

# Public Service Provision, User Fees, and Political Turmoil\*

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## Abstract

This study looks at public service delivery in rural areas of Madagascar. The blockade of the central highlands of Madagascar by a defeated president lets us examine the short-term effect of a large unanticipated macro shock and subsequent elimination of user fees on the rural delivery of health and education services. We found enrollment in rural primary schools surprisingly resilient to the crisis, probably because it unfolded in the middle of the school year. In contrast, the blockade led to a large drop in health care services, measured by the number of patient visits to health care centers. Part of this effect can be explained by an increase in monetary poverty. After the blockade, user fees were suspended in schools and health centers but the measure was not applied immediately in all rural communes. Controlling for supply effects, time dummies, and school and health center fixed effects, we find that the suspension of user fees is associated with a significant increase in both school enrollment and visits to health centers.

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## 1. Introduction

Providing public services such as basic health and education to millions of poor people all over the world is one of the fundamental challenges of this century. Yet little is known regarding the factors affecting the supply and demand for these services in poor countries. One issue that has been debated in the recent literature is the effect of user fees on demand for health and education (e.g. Pradhan & Prescott 2002, Deininger 2003, Alderman, Orazem & Paterno 2001, Gertler & Glewwe 1990, Behrman & Knowles 1999). Lack of funding is a major cause for insufficient provision of public services in less developed countries. Cost recovery in the form of user fees is seen by many as a way of easing funding constraints, and thereby of increasing supply. Although the importance of adequate funding is not in dispute, some researchers worry about the effect user fees have on demand, especially among the poor. Social services are also at the mercy of macroeconomic and political shocks. Poor countries are often subjected to riots, blockades, and various forms of warfare. These political shocks are likely to disrupt the delivery of public services but there is little evidence regarding the magnitude of the disruption. In particular, it is not known whether some public services are more resilient and whether others are more vulnerable.

In this paper we seek to provide some elements of answer to these questions. We examine the short-run effect of a blockade on health and education services. The evidence suggests considerable resilience in primary education but more vulnerability in health care delivery. We also find that unexpectedly removing user fees in schools and health centers – without apparent change in supply quality – triggers a large short-term increase in usage.

The data on the basis of which this paper is written come from Madagascar, an island with a population of approximately 16 million people off the East coast of Africa. In the first half of 2002, Madagascar experienced a major political crisis. This crisis was the outcome of a dispute over the results of a presidential election held in December 2001. Following his electoral defeat, the incumbent president blockaded the central highlands of the country for several months. The blockade, which lasted from January to June 2002, affected the delivery of public services in several ways. Essential supplies became scarce, especially drugs and medical equipment (Programme Ilo 2002*b*). Fuel prices experienced a six-

fold increase in the central highlands, dramatically raising the cost of transportation. Energy generation and distribution were also disrupted and poverty increased dramatically (Fafchamps & Minten 2002). Fortunately, violent confrontation between the two sides of the political dispute remained limited and little bloodshed occurred.<sup>1</sup>

The aftermath of the crisis also introduced large changes in public service delivery. As a palliative to the massive increase in poverty generated by the blockade, the new president ordered in August and September 2002 a (temporary) elimination of school and health care fees. These measures were not adopted simultaneously in all provinces but rather followed the gradual process of reestablishment of central authority over the country. By June 2003 – one year later – all provinces had eliminated school fees and user fees in health care (e.g. Programme Ilo 2003*b*, Programme Ilo 2003*a*).

This sequence of events is illustrative of the kinds of macro shocks that many developing countries experience. It is now commonplace for the losers of an election to dispute official results and for defeated incumbents to entrench themselves, often at great cost to the country.<sup>2</sup> The blockade imposed by the defeated president is representative of such political costs. Furthermore, as a result of changes in international commodity prices and foreign exchange crises, developing countries regularly go through massive changes in fuel prices and in the availability of medical supplies. The blockade mimics such shocks quite well, but offers the advantage of being unanticipated. The blockade can thus be construed as a laboratory for the resilience of public services under the stress induced by unanticipated macro-economic shocks.

The blockade and the subsequent removal of user fees provides a good opportunity to compare the short-term effect of a removal of user fees to that of a large macro shock. Data on public service provision collected in November 2002 give us a rare glimpse into the workings of public service provision under stress.

What makes this paper unique is the fact that these massive changes took place over a short time period. Over this short period, location-specific factors affecting the demand and supply of public services

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<sup>1</sup>Violent confrontation between partisans of the two sides took place nearly exclusively in June 2002, shortly before the end of the crisis. Approximately 100 casualties were reported in various incidents. The crisis was ended in late June when the incumbent presidential candidate fled the country.

<sup>2</sup>This is certainly true in many developing countries, but also increasingly true in developed countries (e.g., the 2000 US election and the 2006 Italian elections). The fact that the results of the presidential election were fiercely disputed is in a sense more representative of the current state of world affairs than the ideal of a smooth transition.

can be regarded as constant – and can be controlled for using fixed effects. Under normal conditions, short panels convey little information because changes occurring over a short period are typically small in magnitude. As a result, measurement error weakens econometric results. This is less true in our case.

There is a large literature on the provision of education and health services in developing countries. One issue that has been debated in the recent literature is the effect of user fees on demand for health and education (e.g. Pradhan & Prescott 2002, Deininger 2003, Alderman, Orazem & Paterno 2001, Gertler & Glewwe 1990, Behrman & Knowles 1999). Lack of funding is a major cause for insufficient provision of public services in less developed countries. Cost recovery in the form of user fees is seen by many as a way of easing funding constraints, and thereby of increasing supply and/or quality (e.g. Johnstone 2004, Birdsall & Orivel 279-96, Lewis 1993).<sup>3</sup> Hammer & Gertler (1999) provide a recent overview of the issues and empirical literature and conclude that the impact of user fees depends critically on whether the revenue from user fees is reinvested in improving supply.

Although the importance of adequate funding is not in dispute, some empirical studies have documented a strong negative effect of user fees on demand, especially among the poor (e.g. Glick & Sahn 2006, Asfaw, von Braun & Klasen 2004). Other empirical studies have suggested instead that the effect of user fees on provision is small, either because people can substitute between private and public providers (Sahn, Younger & Genicot 2003) or because an improvement in quality more than compensates for the rise in price (Deininger & Mpuga 2005). Which effects dominates thus remains largely unresolved empirically.

