—on wages (Glick 1999). And of course, it is anticipated that secondary enrollments will resume the expansion that was interrupted by economic crisis in the 1980s. To insure that girls participate equally in this expansion, additional research is necessary to investigate the reasons why parents are more likely to send sons than daughters on to secondary school.

10. Household income and education are important determinants of investments in health and in children's schooling

These are not surprising findings by any means—they merely confirm what has been found in countless studies of developing countries—but they bear reiterating. Household income, represented in the models by household per capita expenditures, has strong positive

effects on primary schooling in rural areas. For both education and health care, it also is an important determinant of the choice of public vs. private providers: controlling for other factors, more affluent households are more likely to enroll their children in private primary schools, and adults from such households who become ill are more likely to seek treatment from private formal health care providers. If private providers are of higher quality than those in the public sector, this means that the well-off not only make greater overall use of education and health services, but are also receiving better quality services. With regard to the effects of schooling, the educational attainment of parents has strong impacts on children's primary and secondary enrollment, and greater schooling of the household head raises the likelihood that a child who is ill will receive formal health care.

These results point to the existence of important synergies in policies to reduce poverty and to expand access to education and health care. Poverty reduction, by raising incomes, will raise household investments in education and health. In turn, these investments, particularly in schooling, will raise future incomes. Furthermore, policies that raise enrollments today will have positive intergenerational effects on schooling by raising the investments these children will eventually make as adults in the education of their own children. However, the other side of the coin of this "virtuous cycle" is a vicious cycle of declining education enrollments and falling incomes leading to further declines in education (and health), and thus also in incomes. From this perspective, the recent declines in primary (and secondary) school enrollments in Madagascar, and of incomes as well, bode ill for Madagascar's future. They provide a further rationale for efforts to raise both school enrollments and incomes.

APPENDIX A: THEORETICAL AND ECONOMETRIC MODEL OF SCHOOLING CHOICE

In this Appendix we present the theoretical background and econometric specification of the model of primary school choice discussed in section III. Essentially the same approach is used in the analysis of health care provider choice. The theoretical model assumes that the household (or the parents) derives utility from the human capital (or simply, education) of its children and from the consumption of all other goods and services. The household must choose between enrolling the child in public school, in private school, or not at all. Enrolling a child in school for another year will raise the child's human capital, but since there are costs associated with schooling, this lowers the household's consumption of other goods and services. In addition, these costs as well as school quality – hence the improvement in human capital from an additional year in school – will in general be different for the public and private school alternatives.

The household chooses the school alternative (including non-enrollment) which brings the highest utility. Formally, the utility associated with each alternative *j* can be represented as:

$$(A.1) \quad U_{ij} = U_{ij}\,(S_{ij}, C_{ij}) + e_{ij}$$

where S_{ij} is the increment to child *i*'s human capital from another year of education at school *j* and C_{ij} is the level of household consumption possible after sending the child to this school alternative. e_{ij} is a disturbance term representing unobserved determinants of utility from option j. The improvement in human capital S_{ij} is a function of individual and household characteristics X_i (e.g., gender, parental education) and school quality factors Q_j :

$$(A.2) \quad S_{ij} = S_{ij}\,(X_i, Q_j)$$

For the no-schooling alternative, S_{ij} is simply zero. C_{ij}, the level of household consumption associated with alternative *j*, equals annual household income minus the costs of schooling:

$$(A.3) \quad C_{ij} = Y_i - P_j$$

where Y_i is household income and P_j is the cost of schooling, including both direct costs such as fees, books, and transportation, and indirect (opportunity) costs. For the no-schooling alternative, school costs are zero so consumption simply equals household income.

Equation (A.1) is a *conditional* utility function, as it represents household utility conditional on choosing alternative *j*. The household maximizes utility by choosing the alternative with the highest conditional utility. Thus the utility level of the household U* will be:

$$(A.4) \quad U^* = \max(U_{\text{non-enrollment}}, U_{\text{public}}, U_{\text{private}})$$

To apply this model empirically we need to specify the conditional utility functions in terms of observed variables. We do not directly observe S_{ij}, the improvement in a child's human

capital from a year of schooling at alternative j, but the dataset does contain information on the individual and school factors that determine S_{ij}, i.e., X_i and Q_j . The latter includes the school characteristics variables described in the text. Therefore conditional utility is specified a function of household income (represented empirically by household per capita consumption expenditures), individual and household characteristics, school costs, and school characteristics. A simple linear functional form for the utility function, frequently used in the literature, would be:

$$(A.5) \quad U_{ij} = \beta_{0j} + \beta_{1j}X_i + \beta_{2j}Q_j + \beta_{3j}Y_i + \beta_{4j}P_j + e_{ij}$$

Note that the coefficients β have *j* subscripts, meaning that the effects of the variables are allowed to vary depending on the alternative.[92] This specification is essentially the same as that used in studies by Mwabu et. al. (1993), Akin et. al. (1985) and others.

A problem with the simple linear specification shown in (A.5) is that the effects of changes in price are restricted to be the same across income groups. As noted in the text, more flexible specifications typically find that poor households are more responsive to changes in price. To provide this flexibility, we interact the price variable with dummy variables for household per capita expenditure quartile:

$$(A.6) \quad U_{ij} = \beta_{0j} + \beta_{1j}X_i + \beta_{2j}Q_j + \beta_{3j}Y_i + \beta_{4j1}P_j * Quartile_1 + \beta_{4j2}P_j * Quartile_2 + \beta_{4j3}P_j * Quartile_3 + \beta_{4j4}P_j * Quartile_4 + e_{ij}$$

The dummy variable $Quartile_k$ (k=1,..,4) equals 1 if the expenditures per capita of the individual's household falls in quartile *k*, and zero otherwise. Thus the model estimates separate price responses for each quartile.[93]

The conditional utility function in (A.6) can be written more compactly as

$$(A.6) \quad U_{ij} = V_{ij} + e_{ij}$$

where $V_{ij} = \beta_{0j} + \beta_{1j}X_i + \beta_{2j}Q_j + \beta_{3j}Y_i + \beta_{4j1}P_j * Quartile_1 + \beta_{4j2}P_j * Quartile_2 + \beta_{4j3}P_j * Quartile_3 + \beta_{4j4}P_j * Quartile_4$

Our objective is to estimate the probability of choosing a given school alternative. The decision rule illustrated by equation (A.4) implies that the probability of choosing an option, say public school, equals the probability that utility from public school exceeds the utility from each of the other choices (private school and non-enrollment). The form that the probability

[92] Gertler et. al. (1987) argue against alternative-specific income and price coefficients on the grounds that this is inconsistent with the basic postulates of consumer rationality. More recently, however, Dow (1999) offers a convincing theoretical rationale for this specification.

