

Mobility, Poverty, and Gender: Travel “Choices” of Slum Residents in Nairobi, Kenya

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ABSTRACT

A survey of 5000 slum residents in Nairobi, Kenya, reveals that the majority cannot afford any of the motorized transport options in the city. They cope by limiting their travel outside their settlement and, if they do travel, by often “choosing” to walk. As compared to the non-poor, poor households are systematically worse off. But the burden of reduced mobility is borne disproportionately by women and children. Using joint-choice modeling to empirically explore the travel “choices” of Nairobi’s slum residents, we show that women, men, and children in this population each face distinct barriers to access. We conclude that policy aiming to improve mobility and transport access for the poor needs to grapple not only with the crucial issue of affordability but also with specific constraints faced by women and children. (131 words)

INTRODUCTION

Much of the discussion of urban transport in the developing world focuses on the problems of traffic congestion and associated ills that stem from increased motorization. Although there is often mention of the urban poor, the focus is – implicitly or explicitly – on the wealthier segment of the population in these cities that can afford to purchase a vehicle.

This paper focuses on the travel “choices” of the urban poor who live in informal settlements in Nairobi, Kenya. We use quotation marks on the word choices because most of these people do not actually have more than one option to choose from. These are Nairobi’s slum residents, an estimated 810,000 people in 2004, accounting for about one-third of the population of the city (Kenya Census 1999, World Bank 2006). Mostly, the slum residents walk. Everywhere they go. Sometimes long distances. The problem is not a lack of motorized transport options – the slums of Nairobi are relatively well connected by informal transit called matatus. The slum residents are walking largely because they cannot afford the motorized options.

It is worth noting that those who do not live in the slums of Nairobi are not in this predicament. Approximately 20 percent of Nairobi households own cars (JICA 2006, Aligula et al. 2005), but virtually none of the slum households do. Over 80 percent of Nairobi households have at least one member who regularly uses motorized transport (KIPPRA 2004), but among slum households we find that this number is only 38 percent.

Our aim is to gain a better understanding of how transport options (or lack thereof) affect and are affected by poverty in this African city. We inductively examine travel choices of a large sample of Nairobi's slum residents – men, women and children – to identify factors that explain whether or not they travel regularly outside their settlement as well as whether or not they use motorized transport. We then examine the policy implications of these findings. This paper is part of a broader research project that looks at various aspects of the lives of the residents of Nairobi's slums, aiming to gain a fuller understanding of the many dimensions of poverty (World Bank 2006, Gulyani and Talukdar 2007, 2008 are other papers in the series).

The clearest story that emerges from our analysis is that both poverty and gender matter in explaining differences in the travel choices of working adults in Nairobi's slums. It is expected that poverty level would affect travel choices, but the gender effect that we find is surprisingly strong among adults. Women's travel "choices" are systematically distinct from men's travel "choices" in this population, even when controlling for poverty level. Among school-going children, however, the gender handicap disappears – although poverty remains a key explanatory variable in explaining decisions regarding their trip to school, there are no systematic differences between boys and girls.

EXISTING LITERATURE

There is a substantial literature on urban transport in the developing world, but most of the existing work focuses on the problems of traffic congestion, road safety, and air quality – all problems that have their root in motorized transport (e.g. Gakenheimer 1999, Schipper 2002). There are few empirical studies published in peer-reviewed journals that focus attention on the transport challenges faced by the urban poor in the developing world. One likely explanation for this is that it is difficult and expensive to obtain reliable data in these communities. Those studies

that have been published are characterized by small datasets (e.g. Srinivasan and Rogers 2005, Kwakye et. al. 1997).

Existing research on transport for the urban poor in developing cities includes four main themes that are relevant for our work here. These are:

1. social exclusion as a cause of poverty and lack of transport as a factor,
2. the link between slum location, transport and labor market access,
3. road safety for non-motorized transport, and
4. the difference between women's and men's transport (and therefore job) access in these populations.

Here, we briefly review what the literature has found on each of these themes.

A number of studies point to the co-dependence of social exclusion and poverty, and lack of good transport options as a factor (Godard and Diaz Olvera 2000 is a good example). The story is that integration into society is vital to escape poverty, and that most urban poor in the developing world lack even the funds for transit fare. Our findings for slum residents in Nairobi support this. There are some in these cities who benefit from government programs that offer reduced or free transit fares, but these are generally not the poorest of the poor. They are people who are already integrated into society, and often could be classified as middle-class and work for the government.

Partially because the poorest people in cities like Nairobi do not enjoy reduced transit fares, they are forced to live close enough to employment centers that they can walk to their jobs. This results in many people with little money living in crowded, unsafe, and unsanitary conditions near the center of town, their main reason for doing so being access to jobs. A more affordable transit system with good coverage of poor neighborhoods could allow more of these

people to move away from the slums and still access the same labor market (Gwilliam 2003, Barter and Williams 2002, and Venter et. al. 2007 elaborate on this point). In contrast to many other cities, the transit system in Nairobi is physically accessible for residents of poor neighborhoods (see Figure 1), but we find that affordability remains a large constraint.

What makes matters worse is that roads in many cities of the developing world are unsafe for non-motorized transport, especially pedestrians. Nairobi is no exception, with few proper sidewalks available; approximately half of all Nairobi road casualties are pedestrians (Ribbens 2003). This lack of pedestrian safety presents a substantial deterrent to travel.