By comparing the situation before, during, and after the blockade, our analysis throws some light on this debate. The available supply information suggests that, over the one year period of the study, key supply measures such as the number of teachers and health staff did not change. Other dimensions of supply did change, however, such as the availability of books and working equipment. The blockade had little effect on school enrollment but it is associated with a large decrease in the use of health services by rural communities of Madagascar. Part of this effect can be attributed to an increase in rural poverty fueled by skyrocketing prices. In contrast, we observe a large increase in school enrollment and visits to

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<sup>3</sup>See, however, Hillman & Jenkner (2002) for an opposite point of view.

health centers following the removal of user fees in late 2002. Only a small proportion of this increase can be explained by changes in observable supply conditions. The evidence provided here can thus be seen as confirming that, keeping supply and quality constant, the demand for schooling and health services among poor rural populations responds significantly to price.

The paper is organized as follows. We begin in Section 2 with a short historical account of the political crisis that sets the stage for this paper. The data are presented in Section 3. Descriptive and qualitative evidence is discussed in Section 4. Econometric results are presented in Section 5 for the education and health sectors. Conclusions and policy implications are presented at the end. Given that our emphasis is empirical, we omit the presentation of a theoretical framework. The interested reader is referred to Deininger & Mpuga (2005), Sahn, Younger & Genicot (2003), Asfaw, von Braun & Klasen (2004) and Glick & Sahn (2006) for recent empirical models of education and health care and education in sub-Saharan Africa.

## 2. The Political Crisis

The political crisis that sets the stage for our analysis unfolded in Madagascar as a result of the first round of the presidential election held in December 2001. The official count did not identify a clear winner in the first round as the incumbent president (Ratsiraka) was shown to obtain 42% of the votes compared to 46% of the votes for the opposition leader (Ravalomanana). However, the own polling results of the opposition leader as well as the results of a donor funded election monitoring committee showed that the opposition leader gathered enough votes (>50%) in the first round to be declared the winner.<sup>4</sup> Hence, the opposition leader maintained that election results were rigged.

Major strikes were organized in anticipation and in contestation of the official results as soon as they came out. Thousands of people gathered every day in the capital of Antananarivo to show their support to the opposition leader. Most of these strikes took place in the capital, the stronghold of the opposition leader, as he was the popular mayor of the capital just before the elections and as he belongs to the

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<sup>4</sup>The own polling results of the group around the opposition leader showed around 52% of the votes for Ravalomanana. The election monitoring committee arrived at a number just above 50%. However, none of these two sources had data for all the voting bureaux.

Merina ethnic group that lives in the highlands in and around the capital. After a month of standoff and under popular pressure to move ahead, the opposition leader declared himself president, formed his own government, and took hold of the ministries in the capital.

The incumbent president Ratsiraka did not accept this turn of events and insisted on a second round arguing that neither candidate obtained the required 50% of the votes. With the support of governors he had earlier appointed in the coastal provinces, he declared the independence of the five coastal provinces and put in place roadblocks to the capital. In an effort to strangle the economy of the central province even further, the president and his cronies started a campaign to blow up several crucial bridges and as such severed transport between provinces.

The overall effect of this dispute was an economic standstill of the country.<sup>5</sup> As access to ports during the stand-off was controlled by the old regime and as no transport between provinces was possible, no fuel could get in the country (although a small black market in fuel developed).<sup>6</sup> From February 2002 onwards, motorized transport became rare in the whole country (in the central as well as the coastal provinces).<sup>7</sup> Most firms that had to import or export goods closed down and the number of unemployed was estimated to rise to around 150,000 in total for the country, most of them in the capital (Government of Madagascar 2002).<sup>8</sup>

The situation was resolved at the end of June 2002 after the opposition leader secured the support of the army which gradually took over the coastal provinces. By the end of June, most of the international community had recognized Ravalomanana as the new president and life slowly returned to normal. In

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<sup>5</sup>In July 2002, the government predicted for 2002 a negative growth of BNP of -10.7% (-19.7% for the secondary sector, -14.6% for the tertiary sector, -1.2% for the primary sector) (Government of Madagascar 2002).

<sup>6</sup>This situation continued even after the situation was resolved as the foreign exchange market stopped functioning during the crisis and the petroleum companies were unable to pay for deliveries due to this situation. The foreign exchange market had been closed down as foreign assets of the Malagasy government had been frozen by the French and the American government after they had received conflicting letters of two different central bank directors (one for each government).

<sup>7</sup>Alistair Leithead of the BBC documented the black market fuel trade. He reported as follows (BBC, May 23, 2002): "About three miles off the coast a boat laden with fuel, which rumour says comes from South Africa, is illegally moored and ready to sell in bulk to anyone prepared to make the trip. Dhows, small traditional sailing boats, make the risky journey. . . In Mahajanga, the petrol pumps are empty, but the

black-market traders sell for 2,500 Malagasy francs, about 35 cents, a litre. But there is not a huge amount of fuel available in the town. Most goes into barrels and heads down the road to Antananarivo. . . By the time the barrels cross the [roadblocks] they are worth 9,000 Malagasy francs, \$1.20 at the black-market exchange rate. Some petrol is sold on the way, but it is too risky to enter the city after dark because of gangsters. They park up and wait for first light. In Antananarivo, fuel is sold for between 12 and 14,000 Malagasy francs a litre, \$1.75. The people you see in the street siphoning off the precious liquid into cars and vans pay even more. Ordinary consumers pay at least double. The political crisis has produced a whole new trade in fuel, becoming more entrenched as the deadlock continues."

<sup>8</sup>Lack of economic activity also led to lack of income for the government. It was estimated in May 2002 that the government only obtained 45% of the planned income for that period (Government of Madagascar 2002).

the beginning of August 2002, most fuel stations were up and running again. Although this crisis proved dramatic for the people of Madagascar, there are clearly lessons to be learned of the impact of such an exogenous shock on the functioning of the economy and the delivery of social services.

### 3. The data

Three types of surveys – at the level of the commune, health center, and school – were organized at the end of 2002. The main purpose was to evaluate the effect of the political turmoil and of the policy changes on the functioning of the economy and on the delivery of social services. Most questions were therefore formulated as recall questions on the period before (November/December 2001), during (May/June 2002) and following the political crisis (November/December 2002). Reliance of recall questions opens the possibility of recall bias but we hope that this bias is minimized by the salience of the events surrounding the crisis and the focus on a few key indicators.

Data collection was undertaken by the USAID-funded Ilo program, in collaboration with INSTAT and FOFIFA.<sup>9</sup> This project has a long experience collecting data in Madagascar and had at the end of 2001 completed a socioeconomic census of all communes in the country. The commune census was used to set up a stratified sampling frame in a way to have the collected data be representative of the rural situation at the national and provincial level. *Fivondronona* (districts) were divided in six strata depending on the distance to the capital of the province (close, medium, far) and on the availability of a tarred road. In each strata, one *fivondronana* was selected for every province. In each *fivondronana* (36 out of 111 in total), four communes were selected randomly. Via interviews with key informants and focus groups – typically local administrators, public servants, traders and farmers – the survey collected detailed information on the socio-economic situation at the commune level. The commune survey was only held in rural areas given the difficulty to obtain reliable overall estimates on the heterogeneous population of large urban centers.