[93] Note that the level of household per capita expenditures (our income variable) affects utility both through the price-expenditure quintile interactions and directly though the linear $\beta_{3j}Y_i$ term. In principle, one should also allow the effect of income to vary by quantile, by including interactions of household expenditure with the quartile dummies; otherwise the price-quartile interactions may be picking up non-linear income effects. However, as noted in the text, statistical tests indicated that the linear income specification is appropriate for the models estimated here.

expression takes depends on the assumption made about the distribution of the disturbance term in (A.6). One common assumption, that the disturbance terms are distributed independently and identically Gumbel, leads to probabilities of the multinomial logit form. While easy to estimate, this imposes the assumption that the error terms for different alternatives are uncorrelated, meaning that unobserved factors affecting utility from one option are not related to unobserved factors influencing another option. This is an unrealistic assumption for pairs of alternatives that are closely related, such as public and private schools.[94]

Instead, as in many recent studies of provider choice, we estimate the choice probabilities as nested multinomial logits. This is a generalization of the multinomial logit model that allows error terms to be correlated across alternatives within a subgroup of related choices but not across subgroups (Maddala 1983).[95] Following standard practice we assume that the error terms of the schooling choices, which in the present case consist of public school and private school, are correlated. Letting K=3 be the total number of alternatives and numbering them 1 for non-enrollment, 2 for public school, and 3 for private school, the probability of choosing option j from among the choices in the school subgroup (2,3) is:

$$\text{Prob}_j = \frac{\exp\left(\frac{V_j}{\sigma}\right)\left[\sum_{k=2}^{K}\exp\left(\frac{V_k}{\sigma}\right)\right]^{(\sigma-1)}}{\exp(V_1)+\left[\sum_{k=2}^{K}\exp\left(\frac{V_k}{\sigma}\right)\right]^{\sigma}}$$

where σ-1 is the correlation in the error terms for private and public school. A value σ outside the 0,1 range is an indication that the nesting structure grouping public and private choices together is inappropriate. If σ equals 1 (or, statistically speaking, is not significantly different from 1) the correlation of the error terms is zero. In this case the model reduces to the simple non-nested multinomial logit model.

These probability expressions are adjusted as needed to accommodate the fact that all individuals do not have the same number of schooling options from which to choose. In particular, the private primary school option is not available to many, indeed the majority, of rural households in our sample.

With regard to the parameter estimates, note that the decision rule implies that it is the *differences* in the U_{ij} functions, not the functions themselves, that determine the probabilities.[96] Consequently, for parameters that vary by choice (all parameters in our specification) we

[94] The assumption that all error terms are independent imposes equality of cross-price elasticities across alternatives. That is, the effect (in percentage terms) of a change in the price of one alternative on the probability of choosing another alternative is identical for all pairs of alternatives.

[95] The nested multinomial logit model was introduced by McFadden (1981) and used by Gertler and van der Gaag (1987) among others to analyze the choice of education or health care providers.

[96] For example, the probability that public school (j=1) is chosen is the probability ($U_1 > U_2$, $U_1 > U_0$), which is equivalent to prob($V_1 - V_2 > e_2 - e_1$, $V_1 - V_0 > e_0 - e_1$). The ($V_j - V_k$) in this expression are vectors, with elements ($\beta_j - \beta_k$)x corresponding to each independent variable x. This illustrates the dependence of the choice probability on the differences in the parameters only, not their absolute values.

estimate not β_j but rather the difference in parameters associated with pairs of choices, i.e., β_j - β_k. It is necessary then to normalize the estimates by fixing the values (e.g., to zero) of the parameters for one of the alternatives, which is then the base choice. We choose non-enrollment as the base. The reported estimates for the public or private school alternatives are therefore to be interpreted as showing the effects of the explanatory variables on the utility from these alternatives relative to non-enrollment.

We estimated the nested logit model using the NLOGIT module of the LIMDEP software package. As noted above, we use the same empirical approach to estimating health care provider choice. For that analysis, the base option is the no care/informal care category, and the structure of the model assumes that the error terms of the three formal care options are correlated.

REFERENCES

Alderman, Harold, Peter Orazem, and Elizabeth Paterno. 1997. "School Quality, School Cost, and the Public/Private School Choices of Low-Income Households in Pakistan." Working Paper Series on Impact Evaluation of Education Reforms 2. World Bank, Policy Research Department, Washington, DC.

Akin, J., C. Griffin, D. Guilkey, and B. Popkin. 1985. *The Demand for Primary Health Services in the Third World.* Totowa, NJ: Rowman and Allanheld.

Cohen, J. and Cohen, P. 1988. *Applied Multiple Regression/correlation Analysis for the Behavioral Sciences* (2nd ed.). New York: Academic Press.

Dow, William. 1999. "Flexible Discrete Choice Demand Models Consistent with Utility Maximization: An Application to Health Care Demand." *American Journal of Agricultural Economics*

_____.1995a. "Welfare Impacts of Health Care User Fees: A Health-Valuation Approach to Analysis with Imperfect Markets." Labor and Population Program Working Paper Series 95-21, RAND (DRU-1233-RC).

_____.1995b. "Unconditional Demand for Curative Health Inputs: Does Selection on Health Status Matter in the Long Run?" Labor and Population Program Working Paper Series 95-22, RAND (DRU-1234-RC).

Gertler, P., L. Locay, and W. Sanderson. 1987. "Are User Fees Regressive? The Welfare Implications of Health Care Financing Proposals in Peru." *J. Econometrics* 36(September/October):67-88.

Glick, Peter. 1999. "Patterns of Employment And Earnings in Madagascar." Cornell University Food and Nutrition Policy Program Working Paper No. 92, Ithaca, NY.

Institute National de la Statistique (INSTAT) 1995. "Enquete Permanente aupres des Manages: Rapport Principal." Antananarivo: INSTAT.

_____. 1997. "Résultats de l'enquête communautaire 1993/1994: Les principaux résultats." Antananarivo: INSTAT]

International Monetary Fund. 1997. "Madagascar—Recent Economic Developments and Selected Issues." Washington, D.C.: International Monetary Fund.