A number of studies have shown that among the urban poor of the developing world, women are worse off than men in terms of both physical mobility and access to employment. These studies consistently find that many more women than men are unemployed, working women have lower-paying jobs and are less likely to have job security than men, working women are substantially more likely than men to walk to work, and women work closer to home than men do. The cities where these studies were conducted include Delhi, India (Anand and Tiwari 2006), Pune, India (Astrop et al. 1996), Chengdu, China and Chennai, India (Srinivasan 2007), Durban, South Africa (Venter et. al. 2007), and Ibadan, Nigeria (Abidemi 2002). Anand and Tiwari (2006) also report that women in one slum in Delhi feel unsafe while traveling, both because of the lack of road safety for pedestrians and because they are often sexually harassed while traveling. Our analysis of commute patterns for Nairobi's slum residents lends support to these observations. In particular, we find that women are far more likely to be unemployed than men of similar qualifications and, even when they do work, they are far less mobile. Working women are less likely to travel outside the settlement for work and, if they do travel, to use motorized transportation for their commute.

The present analysis of travel decisions of Nairobi's slum residents continues and supports the thread of this existing empirical work, but it also differs from it and contributes to the literature in the following ways. First, in contrast to existing studies that examine either the gender angle or the poverty angle, we examine and control for both. Second, we investigate the travel patterns of slum children and adults separately. Third, although most of our findings are consistent with those in the existing literature, we have been able to elaborate on some important nuances in recognized patterns due to the high quality and larger size of our dataset. Finally, we apply the methodology of joint choice modeling to better understand the employment and travel choices of the extreme poor. While our methodological approach is common in studies of the travel patterns of wealthier populations, the literature that focuses on the poor generally relies on more rudimentary statistics.

DATA AND METHODOLOGY

The data we use come from an extensive household survey conducted by the World Bank in 2004 of slum households in Nairobi. The sample size for the present analysis is 1596 households and 3292 individuals who travel daily either to work or school. In the survey collection process, the World Bank worked closely with Kenya's Central Bureau of Statistics to insure that the sample is representative of Nairobi's slum population.

This is a valuable data set for two reasons. First, it is one of very few large-scale and carefully sampled surveys of urban slum residents in Africa. Second, the survey gathered information relevant not just to one narrowly-defined theme or even one sector, but instead aimed to characterize as fully as possible the quality of life of Nairobi's slum residents. This allows us to examine linkages between diverse factors and their net effect on employment and poverty.

The survey includes basic household demographics plus detailed information about household water, electricity, sewer, and road access. Some health information was collected. There were a number of questions aimed at understanding employment and entrepreneurship within the slums. For more details on the survey itself and the sampling methodology, please see World Bank (2006).

There is one variable used throughout this paper that deserves a bit more explanation, and that is the “poor” variable. We use a discrete poverty measure – an expenditure-based poverty line – to disaggregate our sample into poor and non-poor households. Here, the poverty line is defined as an expenditure of 3174 (US\$42) Kenyan shillings per adult equivalent per month, excluding rent (inclusion of rent would make some renters seem artificially richer than home owners). This measure is based on the 1997 urban poverty threshold as defined by government and adjusted for inflation during the period 1997-2004. Using this poverty line, 73 percent of the slum households are “poor” and 27 percent are “non-poor.”

The methodology used for this paper was strictly exploratory and inductive. We did not begin with specific hypotheses about travel behavior in this population. Rather, we allowed the survey data to reveal its patterns to us by creating every graph, cross-tab, regression, and discrete choice model relating to transport choices that seemed likely to yield interesting relationships.

In analyzing the data, we find that three major transport-related responses exhibit substantial variation – whether each respondent’s work or school location was inside or outside of the home settlement, transport mode for the commute trip, and household weekly transport expenditure. The choices of destination (inside or outside the home settlement) and transport mode were explored using comparisons between subpopulations as well as multivariate discrete choice models. The subpopulations were those divided by age group, job type, and home

settlement location. Each of these subpopulations was then further broken down by gender and by poverty level. In every case, we compared the proportions of these subpopulations that chose to stay inside their home settlement for work or school. Proportions of people who did leave their home settlement and chose to walk were compared in the same way.

In all of the tables in this paper that list sample proportions, we use z-statistics to test for significant differences in these proportions between subpopulations. The z-statistic is calculated in the following way.

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1 - \hat{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where n_1, n_2 : sample sizes in samples 1 and 2
 p_1, p_2 : proportions for samples 1 and 2
 p : proportion in the pooled sample

For a two-sided z-test, the critical value for $p=0.05$ is 1.96 and that for $p=0.10$ is 1.645.

RESULTS

From the full sample of over 5000 individuals who reside in Nairobi's slums, there are 3292 of them who travel for either work or school. Of these, 905 are children (under 15) and are traveling to school. The full exploratory analysis that we conducted is far too extensive to include in its entirety. Instead, we highlight some of the key results here and explore them in more detail in subsequent sections.

Before we examine the results, it is important to note that slum residents report using only one form of motorized transportation – matatus. Matatus are privately-owned and operated public transport vehicles, usually 14- and 25-seater vans and small buses. These constitute the “informal” paratransit system in the city; there is no formal transit system to speak of.

Government control over the *matatu* industry is weak.

Summary statistics regarding mode choice are striking. Among working adults, just over 65 percent walk to work, about 2 percent use bicycles for their commute, and the remaining 32 percent use matatus. Among school-going children, 96 percent walk and 4 percent ride a matatu.