A key objective of the data collection was to study the impact of the political crisis and the ensuing reduction in user fees on social services. Health centers and schools were visited and surveyed separately

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<sup>9</sup>INSTAT is the statistical institute of the Ministry of Economy and Finance. FOFIFA is the agricultural research center within the Ministry of Scientific Research.

from the commune. There is a health center in every commune in Madagascar. This health center was visited in every sampled commune. Since there are multiple primary schools in each commune, two were selected randomly using stratified sampling: one school was selected in the center of the commune; the other is a randomly selected ‘remote’ school located at least 3 kilometers away from the center. Some 284 schools were visited in total.

## **4. Public service provision during the study period**

We begin by examining the descriptive evidence in detail. We first discuss the effect of the crisis and its aftermath on rural prices and incomes. We then examine supply and demand shifts in health care and education over the study period.

### **4.1. Prices and incomes**

The results of the commune focus group interviews illustrate the dramatic impact of the political crisis (Table 1). As the regular distribution channels of fuel were disrupted during the blockade, the prices of kerosene and gasoline skyrocketed (as they were only available on the black market). This led to a doubling of transport costs for personal travel as well as for the shipping of goods (Table 1). It led also to a dramatic reduction in the availability of means of transport. 80% of motorized transport was estimated to have been immobilized during the crisis (Government of Madagascar 2002). The transport situation improved after the blockade was lifted but transportation costs after the crisis had not yet come down to their pre-crisis level by the time of the December 2002 survey.

Focus groups were asked to evaluate the percentage of the population that had difficulties or was unable to feed itself. While admittedly a crude method, this number turned out during pre-testing to be quite easy to estimate. Survey results indicates that, by this measure, the percentage of poor households fell during the crisis (Table 1). This underestimates the poverty effect of the crisis because many farmers auto-consume their own output. Furthermore, the time of the crisis corresponds with the harvest period (May/June) while the pre- and post-crisis reference periods correspond to the lean season (November/December). Using a detailed expenditure survey that was done at the end of 2001 and at the



end of 2002, INSTAT (2003) estimates rural poverty to have increased by 9% between the two years.

During the crisis, the prices of imported goods increased dramatically and many goods became unavailable. The prices of basic consumption goods (salt, sugar, vegetable oil, kerosene) at least doubled. Producer prices decreased slightly during the crisis – and the number of traders that bought producer goods declined due to transport difficulties – while agricultural wages remained stagnant (Table 1). Consequently, the purchasing power of rural households declined and a much larger proportion of households had difficulties paying for school fees and health care visits. Almost two thirds of commune focus groups stated that the effect of the political crisis was the worst welfare shock in the commune over the last ten years – in a country that is regularly hit by cyclones, droughts, plant diseases or locus invasions. To have some quantitative idea on the effect of the political crisis on monetary income, communal focus groups were asked to evaluate its evolution for an average household in the commune. According to focus group estimates, the income of an average household decreased by 46% during the crisis and at the end of 2002 was 20% lower compared to the same period in 2001 (Table 1).

#### **4.2. The effect on the health sector**

We now examine how the functioning of the health and education sectors were affected during the study period. We begin with the health sector. Manpower in this sector was surprisingly resilient during the crisis: there is anecdotal evidence that some health staff were not able to report for work, but this was not an overall trend (Table 2).<sup>10</sup> Some health centers adjusted to the crisis through a reduction in opening hours, especially in urban centers. This was generally implemented to allow staff more time to walk home given the lack of motorized transport. When the transport crisis was over, opening hours were adjusted back to the pre-crisis schedule.

Another indication of supply changes is the evolution of the availability of different medicines. We measure drug availability by taking a simple average of the most frequently used medicines. According to this measure, availability of medicines declined from 89% to 73% between December 2001 and May/June 2002 and got even slightly worse after the crisis (Table 2). The worsening situation after the crisis has

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<sup>10</sup>For Madagascar as a whole, the Ministry of Health estimates that during the crisis around 250 doctors left the health center to which they were assigned. By November 2002, 181 had returned to their post.

been blamed on an increase in the number of visits resulting from the change in the pricing policy of the new government, and on the bad organization of the distribution of the free medicines.<sup>11</sup>

Access to electricity in rural areas did not show any major change during the crisis (Table 2).<sup>12</sup> Some 50% of the public rural health centers did not have electricity before the crisis and this proportion only increased marginally during the crisis. More worrisome was the situation with fridges, used to store medicines and vaccines. While 73% of the health centers had a working fridge before the crisis started, this number dropped to 56% in June (Table 2). The reason for the decline was lack of fuel to power fridges in rural areas.

Given the dramatic circumstances, the supply side of the health sector appears to have been affected surprisingly little by the transportation shock. The obvious explanation is that only motorized transport was touched by the crisis. The supply side of the health sector was thus only affected for these goods and services that depend on motorized transport. However, while the supply side was less affected than expected, this does not mean that the use of health services stayed constant. As shown in Table 2, the median number of visits to health centers dropped. The staff at the health center were asked to voice their opinion on the reason for change. Their responses are summarized in Table 3. The major reason perceived for the drop is the increase in poverty. In 54% of the health centers that noticed a drop in the number of visits, the staff of the center related this to the increase of poverty and the inability of people to pay the fees (Table 3).<sup>13</sup> Only in 17% of the cases did they explain the drop in visits by a lack of staff or medicines.

This state of affairs was one of the reasons the new government intervened after the crisis. To reduce the welfare impact of increased poverty, the pricing policy of public services was changed. The new president declared in August that user fees would (temporarily) be abolished in public health centers. This policy, however, was unevenly applied in space and time. Table 1 shows that simple medicines and

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<sup>11</sup>After the crisis, SALAMA, the governmental medicine distribution center, bought 20 billion Fmg (3 billion \$) worth of medicines for free distribution. Since these medicines were only distributed at the very end of December 2002, their effect is not captured in our survey.

<sup>12</sup>The new government was able to bring in occasional supplies of fuel in well protected convoys. This fuel was used as part of a strategic stock to keep electricity going and for other essential activities.

<sup>13</sup>It was stated that in case of illness, patients who no longer came to health centers either did not seek formal services at all or did visit traditional healers. The people in charge of the health estimated that, if there was a drop in the number of visits in their center during the crisis, a significant part of their normal patients did not receive any treatment at all anymore. A quarter of the centers said that patients would go to traditional healers. This is especially the case for rural areas. It is only in urban centers that patients seemed to have had at least partial substitution possibilities.

consultations were offered for free in 15% of the public rural health centers before the crisis. By the time the survey team visited them in December 2002, only 74% of surveyed health centers were refraining from charging user fees. The reason for this was that it took time for the new government to assert its authority in all provinces. The new policy was well applied in the central province of Antananarivo where 93% of the public centers had abolished fees by the time of the survey. In the central province, the median month for abolishment was August. In contrast, in the northern province of Antsiranana only 55% of surveyed health centers had abolished user fees by November 2002.