Maddala, G.S. 1983. "Limited Dependent and Qualitative Variables in Econometrics." Econometric Society Monograph No. 3, Cambridge University Press, Cambridge.

McFadden, D. 1981. "Econometric Models of Probabilistic Choice." In *Structural Analysis of Discrete Data with Econometric Applications*, C. Manski and D. McFadden, eds., Chapter 5, pp. 198-272. Cambridge, MA: MIT Press, 1981.

Michaelowa, K. 2000. "Depenses d'education, qualite de l'education et pauvrete: l'example de cinq pays d'Afrique francophone." Paris: OECD Development Center.

Mwabu, G., M. Ainsworth, and A. Nyamete. 1993. "Quality of Medical Care and Choice of Medical Treatment in Kenya: An Empirical Analysis." *J. Human Resources* 28(Fall):838-62.

Sahn, David, and Younger, Stephen D. 1999. "Fiscal Incidence in Africa: Microeconomic Evidence". Cornell University Food and Nutrition Policy Program Working Paper No. 91, Ithaca, NY.

Selden, Thomas. and Michael Wasylenko. 1995. "Measuring the distributional effects of Public Education in Peru." In *Public Spending and the Poor: Theory and Evidence*, Van de Walle, D. and Nead, K., eds. Baltimore and London: The John Hopkins University Press.

Sen, Amartya, 1987. "On Ethics and Economics: The Royal Lectures at the University of California at Berkeley." Oxford: Basil Blackwell, Ltd.

Strauss, J., and Thomas, D. 1995. "Human resources: empirical modeling of household and family decisions." In: *Handbook of Development Economics*, Vol. 3, Srinivasan, T.N. and Behrman, J., eds. Amsterdam: North-Holland Publishing Company.

World Bank. 1995. "Madagascar: Towards a School-Based Strategy for Improving Primary and Secondary Education." Washington, D.C.: World Bank.

_____. 1996. Madagascar Poverty Assessment. Washington, D.C.: World Bank.

Table 1: Gross and net enrollment rates and private and female shares in enrollments, by expenditure quintile: all Madagascar

	Expenditure quintile					
	1 (poorest)	2	3	4	5 (richest)	all
Primary						
Gross enrollment rate[a]	0.48	0.70	0.75	0.87	1.08	0.73
net enrollment rate[b]	0.33	0.49	0.51	0.62	0.72	0.51
% female[c]	0.50	0.51	0.50	0.49	0.50	0.50
% private[d]	0.17	0.12	0.18	0.26	0.45	0.23
Secondary						
Gross enrollment rate[a]	0.03	0.07	0.10	0.23	0.49	0.17
net enrollment rate[b]	0.02	0.06	0.08	0.19	0.36	0.13
% female[c]	0.45	0.45	0.44	0.50	0.48	0.48
% private[d]	0.38	0.18	0.27	0.35	0.53	0.42
University						
Gross enrollment rate[a]	0.000	0.003	0.003	0.012	0.069	0.021
net enrollment rate[b]	0.000	0.003	0.002	0.005	0.038	0.011
% female[c]	--	0.00	0.21	0.47	0.54	0.51

Notes:

[a] All enrollments at the school level (primary, secondary or university) divided by the number of school age children (school age defined as 6-11 for primary, 12-18 for secondary, 19-24 for university)

[b] Enrollments of school age children divided by the number of school age children.

[c] Share of girls in total enrollment

[d] Share of private enrollment in total enrollment

Table 2: Rural and urban enrollment rates by expenditure quintile

	Rural			Urban		
	1 (poorest)	5 (richest)	all	1 (poorest)	5 (richest)	all
Primary						
Gross enrollment rate	0.44	0.90	0.65	0.95	1.32	1.17
net enrollment rate	0.30	0.61	0.46	0.63	0.86	0.78
% female	0.50	0.48	0.50	0.50	0.51	0.49
% private	0.14	0.25	0.18	0.16	0.78	0.40
Secondary						
Gross enrollment rate	0.02	0.22	0.09	0.18	0.88	0.52
net enrollment rate	0.02	0.18	0.08	0.11	0.57	0.38
% female	0.44	0.48	0.48	0.47	0.46	0.47
% private	0.28	0.43	0.33	0.23	0.62	0.49

Notes:
Expenditure quintiles are calculated separately for rural and urban samples.

Table 3: Gross and net enrollment rates by province

	ANTANANARIVO	FIANARANTSOA	TOAMASINA	MAHAJANGA	TOLIARY	ANTSIRANANA
Primary						
Gross enrollment rate	0.91	0.55	0.80	0.69	0.47	1.02
net enrollment rate	0.63	0.40	0.54	0.49	0.32	0.65
Secondary						
Gross enrollment rate	0.26	0.12	0.12	0.17	0.09	0.26
net enrollment rate	0.20	0.09	0.10	0.12	0.08	0.19

Table 4: Per child and per capita enrollment rates for public schooling by level and expenditure quintile: all Madagascar

	Expenditure quintile					
	1 (poorest)	2	3	4	5 (richest)	all
Primary						
per child enrollment rate[a]	0.278	0.421	0.426	0.465	0.380	0.388
per capita enrollment[b]	0.089	0.129	0.103	0.098	0.066	0.097
Secondary						
per child enrollment rate[a]	0.015	0.047	0.061	0.125	0.172	0.080
per capita enrollment[b]	0.003	0.010	0.012	0.023	0.034	0.017
University						
per child enrollment rate[a]	0.0000	0.0026	0.0019	0.0052	0.0377	0.0111
per capita enrollment[b]	0.0000	0.0002	0.0003	0.0016	0.0093	0.0023

Notes:

[a] public enrollment rate for school-age children

[b] number of public enrollments divided by number of individuals (all ages) in the quintile

Table 5 : Median annual household school expenditures per student by school type and expenditure quintile

	Expenditure quintile					
	1 (poorest)	2	3	4	5 (richest)	all
Primary						
Public:						
School expenditures (FMG)	4,717	5,988	6,173	10,000	14,352	7,453
As % of household per capita expenditures	0.046	0.036	0.028	0.030	0.027	0.032
Private:						
School expenditures (FMG)	10,101	11,363	15,732	32,407	56,019	33,230
As % of household per capita expenditures	0.103	0.068	0.075	0.111	0.083	0.085
Secondary						
Public:						
School expenditures (FMG)	18,557	21,593	21,803	26,791	36,598	29,764
As % of household per capita expenditures	0.146	0.131	0.102	0.086	0.061	0.081
Private:						
School expenditures (FMG)	23,430	26,087	58,800	50,000	73,711	66,598
As % of household per capita expenditures	0.221	0.158	0.252	0.149	0.110	0.132