While the above statistics are useful, we propose that the following three indicators provide a better insight into transport access and affordability for the urban poor, and especially for our sample of Nairobi's slum residents (see Table 1):

1. percent of households with at least one member using public transport – we find that although all slum households have at least one member working or attending school, only 38 percent of them have a member using motorized public transport (matatus),
2. percent of adults working outside their settlement who use public transport – 45 percent in Nairobi's slums, and
3. percent of children studying outside their settlement who use public transport – 9 percent in our sample.

Table 1 provides the values of these indicators for Nairobi's slum population as a whole, and then separately for females and males within the slums and for those in poor and nonpoor slum households. The values in bold indicate statistically significant differences between gender or poverty level subpopulations. Figure 1 shows the spatial distribution of matatu use for working adults across slum settlements in Nairobi, clearly showing that adults living farther from the center are more likely to use matatus for their commute.

Among working adults, almost one-third (32 percent) live and work in the same settlement, so it makes sense that these individuals chose to walk. However, the majority (68 percent) of working adults leave their home settlement for work and more than half (55 percent) of them also walk to their destination. Those who leave their home settlement likely do so to gain

some opportunity that is beyond what they can attain within their settlement. Although we do not know exactly how far these people are walking, it is likely that many of them are shouldering a large travel time burden.

Among adults who work outside their home settlement, the proportion using matatus rather than walking is higher among the non-poor as compared to the poor, and among men as compared to women. Disaggregating the working adults by poverty level, we find a 14 percentage point gap between the poor and non-poor in their likelihood of riding a matatu to work. The gender gap is essentially the same as the welfare gap, at 12 percentage points (see Table 1).

Unlike adults, the majority (63 percent) of school-going children attend schools within their own settlements. Among those who attend school outside, the vast majority (91 percent) walk, while the remaining 9 percent ride a matatu. Within this group of traveling children, there is no difference in matatu ridership among boys and girls. This absence of gender gap among school-going children is rather encouraging. On the negative side, the welfare gap seen among adults seems to be magnified among children – among those attending school outside, there is a whopping 41 percentage point difference between poor and nonpoor children in their likelihood of riding a matatu to school (see Table 1).

Overall, it is clear that for all three of the indicators examined, those from poor households fare worse than those from non-poor households. Somewhat surprising, though, is the extent to which women fare worse than men among working adults, but girls do not fare worse than boys among school-going children. Much of the rest of this paper focuses on these findings, providing further details and identifying potential explanations for them.

Slum Children's Journey to School

As noted earlier, the child traveling population and the adult traveling population differ substantially. Most obviously, gender does not seem to play a role in determining children's travel patterns. Just over one-third of both boys and girls travel outside their home settlement for school, and the same percentage (9 percent) of both genders uses motorized transport (see Table 1).

Poverty level is a factor in determining both children's and adults' likelihood of traveling outside their home settlement for school or work. Nonpoor slum residents are slightly more likely to travel than are poor slum residents. 36 percent of poor children travel, and this figure is 41 percent for nonpoor children. Although poverty affects *whether* adults and children travel outside, it has an even stronger influence on *how* they travel. As we have already seen, poverty level is a major factor that determines whether these travelers use matatus, and it seems to be even more important for children than for adults.

Going beyond gender and poverty level, there are a number of other factors that are likely to determine whether children travel to attend a school outside their settlement. Specifically, we think that both local school availability and the travel patterns of adults in the household should affect children's travel. We also hypothesized that the gender of the household head, the number of under school-age children in the household, and the education level of household members might affect children's travel.

Table 2 provides the estimated coefficients of a logit model that captures these effects while controlling for home location within the city. The dependent variable in the model is 1 if the child attends a school outside of the home settlement and 0 if the child goes to school inside the home settlement. In addition to the listed variables, 21 location-specific variables were

included in the model to control for unobserved differences between settlements that might affect travel. As is clear from the model, both school availability and the work location choice of adults in a household impact the children's school location choice. Both poverty level and household size are less important factors, but both still statistically significant at the 10% level. Additional variables that were excluded from the model presented here due to insignificance included the gender of the household head, the number of small children in the household (under school-age), and the number of household members having more than primary education.

These findings lead to a potentially important policy conclusion. To serve both poor and non-poor children equally well, it is important *either* to have schools in all neighborhoods *or* to provide school transportation service to children who do not have a school in their neighborhood. In some slum settlements it may not be feasible to build a school; the population of children might be too small or there may not be an appropriate physical site. This study suggests that it is crucial to make a special effort to ensure that children in these locations have easy access to a good school.

Adult Slum Residents' Journey to Work

The demographic and employment profile of adults reveals that women lag behind men on several basic indicators (see Table 3). There are more men than women in the slums – 58 percent of the adults in this sample are men. Of those who are employed, the gender ratio is even more uneven – 73 percent of the working slum population is male. As compared to men, women are systematically more likely to be unemployed, poor, and to have lower levels of education. They are also less likely to have a “regular” wage-earning job or one that entails skilled work. All of the above gender differences are statistically significant.

The travel behavior of men and women differs significantly and poverty has different implications for the two groups (see Table 4). This is a key finding of our paper. It is worth stressing again that our methodology was strictly exploratory – we did not set out to analyze the gender effect on slum residents' travel. Gender simply emerged from the data as a dominant factor every time we included it in our exploratory analysis. While this gender pattern has been documented in the literature, the present survey is perhaps the most extensive and representative data set ever collected from a city's slum population.