Table 2 shows the mean and the median of the number of visits to health centers in the period December 2001, May/June 2002 and December 2002. Compared to December 2001, the number of visits to public rural health centers decreased slightly during the crisis and increased significantly afterwards.<sup>14</sup> Monthly visits in December 2002 almost doubled compared to the previous year. Answers to qualitative questions asked to health staff indicate that the main perceived reason for the increase in the number of visits is the elimination of user fees (Table 3).

#### **4.3. The effect on the education sector**

The impact of the political crisis was slightly less visible in the education sector (Lassabille & Tan 2003). As in the health sector, working hours were reduced. Some 56% of schools experienced interruptions in teaching, mostly due to strikes and rallies in favor of the two presidential candidates. In urban areas, all schools were affected and, on average, cancelled classes for an average of 58 days (Programme Ilo 2002a). After the end of the strikes, the teaching schedule was re-organized (as in health centers) to better face the transportation problems caused by fuel shortages. In general, this change led to a reduction in the total number of class hours per day. As a result, the required annual number of hours of classes was not reached during the academic year 2001/2002.<sup>15</sup>

While school enrollment did not change much during the crisis, the passing rate at the CEPE – a standardized national examination at the end of the primary school – shows a significant 13% decline

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<sup>14</sup>One health center in one of the communes closed down completely. Given that no data were available on this health center, it was not taken into account for further analysis.

<sup>15</sup>The political crisis also disturbed the normal school year calendar. The school year normally ends in late June. But in 2002 the official examinations that mark the end of the school year were delayed by about 1 month. Moreover, the school year 2002-2003 started only in the first week of October, not in mid-September as initially expected.

relative to the previous school year (Table 2).<sup>16</sup> The rate of child absenteeism increased by 20% in May 2002 compared to the first trimester of the school year. This increase has been blamed by survey respondents on child labor as well as on the difficulties encountered by parents in paying for school expenses such as food and transportation. Similar effects of a decrease of income on education have been documented in other low income countries (e.g. Basu 1999, Jacoby & Skoufias 1997, Ablett & Slengesol 1999, Davies 1996, Glewwe & Jacoby 2004, Thomas, Beegle, Frankenberg, Sikoki, Strauss & Teruel 2004). Child absenteeism should not entirely be attributed to the crisis, however. Demand for child labor always increases in April-May in rural areas because it corresponds to the harvest period of rice, the major staple in Madagascar. For this reason, school attendance is not a reliable measure of the effect of the blockade.

The number of teachers was little affected by the blockade (Table 2). The proportion of teachers who abandoned their post did not change significantly compared to a normal year. Salaries were mostly paid during the crisis: only 10% of the schools reported a delay or interruption in the payment of salaries.<sup>17</sup> Transportation difficulties seem to have caused two types of delays: it took teachers longer to get to the capital of the Fivondronana where they receive their salary; and the arrival of their salaries in the capital of the Fivondronana was sometimes delayed. While few teachers abandoned teaching altogether, an increase in teachers absenteeism was noticed compared to the period before the crisis.

To summarize, rural schools resisted rather well to the crisis. Some schools had to close during the two months of strike and then had to deal with transportation difficulties triggered by the rapid increase in fuel prices. The sector nevertheless adjusted to face these problems. The teaching schedule and the timing of the 2001/2002 and 2002/2003 school years were adjusted and payment facilities for school fees were put in place to allow students to finish their school year. These findings came as a pleasant surprise to most observers who expected more dramatic consequences.<sup>18</sup>

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<sup>16</sup>The high decrease for the passing rate in the province of Antsiranana (49% in 2000/2001 compared to 14% in 2001/2002) is partly explained by confusion on the CEPE exam. In most of the province two exams were administered (referred to as the Ratsiraka exam and the Ravelomanana exam). Only a small minority of students showed up for the second exam which was held one month into their normal vacation period.

<sup>17</sup>In the communes situated far from the capital in each province, the delay in the payment of the salaries has had an impact on absence of teachers: while the average number of days of absence per month is estimated at 1 or 2 days, the teachers were reported during the crisis to be absent for 5 to 10 days per month.

<sup>18</sup>Cameron (2002) shows similar effects in a study on the effect of the Indonesian crisis on children: school attendance dropped slightly after the onset of the crisis but rebounded afterwards to higher than pre-crisis levels.

In response to the expected negative impact of the political crisis, the new president changed user fee policies in the education sector and announced that the government would waive the tuition fee for the school year 2002/2003. Each student inscription would lead to an extra allocation of 10,000 Fmg (15,000 Fmg for the capital) towards the school.<sup>19</sup> However, the distribution of these funds was not without difficulties. Most of the public schools had not received these funds at the beginning of the school year. At the moment of the survey in November, only 41% of the public primary schools had received all or part of the promised funds. Therefore, a significant number of schools asked parents to pay a tuition fee. The schools that asked for a tuition did so mostly to deal with liquidity problems caused by the late arrival of the funds. The reader may worry that the fee change was endogenous and that this should be controlled for. Based on field observations, however, there seems to have been no clear pattern in the spatial variation of the abolishment of user fees. User fees were often abolished by a law at the local level. This was a political decision and the policy was implemented to the extent that local authorities felt they were already part of the new government. For these reasons, the adoption of the user fee waiver can safely be regarded as exogenous.

Table 2 also illustrates the dramatic increase of the number of books given by the central government to the schools after the crisis. This is mostly due to the activities of a World Bank financed program (CRESED) that markedly increased its disbursement in the aftermath of the crisis. This has to be kept in mind when seeking to ascertain to impact of the user fee removal.

Primary school enrollment rates increased dramatically in the 2002/2003 school year relative to the previous year. For public primary schools as a whole, enrollment increased by 15% relative to the previous school year (Table 2). The number of first grade students increased by 20%. Even in higher grades, the increase in the number of students is significantly above population growth.<sup>20</sup> To gain more insights in the perceived reason for the change in the number of students, school staff of the school were asked why they thought the change occurred. The major reason mentioned for increased enrollment is the decrease

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<sup>19</sup>One part of this amount, theoretically not higher than 7500 Fmg, would be used towards the payment of the general costs and inscription costs. The rest would be used towards the school budget (“Caisse Ecole”).