Table 6 : Rates of reported illness /injury and treatment by expenditure quintile: All Madagascar

	Expenditure quintile					
	1 (poorest)	2	3	4	5 (richest)	all
Percent reporting recent[a] illness or injury	0.10	0.13	0.14	0.15	0.17	0.14
of which : Percent consulting a health care provider	0.34	0.32	0.34	0.41	0.45	0.38
of which : Percent consulting[b]:						
Formal care:						
Hospital	0.36	0.17	0.19	0.21	0.18	0.21
Basic health care facility[c]	0.36	0.55	0.52	0.48	0.39	0.46
Doctor, private clinic, or pharmacy	0.14	0.15	0.22	0.20	0.35	0.23
All formal care	0.85	0.87	0.93	0.88	0.92	0.90
Informal care (Traditional healer)	0.15	0.13	0.07	0.12	0.08	0.10

Notes:

[a] in the two weeks preceding the interview

[b] refers to first type of treatment sought

[c] Includes *Dispensaire, Post sanitaire, Poste d'infirmerie,* and *CSSP.*

Table 7: Rates and type of treatment of ill/injured individuals by zone and expenditure quintile

	Rural			Urban		
	1 (poorest)	5 (richest)	all	1 (poorest)	5 (richest)	all
Percent of ill/injured consulting a health care provider	0.33	0.37	0.34	0.38	0.61	0.53
of which : Percent consulting:						
Formal care:						
Hospital	0.40	0.19	0.20	0.36	0.17	0.22
Basic health care facility	0.34	0.41	0.48	0.34	0.35	0.38
Doctor, private clinic, or pharmacy	0.10	0.29	0.19	0.25	0.45	0.35
All formal care	0.85	0.89	0.88	0.96	0.98	0.95
Informal care (Traditional healer)	0.15	0.12	0.12	0.05	0.03	0.05

Notes:
Expenditure quintiles are calculated separately for rural and urban samples.

Table 8 : Per capita health care utilisation rates by provider type and expenditure quintile

	Expenditure quintile					
	1 (poorest)	2	3	4	5 (richest)	all
Public[a]:						
Hospital	0.012	0.008	0.010	0.013	0.015	0.011
Basic health care facility	0.012	0.026	0.025	0.029	0.034	0.025
Total public	0.025	0.033	0.035	0.041	0.049	0.037
Private (formal care) [b]	0.005	0.007	0.010	0.013	0.029	0.013

Notes:
Refers to first type of treatment sought.
Shows number seeking curative or non-curative care as a percentage of the total number of people in the quintile (ill or not ill).
(Excludes pre-and post-natal care and vaccinations for children)
[a] Includes (under basic health care) *dispensaire* , which may be private or public.
[b] Private doctor, clinic, or pharmacy

Table 9: Mean expenditure per illness or injury by provider type and expenditure quintile (FMG)

	Expenditure quintile					
	1	2	3	4	5	all
	(poorest)				(richest)	
Hospital	2,805	1,718	1,177	2,120	2,810	2,222
Basic health care facility	1,085	1,580	588	1,868	1,448	1,367
Doctor, private clinic, or pharmacy	4,879	2,786	3,266	6,120	6,799	5,480
Informal care (Traditional healer)	2,048	1,781	1,580	2,551	5,408	2,825
Monthly household expenditures[a]	69,289	97,942	114,406	143,141	284,902	141,889

Notes:
Shows mean expenditure per individual illness (fees and transportation costs)
[a] mean total household monthly expenditures

Table 10: Children age 6-12: Enrollment rates and school availability indicators by rural household per capita expenditure quartile

	Expenditure quartile				
	1 (poorest)	2	3	4 (richest)	all
Not enrolled	0.59	0.47	0.46	0.31	0.48
Enrolled in public primary school	0.35	0.47	0.48	0.51	0.45
Enrolled in private primary school	0.05	0.05	0.06	0.18	0.08
School availablilty indicators:[a]					
Public primary	0.96	0.96	1.00	0.96	0.97
Private primary	0.22	0.20	0.19	0.35	0.23

Notes:
Sample of children age 6-12 used in estimation of primary school choice model.
[a] A school type (public or private) is considered available if it is listed in the community survey as one of the three schools most frequently used by residents of the community.

Table 11: Characteristics of public and private primary schools by rural household per capita expenditure quartile

	Expenditure quartile				
	1 (poorest)	2	3	4 (richest)	all
Public schools					
Annual costs (Fmg)[a]	4,982	6,232	5,837	7,979	6,092
Distance (km)	0.35	0.21	0.36	0.14	0.27
Student-teacher ratio	53.47	61.59	51.54	53.41	55.45
Maximum class size	44.83	45.27	44.22	46.08	45.03
Share classrooms[b]	0.65	0.73	0.65	0.59	0.67
Building condition[c]	0.41	0.40	0.38	0.41	0.40
Window condition[d]	0.05	0.07	0.03	0.10	0.06
Roof condition[e]	0.31	0.24	0.22	0.33	0.27
Private schools					
Annual costs (Fmg)[a]	15,053	14,672	16,997	21,004	16,957
Distance (km)	0.42	0.31	0.22	0.21	0.29
Student-teacher ratio	48.38	47.64	38.96	42.04	44.67
Maximum class size	48.77	45.83	49.01	48.70	48.02
Share classrooms[b]	0.59	0.60	0.62	0.47	0.56
Building condition[c]	0.83	0.83	0.81	0.97	0.87
Window condition[d]	0.40	0.43	0.32	0.44	0.40
Roof condition[e]	0.46	0.49	0.57	0.71	0.56

Notes:
[a] Community median annual expenditures per student
[b] =1 if two or more classes are taught in the same room, zero otherwise.
[c] =1 for good or fair building condition, zero for bad building condition.
[d] =1 for none or few windows missing/broken, zero for many missing/broken or no windows.
[e] =1 for good or fair roof condition, zero for bad roof condition.