As we have already seen, there is a large gender gap in travel patterns. Three-quarters of working men travel outside of their home settlement for work, while only half of working women travel. Among those who are traveling, men are more likely to use motorized transport. In an attempt to more fully document the extent of this transport gender gap and to shed light on potential causes for it, the remainder of this paper will look at determinants of travel behavior separately for women and for men. We examine four factors that could explain these differences in the commute decisions of men and women – poverty, childcare responsibilities, types of jobs, and education.

Poverty gap

Poverty is negatively and strongly correlated with use of motorized transport for all slum residents. Affordability of matatus for this population is clearly an issue. We have seen this in the indicators from Table 1. In the last section of Table 4, we see that the median expenditure on transport for poor slum households is zero. Since the only form of free transport is one's own feet, this means not simply that these people do not commute by motorized means, but that they cannot afford motorized transport for any trip purpose. Because it is likely that slum residents need motorized transport in order to access education and employment opportunities that could

lift them out of poverty, it is particularly troubling that many of them are unable to afford matatu fare.

The situation is especially bad for slum women. First, women are more likely to be poor than are men (see Table 3). Second, there is a significant correlation between poverty level and the likelihood of working outside of the home settlement for women, but not for men (see second section of Table 4). Women from poor households are more likely than nonpoor women to stay inside their settlements for work, but three quarters of poor and nonpoor men alike leave their settlements to access jobs. This “choice” to work inside the home settlement may be partially due to lack of access to motorized transport. Third, although poverty level does affect the likelihood of commuting by matatu to a job outside of the home settlement for both women and men, the disparity between the genders in motorized transport use persists even among nonpoor adults who work outside their home settlement. 47 percent of nonpoor women who work outside their settlement walk versus only 36 percent of nonpoor men in this category.

Put together, these facts show that women’s employment and transport options are constrained differently from – and more than – men’s. Poor slum women are less likely to leave their settlements for work than nonpoor slum women, likely meaning that poverty level negatively affects job access and opportunity more for women than for men in this population. Slum women in either wealth category who do work outside their home settlement are more likely to access their jobs on foot than are men. Although poverty level affects access to motorized transport for all slum residents, women seem to have less motorized transport access than men.

Childcare responsibility difference

Beyond the poverty gap, the first explanation that comes to mind to explain gender differences in commuting is that women have more childcare responsibilities than men, and therefore need to stay closer to home. Looking at the effect of the household presence of children on adult employment, we see evidence that women do indeed bear more of the responsibility for childcare than men do (see Table 5). Only 35 percent of women living in households with children under the age of 5 are employed, compared to 56 percent of women in households without children. In contrast to this large effect of children on women's employment, children do not have any effect on men's employment status. Both those with and without small children, 86 percent of the men in our sample are employed.

We now turn to the question of how the presence of children in the household affects the commute choices of working men and women. There are two types of comparison that are relevant – that between the genders from households of the same child status, and that between those with and without children within each gender. Table 5 provides statistical comparisons of each of these subpopulations for both work location choice and mode choice for those working outside of their home settlement.

The story these comparisons tell is complex, but consistent with the hypothesis that childcare responsibilities affect women's commute choices in this population. The presence of children reduces the likelihood that a woman will work outside of the home settlement, but does not have this effect for men. Interestingly, the *direction* of the effect of children on the likelihood that a person working outside will walk is opposite for men and women; men with children are less likely to walk than are men without children and the effect is opposite for women. Looking at differences between the genders within child status categories, the main story is that in all

cases, women are disadvantaged compared to men. The gender differences are statistically significant in all cases except for that of mode choice among childless adults working outside their home settlement. Comparing these figures with those given in Table 4, it is clear that the gender gap in commuting has narrowed in the absence of children, but it has not entirely disappeared.

Job type difference

A second explanation for the gender gap in commuting could be related to job type. Many men in this population have manual labor jobs, and women are rarely hired in these jobs. Women, on the other hand, are often employed in sales, selling food and other household necessities at kiosks in their neighborhoods. This type of sales employment is usually close to home, and is often run as a household microenterprise (HME). In fact, we know that approximately half of the HMEs reported in the survey are such businesses – selling clothing, vegetables, water, or “various items”. Unfortunately, we do not know from the survey data which jobs are manual labor, and therefore cannot say how likely job type is to account for the remainder of the discrepancy between men’s and women’s travel “choices” to access jobs.

Education gap

A third possibility is that women’s relative lack of education holds them back from earning higher wages, and therefore their earning potential does not justify spending money to travel to work. There is some evidence that this might be true as well. The comparison in Table 3 shows that the percent of women who are educated beyond primary school is much lower than that of men in the sample. However, comparing the travel “choices” of the subpopulations of women and men who are similarly educated reveals a clear discrepancy between the genders (see Figure 2). It is clear that education increases the likelihood of traveling outside the home settlement for

work for both genders. Even when taking the education differences into account, the gender gap remains strong; less-educated men are substantially more mobile than more-educated women.

A Multivariate Analysis: Working adults' choices of work location and commute mode

Table 6 provides a multivariate view of working men's and women's employment and travel choices. This analysis tests which of the hypotheses identified above to explain differences between men's and women's choices hold up in a model that controls for a variety of other factors. The statistical analysis technique used is discrete choice multinomial logit, and the four alternatives modeled are (1) Work inside settlement and walk, (2) Work outside settlement and walk, (3) Work anywhere and ride a matatu, and (4) Do not work. Almost all of the individuals who ride matatus work outside of their home settlement.