<sup>20</sup>After the abolition of school fees, the government funded students on a per capita basis. This could potentially set up an incentive to inflate student numbers. Evidence in some other countries (e.g. Uganda) shows that capitation grants lead to an inflation of enrollment numbers. However, the large increase in student enrollment during this period in Madagascar are confirmed by other sources, most importantly the national household surveys fielded by INSTAT at the end of 2001 and 2002. Based on these data, it is estimated that gross primary enrollment ratios increased from 112% to 123% between 2001 and 2002 (INSTAT 2003).

in schooling costs. This is not the only reason, however: other reasons make up 30% of the explanations (Table 3).<sup>21</sup> Enrollment rates could have risen even more if it was not for supply constraints: 20% of the schools reported that they had to refuse students due to lack of space (Table 2).

## 5. Econometric analysis

The descriptive and qualitative evidence presented in the previous section suggests that the large changes that affected the provision of health and education services in Madagascar were driven at least in part by an increase in poverty during the crisis and by the removal of user fees after the crisis. However, we also found evidence of supply shifts, particularly in the availability of school books, drugs and working fridges. To disentangle the respective effects of these various factors, we need to rely on a multivariate approach. To this we now turn.

Our measure of health service provision is the monthly number of patient visits to each health center covered by the survey. For primary schools, the total number of enrolled students is used as dependent variable in our analysis. We do not use school attendance because we fear that seasonality may affect the demand for child labor and hence student absenteeism. Using school attendance would overestimate the effect of the blockade on schooling.

Our strategy is to use variation across the sample in changes across period. Fortunately, we have a lot of variation in the data, which makes identification possible in spite of the small sample size. For instance, the drop in the number of health center visits during the crisis is not identical across health centers: one center reports a drop to 9% of its pre-crisis level while another reports almost a fourfold increase. Similar cross-section variation is noticed after the crisis.

### 5.1. Reduced form

We begin by estimating a reduced-form model, regressing the number of patient visits and the number of enrolled students on user fees and time dummies. All regressions are estimated using fixed effects specific

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<sup>21</sup>One explanation was extra efforts to explain the utility of schooling to the local population. Another important reason (esp. in the central and eastern regions) that was mentioned was the availability of a birth certificate. While children did have to possess a birth certificate before to be accepted in public schools, this condition was annulated in a significant number of communes post-crisis. Alternatively, communes made sure that enough copies were available this year to ensure that more children could go to school.

to each facility. This means that identification is achieved solely from variation in user fees across facilities over time. In the case of schooling, the user fee variable is the fee amount charged by the government for registration in a public primary schools. In the case of health centers, the user fee variable is a dummy variable that takes the value 1 if patients pay for consultation and medicines in the health centers, and 0 otherwise. Estimated coefficients are presented in Table 4. The first column measures the effect on health care, the second the effect on education. Both dependent variables are in logs, as well as school fees.<sup>22</sup> Coefficients thus have the usual elasticity interpretation.

Coefficients of the time dummies suggest that the blockade (period 2) and subsequent recovery (period 3) are associated with large variation in public services across the sample. This is particularly noticeable in health care, where the number of visits dropped by 17% in June 2002 relative to December 2001. Perhaps even more remarkable is the expansion of service in November 2002, with an average increase of 36% for the number of patient visits and 8% for school enrollment relative to the year preceding the crisis.

The relationship between public services and user fees is also clearly apparent in the results: the coefficients of user fee variables have the expected sign and are significant in both regressions. The elimination of user fees is associated with a 17% increase in the number of visits to health centers. To interpret the school fee coefficient, note that the average log of school fees is 6.5. A coefficient of 0.012 thus means that an elimination of school fees is associated with a 7.8% increase in school enrollment. The order of magnitude of this elasticity may appear small but one should keep in mind that it only captures a short-term response to a temporary change. Since the policy measure was announced as temporary, parents who enroll an additional child in school expect to pay the school fee in the future. As shown by Lavy (1996) in the case of Ghana, this tends to reduce price responsiveness. If the abolishment of school fees were made permanent, we may observe a larger response. Moreover, children enter school for the first time around a given age. Only children within that age range are affected by the measure; older kids who never went to school or dropped out at a young age are unlikely to reenter school in response to a change in fee. For these reasons, we expect the long-term response to a change in user fee to be stronger

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<sup>22</sup>To avoid losing zero observations after taking logs, we take the log of school fees plus 1 FMG.

than the short term response (Glick & Sahn 2006).<sup>23</sup>

## 5.2. Controlling for supply effects

The evidence presented in Table 4 does not control for changes in supply. We have seen that the number of teachers and health staff did not increase over the study period. But other supply factors changed, such as the availability of health equipment in working order and the distribution of student books.<sup>24</sup> The literature has emphasized the role that quality plays in the demand for public services because it is a potential source of bias in estimating the benefits from introducing user fees (e.g. Sahn, Younger & Genicot 2003, Birdsall & Orivel 279-96, Hammer & Gertler 1999). Advocates of user fees usually argue that revenues generated by the fees can be used to finance an improvement in quality. If this is the case, introducing user fees does not necessarily lead to a dramatic reduction in demand because the increase in supply or supply quality compensates for the rise in price (Deininger & Mpuga 2005). As a result, the demand effect of introducing user fees may be underestimated because of a simultaneous increase in supply.

The situation we are studying is different. The events that resulted in the removal of user fees also led, in the aftermath of the blockade, to a general improvement in supply conditions. In other words, supply improved at the same time that user fees were abolished. The time dummies we introduced in Table 4 control for this to a large extent, while cross-section variation in supply quality is controlled for by fixed effects at the level of each school or health center. But there still remains the possibility that the first localities to abolish user fees were also those that enjoyed an improvement in essential supplies, such as school books or electricity. As a result, service quality may have improved at the same time that user fees were being phased out, leading to an overestimation of the user fee coefficient.

To address this source of omitted variable bias, we introduce additional regressors that capture variation in quality. For health, we use the availability of a working fridge as proxy for supply quality. As we

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<sup>23</sup>It is also conceivable that some parents paid the school fee but, having heard about the suppression of school fees in the news, anticipated a refund. This would raise enrollment also in school districts where the fee was not formally eliminated, thereby reducing the difference between paying and non-paying schools.

<sup>24</sup>According to our best information, except for school book distribution project that began operation in the Fall of 2002 – see below – no new government or donor program were put in place to increase supply quality at the time of the removal of user fees. This is hardly surprising given the circumstances. One could in fact argue that the government opted for a removal of user fees precisely because a large scale increase in supply was inconceivable in the immediate aftermath of the blockade.



have seen, a working fridge is essential to keep medical supplies, especially vaccines. During the blockade many parts of the country experienced power outages and fuel shortages and hence much of their medical equipment did not work properly. As power supply was progressively restored and fuel shortages disappeared, equipment started working again. While the type of equipment available in each health center varies a lot, all have a fridge. Variation in the availability of a working fridge proxies for the speed with which things went back to normal after the blockade.