Table 12: Children 6-12: Primary School Choice Nested Logit Model Estimates

	Public school		Private school	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic
Intercept	-3.948	-3.355 ***	-4.5017	-3.303 ***
School variables[a]:				
price*quartile1	-0.019	-3.491 ***	-0.0110	-2.951 ***
price*quartile2	-0.008	-2.683 ***	-0.0054	-1.940 *
price*quartile3	-0.005	-1.756 *	-0.0030	-1.325
price*quartile4	-0.001	-0.272	0.0022	1.174
Distance (km)	-0.689	-2.877 ***	0.4445	1.347
Share classrooms	-0.803	-3.304 ***	0.3829	1.164
Window condition	0.983	2.405 **	-0.0807	-0.215
Building condition	0.241	1.393	-0.2645	-0.565
Household expenditures per capita/100	0.011	1.165	0.0119	0.928
Age	0.333	3.587 ***	0.2949	3.158 ***
Female	0.139	0.930	0.0001	0.000
No. of children	-0.001	-0.026	-0.1651	-1.619 *
No. of adults	0.219	2.656 ***	0.4128	3.852 ***
Mother primary	0.748	2.875 ***	0.3736	0.873
Mother Secondary or higher	1.748	2.925 ***	1.6755	2.138 **
Mother education missing	-0.482	-0.619	--	--
Father primary	0.713	2.665 ***	1.6127	3.049 ***
Father secondary or higher	2.124	3.302 ***	3.4345	3.975 ***
Father education missing	0.274	0.595	1.0912	1.129
Fianarantsoa	-1.158	-2.719 ***	-0.9385	-1.655 *
Toamasina	0.532	2.036 **	0.6630	1.232
Toliara	-0.160	-0.524	-1.2880	-2.111 **
Mahajanga	0.253	0.926	-1.1258	-1.249
Antsiranana	0.827	2.322 **	0.6293	0.743
Sigma	0.765	3.858 ***	0.7650	3.858 ***

No. of observations = 1820

Notes: Base choice is non-enrollment. For province (Faritany) dummy variables, Antananarivo is the excluded category.

[a]school cost variables: price*quintilej = annual school cost divided by 100 if the expenditure per capita of the individual's household falls in the jth quartile, zero otherwise

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 13: Primary school price elasticities by expenditure quartile

	Public school				Private school	
	Public available sample (n=1784)		Public and private available sample (n=504)		Public and private available sample (n=504)	
Quartile	Own price elasticity[a]	Cross price elasticity[b]	Own price elasticity[a]	Cross price elasticity[b]	Own price elasticity[c]	Cross price elasticity[d]
1 (Poorest)	-0.51	0.10	-0.88	0.54	-1.14	0.25
2	-0.22	0.05	-0.37	0.29	-0.77	0.17
3	-0.12	0.03	-0.19	0.18	-0.41	0.13
4 (Richest)	-0.03	0.01	-0.05	0.04	0.34	-0.27
All	-0.25	0.06	-0.38	0.26	-0.41	0.04

Notes:
Computed from nested logit parameter estimates and data using analytical derivatives.
Elasticities are computed for each observation; table shows overall sample and quartile means.
[a]elasticity of public school probability with respect to public school price
[b]elasticity of private school probability with respect to public school price
[c]elasticity of private school probability with respect to private school price
[d]elasticity of public school probability with respect to private school price

Table 14: Simulated changes in primary enrollment probabilities from a 1000 Fmg increase in public school fees

	Public school			Private school			All primary		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.358	0.332	-0.027	0.052	0.055	0.003	0.411	0.386	-0.024
2	0.455	0.442	-0.012	0.059	0.060	0.001	0.514	0.503	-0.011
3	0.480	0.472	-0.008	0.060	0.061	0.001	0.540	0.534	-0.007
4	0.517	0.516	-0.001	0.175	0.175	0.000	0.691	0.691	-0.001
All	0.441	0.427	-0.014	0.077	0.079	0.002	0.519	0.506	-0.012

Table 15: Simulated changes in primary enrollment probabilities from implementation of a 5000 Fmg fee in all public schools

	Public school			Private school			All primary		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.358	0.246	-0.112	0.052	0.062	0.010	0.411	0.308	-0.103
2	0.455	0.401	-0.054	0.059	0.065	0.006	0.514	0.466	-0.048
3	0.480	0.445	-0.035	0.060	0.065	0.005	0.540	0.510	-0.030
4	0.517	0.512	-0.005	0.175	0.176	0.001	0.691	0.688	-0.003
All	0.441	0.382	-0.059	0.077	0.083	0.006	0.519	0.465	-0.053

Table 16: Simulated changes in primary enrollment probabilities from elimination of sharing of classrooms in public schools

	Public school			Private school			All primary		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.358	0.433	0.075	0.052	0.045	-0.007	0.411	0.479	0.068
2	0.455	0.544	0.089	0.059	0.048	-0.011	0.514	0.592	0.078
3	0.480	0.567	0.087	0.060	0.048	-0.012	0.540	0.616	0.075
4	0.517	0.580	0.063	0.175	0.162	-0.012	0.691	0.742	0.051
All	0.441	0.521	0.080	0.077	0.067	-0.010	0.519	0.588	0.070

Notes:
See text for details of the simulation.

Table 17: Simulated changes in primary enrollment probabilities from improvement of window condition in public schools

	Public school			Private school			All primary		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.358	0.493	0.134	0.052	0.040	-0.012	0.411	0.533	0.122
2	0.455	0.594	0.139	0.059	0.042	-0.017	0.514	0.636	0.123
3	0.480	0.631	0.151	0.060	0.038	-0.022	0.540	0.669	0.128
4	0.517	0.639	0.122	0.175	0.133	-0.041	0.691	0.772	0.081
All	0.441	0.578	0.137	0.077	0.057	-0.021	0.519	0.635	0.117

Notes:
See text for details of the simulation.

Table 18: Simulations of fee increases combined with quality improvements in public primary schools: eliminating sharing of classrooms

	Expenditure quartile				
Policy	1	2	3	4	all
	Public primary enrollment probabilities				
None[a]	0.34	0.46	0.45	0.51	0.43
Eliminate room sharing	0.45	0.58	0.58	0.62	0.55
Eliminate room sharing *and* raise fees by Fmg:					
5,000	0.31	0.52	0.55	0.62	0.48
10,000	0.20	0.46	0.51	0.61	0.41
20,000	0.06	0.34	0.43	0.60	0.32
	Overall primary enrollment probabilities[b]				
None[a]	0.38	0.51	0.51	0.63	0.49
Eliminate room sharing	0.49	0.63	0.62	0.72	0.60
Eliminate room sharing *and* raise fees by Fmg:					
5,000	0.36	0.57	0.59	0.72	0.53
10,000	0.25	0.51	0.55	0.71	0.48
20,000	0.13	0.41	0.48	0.70	0.39

Notes:

Sample for simulation consists of observations for which public school classroom sharing variable = 1.