Discrete choice analyses are distinct from continuous choice analyses in that the dependent variable can take only discrete values. Often, as in the present analysis, these discrete alternatives are options without an obvious order to them. Random utility theory forms the basis for the multinomial logit discrete choice model estimated here. The signs of the estimated coefficients in the model can be interpreted intuitively, but they must always be considered relative to the base alternative. Positive signs indicate a positive relationship between the variable's magnitude and the likelihood of choosing the alternative compared to the base alternative. In the analysis presented here, for instance, the high significance and positive signs on the men's coefficients for "Kids in HH" indicate that presence of children makes it more likely for a man to walk or ride a matatu to work outside of his home settlement than to choose the base alternative of staying inside his settlement for work. While coefficient signs can be interpreted intuitively, the magnitudes of the coefficients have meaning only when considered

relative to each other. For a detailed review of discrete choice multinomial logit methodology and theory, please see Train (2003) or Ben-Akiva and Lerman (1985).

The reason to include this analysis here is twofold. First, the multivariate analysis tests whether the variables we focus on in the above discussion of sample percentages do in fact appear to be the variables that are important, even after controlling for various other factors such as the effects of age and settlement location. Second, the multivariate analysis allows for calculation of the effects of change in selected factors – such as reduction in poverty, increase in education level, or number of children – on work and travel choices. These analyses can provide a better basis for policies aiming to enhance transportation access and mobility for slum residents.

Looking first at the effect of poverty level on travel, it is clear that poverty negatively affects the ability of all workers in our sample to use matatus. Affordability is a key constraint for Nairobi's slum residents who wish to use motorized transport. If matatu affordability increases – either through reduction in poverty or lower price – our work predicts that matatu use will rise sharply. Since we are separately controlling for factors that help to determine poverty status such as education level and job type (skilled vs. unskilled work), the relatively modest coefficients on the variable “Poor” likely belie a much stronger poverty effect. To fully understand the predicted differential effect of poverty on the travel “choices” of Nairobi's slum residents, it is useful to look at the top row of Table 7. Clearly, poverty has a large effect on commuting for this population. If all poor slum residents became “nonpoor”, their likelihood of motorized commuting jumps by 10 percentage points. But this large effect is not evenly distributed between men and women. For poor men, moving into the nonpoor category increases their likelihood of commuting by matatu by over 15 percentage points. Poor women are also

predicted to gain mobility with nonpoor status, as they are more likely to be employed and to work outside of their home settlement. Their likelihood of commuting by matatu, however, only increases by approximately 5 percentage points.

Turning to the effect of children on commuting, we find that the presence of children makes men more likely to use a matatu to get to work, while it reduces the likelihood of women using matatus, relative to staying in the home settlement and walking. For this multivariate analysis, children include both small (under 5) and school-age children. This is consistent with the previous hypothesis that because women have greater childcare responsibilities than men, the presence of children in the household is likely to result in working women staying closer to home. It is striking that this effect remains strongly significant even in the presence of many control variables. The coefficient estimates in this model indicate that, in fact, the effect of children in the household on men's destination choice is toward working outside of the home settlement. This may be because outside work is better paid, and with more mouths to feed at home (and, as we saw earlier, the women not working as much outside the home), the men need to earn more to support the household. The values in Table 7 indicate that the main effect of having children for women is to reduce their chances of being employed, while men become more mobile.

Education has a positive effect on use of motorized transport by all slum workers (Table 6). Looking again at Table 7 to understand the magnitude of this effect, we find again that this effect is not equal across the genders. When moving from the educational attainment category of "primary school completion or less" to that of "completed more than primary school", men and women experience approximately the same increase in their likelihood of using motorized transport. However, women reap larger mobility gains from education than do men. For women,

it appears to be a transition from being unemployed to working outside and riding a matatu. For men, on the other hand, the transition is from commuting via walking to commuting via matatu.

CONCLUSIONS AND POLICY IMPLICATIONS

There are two “take-home” conclusions from the analysis presented here. First, it is clear that most people in the slums of Nairobi do not have travel “choices” – they cannot afford motorized transport, so they walk. Second, it is also clear that women and children are disproportionately affected. The question we ask here, then, is what can and should be done to enhance mobility for slum residents?

Since the vast majority walk, the first priority must be to invest in pedestrian infrastructure and safety. Paved sidewalks, pedestrian crossings, pro-pedestrian traffic rules, and efforts to enhance security for the walking masses are all low cost investments with extraordinarily high returns. In addition, these are the kinds of investments that make cities more livable for citizens across the income spectrum, more attractive for visitors, and more environmentally sustainable.

Second, it is crucial to enhance the affordability and desirability of public transport. The current system of informal and privately-provided paratransit has emerged to fill the void created by the absence of a public transport system. But the matatu paratransit system has serious limitations. This study categorically shows that it is unaffordable for the majority of the poor. In addition, as is widely-acknowledged, it has an abysmal safety record, and the driving practices of matatu drivers create havoc on Nairobi’s highly congested roads, negatively impacting the efficiency and contribution of the nation’s economic powerhouse. These concerns lend strong support for expedited implementation of the proposed mass rapid transit included in the government’s draft mid-term plan (Government of Kenya, June 2008). For the design and

implementation of its proposed transit system, the government can learn from and build on the highly successful Bus Rapid Transit (BRT) System in Bogotá, and the new ones being implemented in cities such as Dar-es-Salaam and Jakarta. Such a public transit system can go a long way toward alleviating the mobility constraints for many of the city's residents and especially for the poor. But, as this study suggests, the design for the new transit system will need to explicitly include the poor as a target group and to find innovative ways of making the system affordable for them without compromising system-wide financial sustainability.