For education, the main concern is the number of books received from the central ministry at the beginning of the school year. As noted from Table 1, the number of school books distributed to rural schools increased a lot in December 2002 as a result of a World Bank funded book distribution program. Schools are in principle entitled to an allotment of books, but due to the blockade not all schools had received their allotted supply by the beginning of the 2002-2003 academic year. There is therefore much variation across communes in the number of books received by the date of the survey.

There may be other *positive* supply effects that are not proxied for by our two supply variables, but this is unlikely. On the other hand, unobserved *negative* supply effects may be present in the data, as would be the case if local schools and health facilities use the proceeds from user fees to finance themselves. In the case of Madagascar, wages and supplies are in principle funded by the central government, so this is probably not a major source of concern. But, as has been noted by the literature, a reduction in local funds as a result of the suppression of user fees could result in an underestimation of the price effect. Given that we obtain very large and significant coefficient on user fees, this source of bias, if present, would mean that the price effect is even larger than what we estimate.

We also seek to address other potential sources of omitted variable bias. We have noted that prices increased dramatically during the blockade, because of the disruption caused by the massive increase in transport costs. The resulting fall in market activity had a deleterious effect on poverty, particularly households' ability to raise the cash needed to pay for school fees and health costs. It is conceivable that some regions recovered faster than others. To the extent that the demand for education and health care are income elastic, usage should have increased with recovery. If localities that recovered faster are also those which were first reached by the user fee reform, this would again generate an overestimation in the

effect of the abolition of user fees. By the same reasoning, slow recovery in transport costs may have had lingering effects on incomes and hence on demand for public services.

To control for these effects, we add two variables. One measures the proportion of households in the commune who experienced temporary or chronic difficulties feeding themselves. This variable, which is measured at the level of the commune in which the facility is located, comes from answers provided by focus group respondents. Poverty figures were collected for each of the three periods. The second variable is the cost of transport to the nearest major city. Since we control for facility fixed effects, these variables capture the effect of variation in the severity of the shock induced by the blockade, and in the speed of recovery afterwards. Because both variables have a highly skewed distribution, they enter the regression in log form so as to reduce the risk of having results driven by outliers.

Estimation results are presented in Table 5. Earlier results are confirmed and, in general, magnified by the inclusion of additional controls. The blockade is now associated with a highly significant 32% drop in visits to health centers and a non-significant 3% drop in school enrollment. In contrast, December 2002 witnessed a 30% increase in health center visits relative to December 2001, and a 7% increase in school enrollment. User fees remain significant and their coefficient is larger: a removal of user fee is now associated with a 22% increase in health center visits and a 9% increase in school enrollment ( $0.013 \times 6.5$ ).

The availability of a working fridge (used to store vaccines and medicines) tends to raise health center visits. This effect is large in magnitude: if the fridge of the health center stops functioning, patient visits drop by 15%. In contrast, the free distribution of books appears to have had no significant effect on school enrollment. Contrary to expectations, we find that changes in transport costs have a mildly significant positive effect on visits to health centers once we control for time dummies and other controls. Transport costs, however, have a strong effect on these controls: locations in which the cost of transport to the nearest major town increased more during the blockade endured a larger increase in poverty and a larger reduction in school books and fridge availability.

Results show a strong effect of poverty on health care: the increase in poverty between December 2001 and June 2002 is associated with a large significant drop in health center visits. In contrast, the effect on school enrollment of short-term changes in poverty is not significant. At first glance this result

contradicts research findings by Jacoby & Skoufias (1997) and by Sawada (2002) in South Asia. These authors show that temporary shocks induce households to withdraw children from school. A similar effect is not observed here, but this is probably because the data we have is on enrollment, not attendance. The blockade affected families late in the academic year when enrollment decisions had already been made, and was resolved before new enrollment decisions were made for the following academic year.

The results presented in Table 5 only show a weak effect of supply quality on the use of public health and education facilities.<sup>25</sup> This stands in contrast with what has been found in other empirical studies (e.g. Deininger & Mpuga 2005, Johnstone 2004, Birdsall & Orivel 279-96, Lewis 1993, Hammer & Gertler 1999). To investigate this issue further, we seek to instrument the supply variables to correct for possible endogeneity or measurement error. When user fees were abolished, the increased demand for public services may have raised government supply. For instance, as more parents enroll their children, the school may request more books. Similarly, as more patients show up at the local clinic, the staff may put more effort in ensuring that their equipment is working. This raises the possibility that the effect of supply variables is partly captured by the fee change, biasing their coefficients towards zero.

To instrument the supply variables (e.g., the availability of a fridge and the number of books distributed to the school), we need variables that affected the capacity to provide quality service without affecting demand directly. Such variables are difficult to find. Here we use the number of media outlets in the commune interacted with period 3, the price of rice in the commune, and the share of ethnic highland people in the commune interacted with period 3. The number of media outlets is a proxy for communication devices between the commune and the central government: presumably, communes that have more media outlets are better informed about what goes on in the capital city, and thus better able to communicate their requests and grievances to central government. We interact this variable with the period 3 dummy to reflect the end of the blockade in July 2002 and the widespread changes in public service delivery that ensued. The price of rice is used as proxy for the price level in the commune: places where prices increased more during – decreased less after – the blockade may lobby for more government support in the form of school and health supplies.<sup>26</sup> Finally, ethnicity may affect the responsiveness

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<sup>25</sup>Very similar results obtain in health visit equation if we add an index variable capturing the availability of medicines. This variable is not significant.

<sup>26</sup>The validity of this instrument hinges on the fact that we control for poverty directly and that our poverty measure is

of central government to local demands. Inhabitants of Madagascar descend from two main settlement waves: Malays who settled predominantly in the highlands (many centuries ago) and Africans who settled primarily on the West coast. Although the two populations are now largely mixed, descendants from highland settlers have traditionally dominated island politics. As a result, we expect them better able to benefit from the large political changes occurring in period 3. We recognize that, as is the case for most instruments, these instruments are not perfect. But this is the best we can do with the data at hand.

Instrumenting regression results are presented in Table 6. The use of all three instruments in both instrumenting regressions is for convenience and symmetry only. Very similar results are obtained if we drop non-significant instruments. Instrumenting regressions by and large confirm expectations. Communes where the price of rice grew more than elsewhere are also those where fridges were more available. Communes with more ethnic highlanders received more school books from the central government. The media outlet variable is not significant. We also find that transport costs have a large negative impact on the availability of a working fridge. The instruments are jointly significant, as reported at the bottom of Table 6. But the value of the joint  $F$ -test statistic is low, suggesting that we have weak instruments. We therefore need to correct confidence intervals for instrumented variables in order to conduct consistent inference. We do so using the correction method suggested by Andrews & Stock (2005).