[a] Shows initial enrollment probabilities

[b] Refers to changes in overall (public plus private) enrollment resulting from changes in classroom sharing and fees in public schools.

Table 19: Simulations of fee increases combined with quality improvements in public primary schools: improving window condition

	Expenditure quartile				
Policy	1.00	2.00	3.00	4.00	all
	Public primary enrollment probabilities				
None[a]	0.35	0.44	0.48	0.50	0.43
Improve window condition	0.49	0.59	0.63	0.63	0.58
Improve window condition *and* raise fees by Fmg:					
5,000	0.35	0.53	0.59	0.63	0.51
10,000	0.23	0.47	0.56	0.62	0.44
20,000	0.08	0.35	0.48	0.61	0.34
	Overall primary enrollment probabilities[b]				
None[a]	0.40	0.50	0.54	0.68	0.51
Improve window condition	0.53	0.63	0.67	0.77	0.63
Improve window condition *and* raise fees by Fmg:					
5,000	0.41	0.58	0.64	0.77	0.57
10,000	0.29	0.53	0.60	0.76	0.51
20,000	0.15	0.42	0.54	0.75	0.42

Notes:

Sample for simulation consists of observations for which the public school window condition variable =0 (no windows in building or many windows broken)

[a] Shows initial enrollment probabilities

[b] Refers to changes in overall (public plus private) enrollment resulting from changes in window condition and fees in public schools.

Table 20: Simulated changes in primary enrollment probablities from an expansion of private primary schools

	Public school			Private school			All primary		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.358	0.322	-0.036	0.052	0.116	0.064	0.411	0.438	0.028
2	0.455	0.361	-0.094	0.059	0.208	0.149	0.514	0.569	0.055
3	0.480	0.361	-0.119	0.060	0.242	0.182	0.540	0.604	0.063
4	0.517	0.315	-0.202	0.175	0.448	0.273	0.691	0.762	0.071
All	0.441	0.341	-0.100	0.077	0.229	0.151	0.519	0.570	0.049

Notes:
Simulates expansion of private primary schools to communities in which private school is currently unavailable.
New private schools are assumed to have the mean characteristics of exisiting ones.

Table 21: Children 12 to 18: indicators of presence of and distance to secondary schools

	Located in village/town	Distance to nearest school (km)[a]
School type:		
Lower secondary	0.24	15
Upper secondary	0.10	41

Notes:

[a] equals zero if school is located in village.

Table 22: Children 12-18: Determinants of Secondary School Enrollment

	All Children 12-18		Primary Completers only	
Variable	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	-0.354	-0.693	5.725	6.247 ***
Distance to lower secondary school (km)	-0.062	-6.338 ***	-0.066	-5.213 ***
Distance to upper secondary school (km)	-0.002	-1.249	0.000	-0.115
Paved road in village	0.337	2.980 ***	0.704	3.904 ***
Female	-0.119	-1.059	-0.387	-2.203 **
Age	-0.079	-2.751 ***	-0.329	-6.529 ***
Household expenditure per capita/10000	0.000	1.309	0.000	0.047
No. of children < 5	-0.121	-2.202 **	0.002	0.022
No. of children 5-14	0.027	0.762	0.082	1.439
No. of males 15-20	0.030	0.496	-0.056	-0.616
No. of females 15-20	0.161	2.235 **	0.183	1.603
No. of males 21-65	0.133	2.126 **	0.021	0.198
No. of females 21-65	-0.010	-0.142	-0.045	-0.404
No. of adults > 65	0.002	0.014	-0.030	-0.168
Mother primary	0.482	4.059 ***	-0.197	-0.958
Mother Secondary or higher	1.363	6.461 ***	0.398	1.192
Mother education missing	-0.586	-1.404	-0.727	-1.230
Father primary	0.178	1.358	0.073	0.340
Father secondary or higher	1.120	6.212 ***	0.806	2.832 ***
Father education missing	0.366	1.344	0.054	0.112
Fianarantsoa	-0.381	-2.528 **	-0.636	-2.794 ***
Toamasina	0.031	0.185	-0.069	-0.280
Toliara	-0.082	-0.432	-0.456	-1.613
Mahajanga	-0.011	-0.068	0.259	0.938
Antsiranana	0.359	2.082 **	0.373	1.361
No. of observations	1979		480	

Notes: Estimates of probit model for current enrollment in secondary school

The excluded province (Faritany) category is Antananarivo.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 23: Simulated changes in secondary enrollment probabilities from reducing distance to schools and providing access to paved roads

	All children 12 to 18	Primary completers only
Simulation:		
None[a]	0.111	0.580
Reduce distance to:		
lower,upper secondary by 1/2	0.133	0.619
lower secondary by 1/2	0.128	0.618
lower secondary to zero	0.166	0.667
Provide paved road to village	0.140	0.700
Provide paved road and reduce distance to lower secondary by 1/2	0.165	0.742

Notes:

Shows sample mean predicted probabilities of secondary school enrollment

[a] mean enrollment probability at actual values of independent variables

Table 24 : Mean costs per visit by health care provider category (Fmg)

	Hospitals	Basic care facilities[a]	Private formal care[b]
Direct costs:			
Fees	46	137	1,951
Transportation	796	123	166
Total direct costs	842	260	2,116
Indirect costs[c]	751	563	326
Total costs[c]	1,593	824	2,442

Notes:

[a] Includes *Dispensaire, Post sanitaire, Poste d'infirmerie,* and *CSSP.*

[b] Includes Doctor, private clinic, and pharmacy

[c] Calculated for adults (age 15 and over)

Table 25: Ill/injured children and adults: percent seeking care and provider availability indicators by provider type and rural household per capita expenditure quartile

	Expenditure quartile				
	1	2	3	4	all
Adults 15 and older:					
No care/informal care	0.74	0.76	0.76	0.68	0.71
Hospital	0.11	0.06	0.06	0.08	0.08
Basic care facility	0.10	0.14	0.14	0.15	0.14
Private formal care	0.05	0.04	0.04	0.09	0.07
Children under 15:					
No care/informal care	0.72	0.69	0.68	0.55	0.66
Hospital	0.11	0.04	0.04	0.11	0.07
Basic care facility	0.14	0.20	0.22	0.23	0.20
Private formal care	0.03	0.07	0.06	0.10	0.07
Provider availability indicators[a]					
Hospital	0.63	0.55	0.57	0.68	0.61
Basic care facility	0.94	0.91	0.94	0.92	0.92
Private formal care	0.32	0.42	0.47	0.53	0.45

Notes:

[a] A provider category is considered to be available if either a provider in the category is listed in the community survey or some individuals in the community report consulting the provider.