Third, with respect to school-going children, the policy goal must be to eliminate the welfare gap in mobility, that is, to ensure that children from both poor and non-poor households are equally able to access a good school. For this, policymakers can either insure that all settlements have good schools – including informal slum settlements – or that all students can travel to good schools outside their settlement. A combination of the two options is probably the most practical. This means education experts should examine whether and in which settlements transport constraints are negatively impacting school choice and education outcomes, and work with transport experts to devise tailored solutions (e.g. targeted subsidies or vouchers) to offset the mobility handicap faced by poor children.

Fourth, transport policies must to be gender-sensitive to be effective and initiatives outside the transport sector may be required to enhance mobility for women. For this, there is a critical need for additional research to better understand women's constraints. From this study we know that the mobility constraints faced by women are not simply an affordability problem. For instance, childcare responsibilities certainly impinge on mobility. To enhance mobility for women with children, it may be worth exploring the feasibility and potential impact of offering childcare—for example, daycare-type services that charge a small fee. Women whose children

are cared for would be free to widen their job search beyond their settlement. This should increase their salaries, allowing them to afford the childcare fees, and employ women who stay behind as well.

Previous research suggests that lack of security is often a key factor influencing women's mobility. Although additional research is required to examine whether and in what ways security issues affect mobility in Nairobi's slums, the following kinds of initiatives can potentially help. First, safety concerns could be factored into investments in pedestrian infrastructure through inclusion of features such as street lighting. Second, additional security could be provided for traveling women to guard against sexual harassment and assault, particularly at night and along routes known to be less safe for women. This added security need not be provided by government; it could be organized by the community itself.

Overall, enhancing mobility for the urban poor deserves special attention on the policy agenda. But policy aiming to improve transport access is unlikely to be fully effective if the target population is seen as the "extreme poor" as a single group. Women, men, and children in this population each face distinct barriers to access—their unique needs and constraints must be further studied and explicitly factored into policies and programs, if we are to provide mobility and transport access to all slum residents in this African city.

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Table 1: Transport access and affordability indicators

	ALL	Female	Male	z-stat	Poor	Nonpoor	z-stat
Pct of HH with at least one member riding a <i>matatu</i>	38%	n/a	n/a	n/a	35%	47%	4.584
N (households)	1751	n/a	n/a		1279	472	
Pct of adults working outside And riding a <i>matatu</i>	45%	36%	48%	3.977	41%	55%	5.049
N (adults working outside)	1624	346	1278		1179	442	
Pct of children studying outside and riding a <i>matatu</i>	9%	9%	9%	0	5%	46%	8.145
N (children studying outside)	333	169	164		296	40	

Statistically significant differences between subpopulations are in boldface.

Table 2: A logit model of slum children’s “choice” to attend a school outside their home settlement

	Coefficient	S.E.
Public school in home settlement	-1.071***	0.361
Private school in home settlement	-1.732***	0.556
Adult in HH works outside	0.688***	0.193
Poor	-0.462*	0.279
Household size	0.079*	0.041

PLUS LOCATION-SPECIFIC CONTROL VARIABLES

N=891, Pseudo-R2=0.180

*** indicates statistical significance at the 1% level, *at the 10% level

Table 3: Summary statistics for adult residents of Nairobi's slums

	Women N=1439	Men N=1976	z-stat
Percent unemployed	49%	10%	10.995
Percent "poor"	85%	76%	5.820
Percent > primary education	34%	49%	5.466
Percent HME* worker	22%	16%	1.942
Median age	26 years	29 years	n/a
Percent "regular" wage job	10%	33%	5.908
Percent skilled work	6%	20%	3.382

Statistically significant differences between subpopulations are in bold.

*HME stands for household microenterprise. People in this category work for themselves.

Table 4: Transport summary statistics for adult residents of Nairobi's slums

	Women			Men	z-stat	
Pct work outside settlement	51%			75%		10.864
N(working adults)	685			1716		
Pct of above who walk	62%			48%		4.740
N(adults working outside)	348			1288		
	Poor	Nonpoor	z-stat	Poor	Nonpoor	z-stat
Pct work outside settlement	48%	64%	3.254	74%	78%	1.904
N(working adults)	561	124		1279	438	
Pct of above who walk	67%	47%	3.139	53%	36%	5.478
N(adults working outside)	269	79		945	343	
	Female-headed HH			Male-headed HH		
Median HH transport expenditure per day	0 Ksh (N=306)			20 Ksh (~\$.30) (N=1440)		
Median percent of HH expenses for transport	0%			9%		
	Poor HH			Non-Poor HH		
Median HH transport expenditure per day	0 Ksh (N=1274)			30 Ksh (~\$.40) (N=472)		
Median percent of HH expenses for transport	0%			13%		

Statistically significant differences between subpopulations are in bold.

Table 5: The effect of children on adult employment and commuting

	Women w/kids	Women no kids	z-stat	Men w/kids	Men no kids	z-stat
Percent employed	35%	56%	6.772	86%	86%	0.035
N(adults)	740	402		632	1094	
Pct work outside settlement	47%	59%	3.095	76%	74%	1.024
N(working adults)	451	234		746	970	
Pct of above who walk	66%	57%	1.581	44%	51%	2.447
N(adults working outside)	210	138		569	719	
	Women w/kids	Men w/kids	z-stat	Women no kids	Men no kids	z-stat
Percent employed	35%	86%	19.484	56%	86%	10.735
N(adults)	740	632		402	1094	
Pct work outside settlement	47%	76%	10.084	59%	74%	4.283
N(working adults)	451	746		234	970	
Pct of above who walk	66%	44%	5.372	57%	51%	1.285
N(adults working outside)	210	569		138	719	

Statistically significant differences between subpopulations are in bold.