2SLS coefficient estimates are presented in Table 7. Overidentification test results suggest that instruments can be regarded as exogenous in the service provision regressions. In both cases, a Davidson-MacKinnon test fails to find evidence of endogeneity. When instruments are weak and endogeneity is severe, it is well known that 2SLS yields biased confidence intervals for the endogenous variable (e.g. Moreira 2001, Andrews & Stock 2005). Since we do not have evidence of endogeneity here, this is probably not a serious source of concern. But to be safe, we compute corrected statistics to test the significance of the instrumented variables. Following Andrews & Stock (2005), we use conditional likelihood ratio test statistics since they are thought to be more reliable. The corrected statistics are reported at the bottom of Table 5. They are calculated using the method suggested by Moreira (2001). For both instrumented variables, the test statistic is well below the simulated critical value for the coefficient to be significantly

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not calculated relative to nominal income but as a percentage of the population that experiences difficulties feeding itself. Consequently, the possible effect of a change in rice price on demand for services is captured by the poverty variable.

different from 0 at the 90% level. If anything, these results suggest that the lack of significance of the book variable in Table 5 is not due to endogeneity. Other results of interest are unaffected: estimated coefficients of the fee, poverty, and transport cost variables remain basically unchanged.

## 6. Conclusions

This study has looked at public service delivery in the face of a policy shock and a change in user fee. The effect of macroeconomic shocks on public service delivery has been a hotly debated issue ever since structural adjustment programs have been put in place and especially since the Asian crisis (e.g. Cornia, Jolly & Stewart 1987, Sahn & Bernier 1995, Sahn, Dorosh & Younger 1997, Stewart & Ranis 1999). The blockade of the central highlands of Madagascar by a defeated president provides a laboratory to examine the effect of a large unanticipated macro shock on the delivery of health and education services. The ensuing rise in the price of fuel and other imported goods indeed mimics the effect of a massive – albeit temporary – foreign exchange crisis without the other macroeconomic imbalances that usually accompany it.

We found enrollment in rural primary schools surprisingly resilient to the crisis. But this is probably due to the fact that the crisis occurred in the middle of the school year and was resolved before the next school year started. Had the crisis lasted longer, it probably would have had a strong effect on enrollment. In contrast, we observed during the crisis a large significant drop in the number of patient visits to health care centers. This effect can be explained in part by an increase in monetary poverty, and in part by a reduction in the quality of service. These results suggest that, in order to mitigate the effects of macro-economic shocks on access to public services, more attention should therefore be paid to the demand side.

After the blockade was lifted, the new president temporarily suspended user fees in schools and health centers. Due to political uncertainty and imperfect communication with the capital, this measure was not applied immediately in all rural communes. This sequence of events provides an excellent opportunity to study the short-term effect of a reduction in user fees on public service provision. Controlling for changes in supply quality, time dummies, and school and health center fixed effects, we find that the suspension

of user fees had a significant positive effect on both school enrollment and visits to health centers. In other words, users respond to prices and the effect is large.

These findings feed into the policy debate on user fees. Many developing countries have found themselves unable to finance the continuation of ambitious social service programs. In this context, user fees have been promoted as a lesser evil, i.e., a way of avoiding the complete collapse of public service provision. There is no doubt in our mind that the long-run financial viability of public service delivery is essential to ensure continued provision. In the case of Madagascar, it is unclear how long it is financially feasible for the government to waive user fees while preserving supply quality.<sup>27</sup>

User fees have sometimes been promoted in their own right, that is, as a way of raising additional funds to improve quality. An implicit cost-benefit analysis underlies this argument: if demand is price inelastic but responsive to quality, raising user fees can result in increased usage. This paper looks at one side of the calculation: it documents the fairly large short-run price elasticity of demand, especially for visits to health care centers. The short-term impact on school enrollment is smaller, but the long-term of an elimination of user fees is likely to be larger because of the combined effect of initial enrollment and reduction in school drop-out rate. These findings imply that, in a context similar to that of Madagascar, supply (quality) effects must be quite strong for the introduction of user fees to improve actual usage. Whether this is true in practice depends on the cost of increasing quality and on the elasticity of demand for quality. Raising user fees in order to raise quality need not always be justified.

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<sup>27</sup>It probably depends, in large part, on the commitment of the donor community to education and health services in Madagascar.

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**Table 1: Commune characteristics**

		Pre-crisis	Crisis	Post-crisis
		Nov./Dec. 2001	May/June 2002	Nov./Dec. 2002
Transport costs to major city (in Malagasy francs)	mean	37038	73965	46793
% of commune population having problems:				
feeding themselves	mean	70%	68%	73%
	median	80%	80%	80%
paying for schooling/health care	mean	54%	60%	56%
	median	55%	68%	60%
Evolution of the monetary income of the average household compared to the same time last year	%		-46%(*)	-20%
% communes that think the political crisis was the worst welfare crisis of the last ten years for the commune	%			64%
Price of rice (in Malagasy francs/kapoaka)	mean	726	690	784
Price of paddy (in Malagasy francs/Kg)	mean	1825	1650	1977
Price of salt (in Malagasy francs/Kg)	mean	369	1168	566
Price of sugar (in Malagasy francs/Kg)	mean	5392	12034	6357
Price of kerosene (in Malagasy francs/Liter)	mean	3671	14434	5047
Price vegetable oil (in Malagasy francs/liter)	mean	7727	15654	10677
Male agricultural wage rate (in Malagasy francs/day)	mean	8407	8675	8893
Number of media outlets (radio, TV)	mean	1.09	1.12	1.11
% of commune population from highland ethnicity	%	32%	32%	32%
No of observations		138	138	138

(\*) based on half of the sample visited in April/May 2002

**Table 2: Public service provision**

		Pre-crisis	Crisis	Post-crisis
		Nov./Dec. 2001	May/June 2002	Nov./Dec. 2002
<b>1. Public health center</b>				
Number of patient visits per month	mean	117	117	208
	median	63	50	105
Percentage of health centers charging user fees	%	85%	84%	26%
Number of staff members per health center	mean	4.09	4.05	4.09
Percentage of health centers with electricity	%	50%	49%	50%
Percentage of health centers with a working fridge	%	73%	56%	70%
Index of availability of medicines (from 0 to 1)(a)	mean	0.86	0.73	0.72
Perceived average change in the number of visits by poor patients compared to last year same time (b)	%		-27% (d)	+55%
No of observations		138	138	138
<b>2. Public primary school</b>				
Number of students per school	mean	244	230	280
	median	181	168	209
School registration fee (in Malagasy francs)	mean	4172	4172	1742
Number of books per school	mean	35	35	137
Number of teachers per school	mean	5.13	5.01	5.10
Schools that refused students due to lack of space	%	18%		21%
Passing rate at CEPE (c) previous school year	%	60%		47%
If decrease, reason				
Insufficient number of courses due to crisis	%			19%
Lack of concentration due to crisis	%			44%
Other reason linked to crisis	%			17%
Reason independent of crisis	%			20%
Total	%			100%
No of observations		282	282	284