Table 26: Characteristics of health care providers by rural household per capita expenditure quartile

	Expenditure quartile				
	1	2	3	4	all
Hospitals					
Distance (km)	19.98	16.52	9.02	12.93	14.14
Hours open per week	66.50	74.39	88.99	83.80	79.62
Personnel[a]					
Doctor	2.80	2.86	2.68	2.69	2.75
Nurse/midwife	2.80	2.85	2.86	2.92	2.87
Free Medicine Availability[b]					
malaria medicine	2.52	2.31	2.15	2.39	2.34
antibotics	2.10	1.98	1.98	2.06	2.03
vaccines	2.98	2.89	2.90	2.85	2.90
Facility condition indicators[c]:					
Electricity	0.52	0.61	0.43	0.58	0.54
Refrigerator	0.84	0.84	0.87	0.84	0.85
Running water	0.70	0.73	0.73	0.65	0.70
Building condition	2.02	2.11	1.96	1.87	1.98
Basic Care Facilities					
Distance (km)	7.85	6.12	4.75	5.42	5.80
Hours open per week	59.94	65.70	73.91	71.37	68.78
Personnel[a]					
Doctor	1.21	1.34	1.43	1.47	1.39
Nurse/midwife	2.48	2.53	2.58	2.62	2.57
Free Medicine Availability[b]					
malaria medicine	1.86	2.06	1.96	2.03	1.99
antibotics	1.74	1.85	1.80	1.76	1.79
vaccines	2.45	2.54	2.46	2.37	2.45
Facility indicators[c]:					
Electricity	0.14	0.17	0.24	0.27	0.22
Refrigerator	0.47	0.46	0.38	0.43	0.43
Running water	0.12	0.16	0.28	0.32	0.24
Building condition	1.66	1.73	1.94	1.89	1.83
Private Formal Care					
Distance (km)	4.82	3.31	3.81	3.32	3.60
Hours open per week	80.20	86.76	94.84	92.83	90.83
Personnel[a]					
Doctor	2.72	2.57	2.71	2.64	2.65
Nurse/midwife	1.83	1.34	1.41	1.41	1.44
Free Medicine Availability[b]					
malaria medicine	1.69	1.22	1.42	1.49	1.44
antibotics	1.41	1.09	1.23	1.23	1.22
vaccines	1.67	1.24	1.28	1.24	1.29
Facility condition indicators[c]:					
Electricity	0.56	0.63	0.45	0.68	0.60
Refrigerator	0.58	0.28	0.23	0.28	0.30
Running water	0.52	0.32	0.30	0.60	0.46
Building condition	2.62	2.46	2.32	2.64	2.53

Notes:

[a] responses: 1= never present, 2 = present part of the time, 3 = always present

[b] responses: 1= never available, 2 = available part of the time, 3 = always available

[c] for all except building condition: 1 = present, 0 = not present
for building condition: 1= bad, 2 = medium, 3 = good

Table 27 Adults: Health Care Provider Choice Nested Logit Model Estimates

	Provider					
	Hospital		Basic Care		Private Formal Care	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Intercept	-12.138	-3.373 ***	-1.374	-1.552	-14.025	-2.835 ***
Provider cost[a]:					0.033	1.060
price*quartile1	-0.050	-2.157 **	-0.143	-3.338 ***	--	--
price*quartile2	-0.013	-1.181	-0.097	-3.191 ***	--	--
price*quartile3	-0.030	-1.126	-0.066	-2.802 ***	--	--
price*quartile4	-0.027	-1.994 **	-0.028	-2.236 **	--	--
Provider Characteristics:						
Doctor	0.596	1.140	0.026	0.138	3.845	2.552 **
Free malaria medicine	-0.263	-0.786	0.438	2.388 **	-0.808	-0.827
Free antibotics	-0.096	-0.249	-0.091	-0.394	-1.180	-0.957
Free vaccines	3.634	3.243 ***	-0.264	-1.270	0.473	0.810
Refrigerator	-2.825	-3.470 ***	0.005	0.020	1.093	1.234
Electricity	0.938	1.794 *	0.421	1.363	-0.127	-0.179
Provider variables missing	0.326	0.932	-0.684	-1.841 *	2.346	3.327 ***
Household expenditure per capita/10000	0.007	1.552	0.003	0.733	0.016	3.434 ***
Age	-0.005	-0.550	-0.014	-2.090 **	-0.012	-1.284
Female	-0.229	-0.788	-0.161	-0.797	-0.097	-0.352
Years schooling	0.056	1.249	0.018	0.489	0.066	1.393
Duration of illness	0.222	1.978 **	-0.004	-0.040	0.193	1.639
No. of children in household	0.078	1.006	0.082	1.354	0.197	2.241 **
No. of adults in household	0.244	3.076 ***	0.070	0.993	0.114	1.316
Sigma	0.870	5.581 ***	0.870	5.581 ***	0.870	5.581 ***

No. of observations = 1229

Notes:

Model also includes dummy variables for region (Faritany) and season.

[a] For hospital and basic care, price*quintilej = cost per visit/100 if the expenditure per capita of the individual's household falls in the jth quartile, zero otherwise. For private care, cost is entered linearly.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 28: Adults: Health care price elasticities by expenditure quartile

	Hospital			Basic care		
Quartile	Hospital*	Basic care	Private formal care	Hospital	Basic care*	Private formal care
1	-0.19	0.14	0.05	0.08	-0.63	0.03
2	-0.05	0.06	0.01	0.05	-0.56	0.03
3	-0.16	0.05	0.01	0.06	-0.31	0.03
4	-0.21	0.05	0.01	0.04	-0.17	0.02
All	-0.17	0.07	0.02	0.05	-0.36	0.03

Notes:

Starred (*) columns show own (direct) price elasticities; other columns show cross elasticities.

Computed from nested logit parameter estimates and data using analytical derivatives.