Table 6: Multinomial logit model of men's and women's work and travel choices (destination and mode)

	WOMEN			MEN		
	Walk Out	Matatu	Unempl.	Walk Out	Matatu	Unempl.
Dist. to CBD	-0.497* (0.268)	-0.041 (0.309)	-0.278 (0.214)	-0.237 (0.181)	-0.319* (0.189)	-0.150 (0.287)
Age 25-34	-0.621*** (0.225)	-0.040 (0.272)	-0.721*** (0.170)	0.560*** (0.177)	0.854*** (0.186)	0.093 (0.238)
Age 35-44	-0.678** (0.296)	0.474 (0.330)	-0.928*** (0.244)	0.633*** (0.221)	1.003*** (0.226)	-0.465 (0.387)
Age 45-54	-0.104 (0.383)	0.278 (0.469)	-0.821** (0.389)	0.171 (0.276)	0.744*** (0.273)	-1.634** (0.762)
Kids in HH	0.026 (0.255)	-0.994*** (0.301)	0.441** (0.213)	0.542** (0.214)	0.507** (0.214)	0.654** (0.295)
Poor	-0.269 (0.273)	-0.657** (0.288)	0.010 (0.236)	0.254 (0.180)	-0.583*** (0.175)	0.235 (0.314)
HH Size	-0.054 (0.058)	0.083 (0.069)	-0.128*** (0.044)	-0.242*** (0.055)	-0.090* (0.052)	0.038 (0.061)
HH Head	0.717*** (0.231)	-0.083 (0.276)	-3.007*** (0.290)	0.267 (0.187)	0.335* (0.195)	-2.387*** (0.271)
Primary Educ.	0.427** (0.198)	0.764*** (0.234)	-0.414** (0.163)	-0.057 (0.141)	0.493*** (0.143)	-0.125 (0.209)
HME	-0.846*** (0.225)	-0.348 (0.253)		-0.973*** (0.168)	-1.165*** (0.175)	
Constant	1.846*** (0.608)	-0.378 (0.758)	2.230*** (0.530)	0.949** (0.458)	0.702 (0.474)	0.842 (0.682)

PLUS LOCATION-SPECIFIC CONTROL VARIABLES

N=3266, Pseudo-R2 = 0.241, Work inside settlement and walk is the base alternative

Notes: Standard errors in parentheses

* indicates statistical significance at 10% level, ** the 5% level, and *** the 1% level

**Table 7: Effects of changes in three variables on women's and men's travel choices
(percentage point changes in likelihood of choosing alternatives)**

	Men				Women			
	Unempl.	Stay In	Walk Out	Matatu	Unempl.	Stay In	Walk Out	Matatu
Poor become non-poor ^a	-2.8	-1.8	-10.9	+15.5	-4.3	-2.6	+2.0	+4.9
Kid-free HH have kids ^b	+2.4	-6.9	+2.8	+1.7	+9.8	-3.5	-1.4	-4.8
Less-educated become educated ^c	-1.7	-3.0	-7.0	+11.7	-14.6	-2.2	+5.6	+11.1

^a Nmen=1431, Nwomen=1185

^b Nmen=832, Nwomen=1006

^c Nmen=910, Nwomen=475

Figure 1: Nairobi City map depicting the sampled slum neighborhoods. The star identifies the Central Business District.