(a) average of the availability (1=yes; 0=no) of oral contraceptives, condoms, aspirin, paracetamol, amoxiciline, cotrimoxazole, peniciline, doxycycline, tetracycline, anti-malaria, vaccines BCG, polio, DTCoq, rougeole, oral hydratation

(b) perception of the staff of the health center

(c) national standarized test at the end of primary school

(d) based on half of the sample visited in April/May 2002

**Table 3: Perceived reasons for change in public service use (compared to the same period last year)**

	Rural centers/schools	
	Number	Percentage
<b>1. Public health center</b>		
If decrease in patient visits, major reason for decrease during the crisis (*)		
Transport costs have increased	2	2%
Lack of staff or medicines	17	22%
People are not able anymore to pay fees	38	51%
Other	18	24%
Total	75	100%
If decrease in patient visits, major reason for decrease after crisis		
Lack of staff	4	19%
Lack of medicines	9	43%
Patients can't pay tariffs	3	14%
Other	5	24%
Total	21	100%
If increase in patient visits, major reason for increase after crisis		
Better quality of service	4	4%
Patients don't go to other centers anymore	7	6%
Reduction cost of medicines	49	45%
Abolishment of consulting fees	33	31%
Other	15	14%
Total	108	100%
<b>2. Public school</b>		
Major reason for absenteeism during crisis (*)		
Lack of teachers	2	2%
Parents could not pay the school fees	0	0%
Parents could not buy school supplies	2	2%
Food problems	42	50%
Child labor	20	24%
Strike	4	5%
Others (malaria epidemics...)	14	17%
Total	84	100%
If decreased enrollment, most important reason for decrease after crisis		
Lack of teachers	7	17%
Parents unable to pay for schooling costs	3	7%
Parents unable to pay for supplies	6	15%
Parents unable to pay for food	6	15%
Children have to work	7	17%
Other	12	29%
Total	41	100%
If increased enrollment, most important reason for increase after crisis		
Lower transport costs	2	1%
More teachers	7	3%
Reduction schooling costs	147	71%
Other	51	25%
Total	207	100%

(\*) only asked for the centers/schools in three provinces (Fianarantsoa, Mahajanga, Antananarivo)

**Table 4. Reduced form**

	log(No of visits health center)		Log(No of students)	
	Coefficient	t-value	Coefficient	t-value
User fee dummy	-0.169	<b>-1.77</b>		
User fee amount (log)			-0.012	<b>-3.66</b>
Period 2 dummy	-0.170	<b>-3.09</b>	-0.055	<b>-3.67</b>
Period 3 dummy	0.364	<b>4.43</b>	0.072	<b>3.08</b>
Facility fixed effects		included but not shown		
Intercept	4.278	<b>48.25</b>	5.300	<b>184.90</b>
Number of observations	403		827	
Number of groups	139		281	

**Table 5: Controlling for supply and income effects**

	log(No of visits health center)		Log(No of students)	
	Coefficient	t-value	Coefficient	t-value
<b>Supply variables</b>				
Availability of working fridge (yes=1)	0.151	<b>1.78</b>		
Number of books (log)			0.002	0.32
<b>Price variables</b>				
User fee dummy	-0.223	<b>-2.36</b>		
User fee amount (log)			-0.013	<b>-3.67</b>
<b>Controls</b>				
% of poor (log)	-0.179	<b>-2.13</b>	0.037	1.66
Transport costs to major city (log)	0.196	<b>1.89</b>	-0.025	-0.77
Period 2 dummy	-0.319	<b>-3.37</b>	-0.033	-1.17
Period 3 dummy	0.295	<b>3.36</b>	0.068	<b>2.37</b>
Facility fixed effects		included but not shown		
Intercept	3.003	<b>2.66</b>	5.417	<b>15.61</b>
Number of observations	369		762	
Number of groups	131		267	

**Table 6: Instrumenting regressions**

Variable	Availability fridge (yes=1)		Log(No of books)	
	Coefficient	t-value	Coefficient	t-value
User fee dummy	0.135	<b>1.79</b>		
User fee amount (log)			-0.086	<b>-2.59</b>
% of poor (log)	-0.086	-1.24	0.517	<b>2.37</b>
Transport costs to major city (log)	-0.181	<b>-2.29</b>	-0.020	-0.07
Period 2 dummy	-0.009	-0.12	0.057	0.22
Period 3 dummy	0.054	0.66	1.798	<b>5.74</b>
Instruments:				
Number of media outlets(log)*period 3	0.028	0.57	0.016	0.09
% of highland ethnicity in commune(log)*period 3	0.001	0.70	0.010	<b>2.72</b>
Price of rice (log) in Malagasy Francs	0.329	<b>2.62</b>	0.000	0.45
Facility fixed effects	included but not shown			
Intercept	0.522	0.48	-0.839	-0.28
	F(3,230)	Prob>F	F(3,487)	Prob>F
Test for joint significance of instruments	2.890	<b>0.036</b>	3.590	<b>0.014</b>
Number of observations	369		762	
Number of groups	131		267	



**Table 7: Instrumenting supply**

Variable	log(No of visits health center)		Log(No of students)	
	Coefficient	t-value	Coefficient	t-value
<b>Supply variables (instrumented)</b>				
Availability of working fridge (yes=1)	-0.038	-0.08		
Number of books (log)			0.032	0.94
<b>Price variables</b>				
User fee dummy	-0.205	<b>-1.95</b>		
User fee amount (log)			-0.011	<b>-2.26</b>
<b>Controls</b>				
% of poor (log)	-0.184	<b>-2.14</b>	0.020	0.65
Transport costs to major city (log)	0.159	1.15	-0.024	-0.72
Period 2 dummy	-0.323	<b>-3.36</b>	-0.035	-1.18
Period 3 dummy	0.317	<b>3.08</b>	0.002	0.02
Facility fixed effects		included but not shown		
Intercept	3.523	<b>2.11</b>	5.421	<b>15.02</b>
Davidson-MacKinnon endogeneity test	test stat.	p-value	test stat.	p-value
error-term instrumental regression	0.43	0.666	-0.94	0.349
Overidentification test	test stat.	p-value	test stat.	p-value
Sargan test	3.471	0.176	0.527	0.768
Conditional likelihood ratio test	test stat.	90% crit.val.	test stat.	90% crit.val.
of significance of supply variable	0.13	3.87	1.55	3.53
Number of observations	369		762	
Number of groups	131		267	