Table 29: Children under 15: Health Care Provider Choice Nested Logit Model Estimates

	Provider					
	Hospital		Basic Care		Private Formal Care	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Intercept	-21.094	-2.902 ***	-1.893	-0.663	-9.461	-2.165 **
Cost per visit /100	0.015	0.601	-0.068	-2.327 **	-0.041	-1.089
Distance (km)	-0.002	-0.143	-0.108	-2.362 **	-0.196	-1.503
Distance missing	0.122	0.103	1.896	1.325	3.389	1.364
Provider Characteristics:						
Doctor	-0.026	-0.024	0.804	1.814 *	1.119	1.182
Free malaria medicine	0.091	0.152	0.583	1.687 *	0.265	0.277
Free antibotics	1.265	1.715 *	-0.670	-1.434	-1.413	-1.009
Free vaccines	5.176	2.717 ***	-0.962	-2.255 **	1.420	1.510
Refrigerator	-1.680	-1.407	1.989	2.903 ***	-0.705	-0.543
Electricity	0.224	0.261	-0.472	-0.687	1.938	1.690 *
Provider variables missing	0.463	0.460	-2.135	-1.574	-2.967	-1.180
Household expenditure per capita/10000	0.001	0.105	-0.006	-0.573	0.004	0.453
Age	-0.318	-2.017 **	-0.212	-1.497	-0.334	-2.043 **
Female	1.322	1.455	1.001	1.243	0.369	0.445
Duration of illness	-0.055	-0.093	-0.011	-0.022	0.594	1.056
Household head schooling	0.370	1.937 *	0.290	1.601	0.387	1.913 *
No. of children in household	-0.342	-1.068	-0.643	-1.860 *	-0.471	-1.397
No. of adults in household	0.864	1.877 *	0.671	1.541	0.901	1.885 *
Sigma	0.261	2.032 **	0.261	2.032 **	0.261	2.032 **

No. of observations = 828

Notes:

Model also includes dummy variables for region (Faritany) and season.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 30: Adults: Simulated changes in consultation probabilities from a 1000 Fmg fee per visit for basic care

	Hospital			Basic Care			Private Formal Care			All Formal Care		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.013	0.013	0.0006	0.014	0.005	-0.0091	0.007	0.008	0.0006	0.034	0.026	-0.0078
2	0.011	0.012	0.0010	0.018	0.009	-0.0091	0.008	0.009	0.0007	0.038	0.030	-0.0074
3	0.010	0.010	0.0005	0.020	0.013	-0.0072	0.012	0.012	0.0008	0.041	0.035	-0.0059
4	0.013	0.013	0.0004	0.030	0.026	-0.0047	0.016	0.017	0.0004	0.059	0.056	-0.0039
All	0.012	0.012	0.0006	0.021	0.014	-0.0072	0.011	0.012	0.0006	0.044	0.038	-0.0060

Notes:
Simulates implementation of a uniform 1000 Fmg fee per consultation at all basic care facilities.
Shows unconditional average probabilities and changes in probabilities, i.e., averages calculated over ill and non-ill individuals.

Table 31: Adults: Simulated changes in consultation probabilities from a 1000 Fmg fee per visit at all public health care providers

	Public Care[a]			Private Formal Care			All Formal Care		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.027	0.015	-0.0116	0.007	0.008	0.0009	0.034	0.023	-0.0106
2	0.029	0.020	-0.0089	0.008	0.009	0.0008	0.038	0.029	-0.0081
3	0.029	0.021	-0.0082	0.012	0.013	0.0010	0.041	0.034	-0.0073
4	0.043	0.037	-0.0061	0.016	0.017	0.0007	0.059	0.054	-0.0054
All	0.033	0.025	-0.0084	0.011	0.012	0.0008	0.044	0.037	-0.0076

Notes:
[a]Public facilities include hospitals and basic care facilities
Simulates implementation of a uniform 1000 Fmg fee per consultation at all public health care facilities.
Shows unconditional average probabilities and changes in probabilities, i.e., calculated over ill and non ill individuals.

Table 32: Children under 15: Simulated changes in consultation probabilities from a Fmg 1000 fee per visit for basic care

	Hospital			Basic Care			Private Formal Care			All Formal Care		
Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
1	0.007	0.008	0.0010	0.013	0.010	-0.0026	0.003	0.004	0.0003	0.023	0.022	-0.0013
2	0.008	0.009	0.0012	0.027	0.022	-0.0050	0.008	0.009	0.0012	0.042	0.040	-0.0025
3	0.009	0.010	0.0013	0.031	0.025	-0.0058	0.012	0.014	0.0016	0.052	0.049	-0.0028
4	0.016	0.017	0.0016	0.035	0.029	-0.0059	0.018	0.020	0.0019	0.068	0.066	-0.0023
All	0.009	0.011	0.0013	0.025	0.020	-0.0047	0.009	0.011	0.0012	0.044	0.042	-0.0022

Notes:

Simulates implementation of a uniform 1000 Fmg fee per consultation at all basic care facilities.

Shows unconditional average probabilities and changes in probabilities, i.e., averages are calculated over ill and non-ill individuals.

Table 33: Simulated changes in consultation probabilities from an expansion of private formal health care providers

	Public Care[a]			Private Formal Care			All Formal Care		
Sample/ Quartile	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability	Initial Probability	New probability	Change in probability
Adults									
1	0.027	0.026	-0.0007	0.027	0.010	0.0029	0.034	0.036	0.0021
2	0.029	0.029	-0.0008	0.029	0.011	0.0026	0.038	0.039	0.0018
3	0.029	0.029	-0.0006	0.029	0.014	0.0022	0.041	0.042	0.0016
4	0.043	0.042	-0.0010	0.043	0.020	0.0032	0.059	0.062	0.0022
All	0.033	0.032	-0.0008	0.033	0.014	0.0027	0.044	0.046	0.0019
Children									
1	0.020	0.016	-0.0038	0.003	0.009	0.0056	0.023	0.025	0.0018
2	0.034	0.029	-0.0055	0.008	0.016	0.0080	0.042	0.045	0.0025
3	0.040	0.033	-0.0065	0.012	0.021	0.0087	0.052	0.054	0.0022
4	0.050	0.040	-0.0099	0.018	0.031	0.0135	0.068	0.072	0.0036
All	0.034	0.028	-0.0061	0.009	0.018	0.0085	0.044	0.046	0.0024

Notes:
Simulates expansion of private formal health care providers to communities in which they are currently unavailable.
New private providers are assumed to have the mean characteristics of exisiting ones.
Shows unconditional average probabilities and changes in probabilities, i.e., averages calculated over ill and non-ill individuals.
[a] Combines hospital and basic care facilities