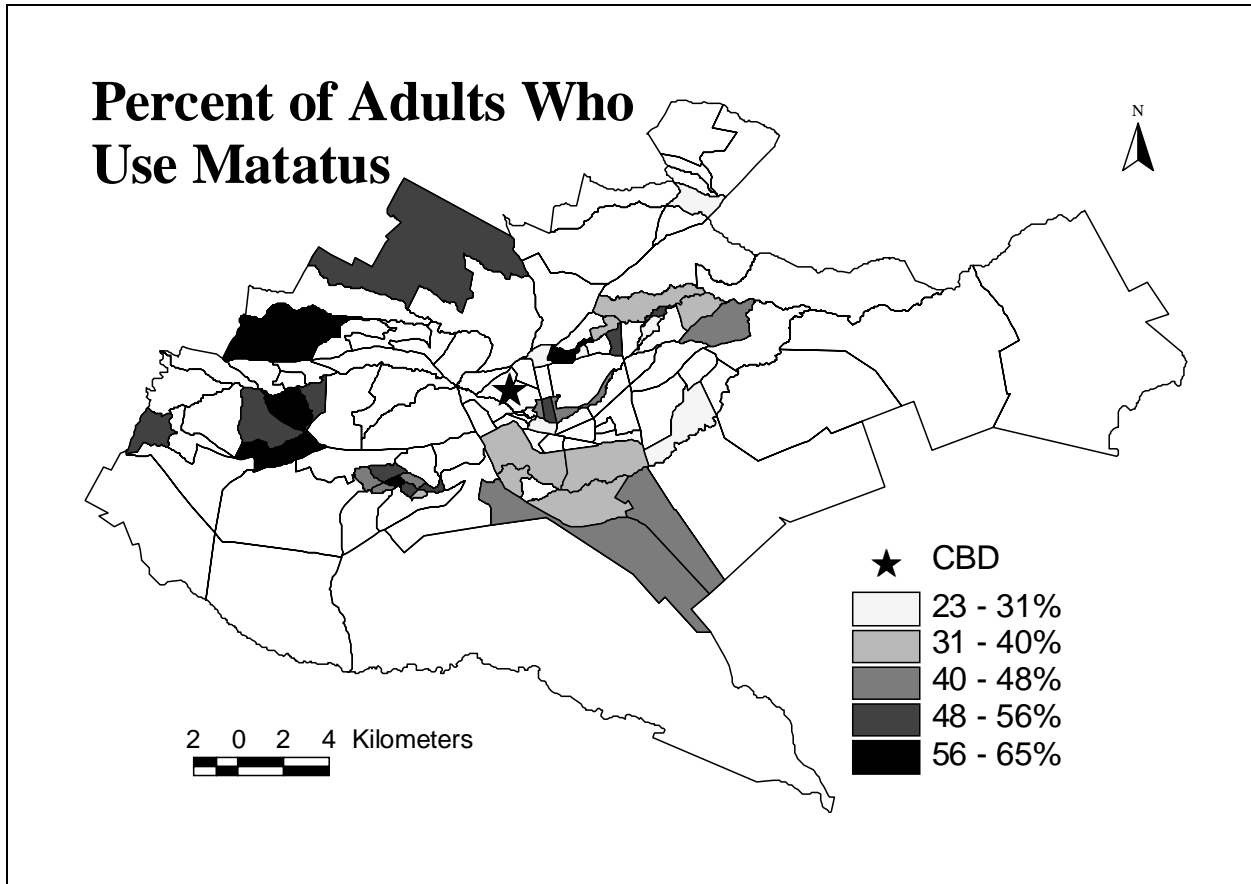
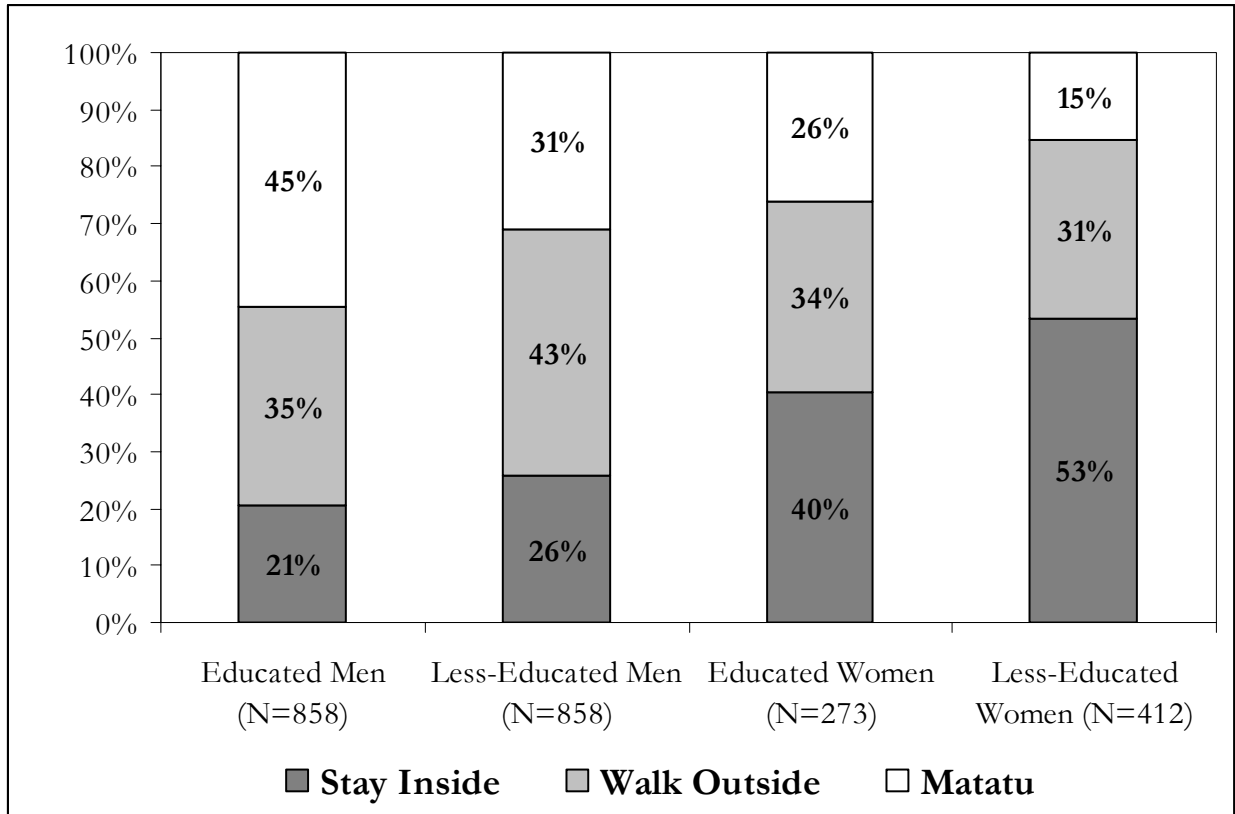


Figure 2: Percent of slum residents in travel categories by gender and education level*



*In this figure, “Educated” means that the person has completed some post-primary education, while “Less-Educated” indicates that *at most*, the person has completed primary school.