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Transportation Choices, Fatalism and the Value of Life in Africa *

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Abstract: We exploit a unique transportation setting to estimate the value of a statistical life (VSL) in Africa. We observe choices made by travelers to and from the airport in Freetown, Sierra Leone (which is separated from the city by a body of water) among transport options – namely, ferry, helicopter, speed boat, and hovercraft – each with differential historical mortality risk and monetary and time costs, and estimate the trade-offs individuals are willing to make using a discrete choice model. These revealed preference VSL estimates also exploit exogenous variation in travel risk generated by daily weather shocks, e.g. rainfall. We find that African travelers have very low willingness to pay for marginal reductions in mortality risk, with an estimated average VSL close to zero. Our sample of African airport travelers report high incomes (close to average U.S. levels), and likely have relatively long remaining life expectancy, ruling out the two most obvious explanations for the low value of life. Alternative explanations, such as those based on cultural factors, including the well-documented fatalism found in many West African societies, appear more promising.

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1. Introduction

This paper exploits a unique transportation setting to estimate the value of a statistical life in Africa, and to assess potential mechanisms behind the results. The revealed preference data from transport choices allow us to evaluate the trade-off individuals make between monetary wealth and fatality risk, expressed in dollars per death averted. Our estimation relies on the observed choices that every airplane traveler to or from Sierra Leone has to make to cross the body of water between the national airport and the capital city of Freetown. They can choose between four distinct transport options – namely, ferry, helicopter, speed boat, and hovercraft – which differ in their ticket cost, travel time and mortality risk. These revealed preference value of a statistical life (VSL) estimates also exploit exogenous variation in travel mortality risk generated by daily weather shocks, e.g. rainfall, that differentially affect risk across transport modes.

We find that African airport travelers have very low willingness to pay for marginal reductions in mortality risk, with an estimated average VSL very close to zero (at US$1,736 in PPP terms). Yet our elite African respondents report quite high incomes, close to average U.S. income levels, and likely have relatively long remaining life expectancy, ruling out the two most obvious explanations for the low value they place on life. A plausible, though speculative, explanation for this finding lies in socio-cultural factors, and especially the perceived role of fate in determining life outcomes in West African societies, a point we elaborate on below.

One major challenge in obtaining reliable VSL estimates is the endogeneity of risk that individuals choose to take on (Ashenfelter 2006). The underlying individual factors that affect the decision to enter a risky situation may also be correlated with income, wealth or fatality risk. To credibly estimate the VSL, we need exogenous events that affect the costs or fatality risk individuals face and which we can observe agents' response. An example is Ashenfelter and Greenstone's (2004a) use of legal changes to highway speed limits in the U.S., which leads them to estimate a VSL between US$1.0 and 1.5 million. In our setting, the fact that basically all individuals who wish to travel to or from Sierra Leone by air need to choose among the available travel options to cross from the airport to Freetown helps to partially overcome these concerns.[1] Additionally, variation in daily weather conditions, which differentially affect fatality risk across

[1] Of course, Sierra Leoneans could simply choose not to leave the country, but they may need to do so for professional or personal reasons.

transport modes, provide exogenous variation in travel risk. We observe respondents making choices under different risk conditions (due to changing weather), which allow us to control for transport mode specific unobserved attributes, in particular, with the inclusion of alternative specific constants in a logit framework.

Our VSL estimates for Africans fall far below previous assessments from rich countries, which typically use hedonic labor market approaches and range from US$1 to 9.2 million (Viscusi and Aldy 2003; Ashenfelter and Greenstone 2004b).[2] The only comparable estimates available from developing countries, for manufacturing workers in India and Taiwan, reveal VSL's that are an order of magnitude higher than our findings for Africans, between US$0.5 and US$1 million. In the African context, Deaton et al. (2008) use a subjective life evaluation approach, and find that the monetary value attached to the death of a relative is only about 30 to 40% of the average annual income, which is less than one percent of most estimates for wealthy countries. Kremer et al. (2011) use a travel cost approach (namely, willingness to walk longer distances to cleaner drinking water sources) to estimate the willingness to pay for avoiding a child death by diarrhea in rural Kenya. Consistent with our findings, the results in that study suggest that such willingness to pay is low, at just US$769.

This seemingly low demand for health and life in less developed countries has been noted by other scholars, and remains something of a puzzle for both researchers and policymakers. The disease burden in low income countries is much higher than in rich countries, and yet a number of scholars have documented extremely low investments in preventive health and life saving technologies (see Kremer and Miguel 2007; Kremer et al. 2011; Cohen and Dupas 2010). Prevailing explanations (surveyed in Dupas 2011) range from a lack of information about new health technologies (Madajewicz et al 2007), a high income elasticity of demand for health expenditures (Hall and Jones 2007), pervasive liquidity constraints (Tarozzi et al 2011), time inconsistent preferences (DellaVigna and Malmendier 2006), agency problems within the household (Ashraf et al. 2010), and short life expectancy (Oster 2009).

A leading explanation for the low demand for health in poor countries is a high income elasticity of demand for health and life. Hall and Jones (2007) argue that the marginal utility of

[2] Ashenfelter and Greenstone (2004a) argue that these estimates are subject to an upward publication bias.

health expenditures is increasing in income, and consistent with the model they develop, they find that the income elasticity of health expenditures is greater than one (at 1.28).[3] Yet at least three types of empirical evidence argue against this explanation in our data. First and most importantly, our sample is largely composed of African elites: mainly business people and government or NGO officials who have average incomes comparable to U.S. per capita income, at US$22.26 per hour (in PPP). While the Hall and Jones (2007) view might explain the low estimated demand for health among poor rural households like those studied in Kremer et al. (2011), it cannot readily do so in a population with U.S. income levels. Second, among our Africans respondents, we are unable to reject that the choices made by those with higher incomes are any more sensitive to marginal changes in mortality risk than for poorer travelers. Finally, we estimate much higher VSL's (on the order of those found in the existing literature) among the non-African respondents in our sample, who report comparable incomes to our African respondents yet are much more likely to avoid additional fatal accident risk when choosing among transportation options. Taken together, it does not appear that the low valuation of life we estimate among African travelers is driven mainly by low income.

A second leading mechanism proposed to explain VSL patterns argues that agents facing high mortality risk in daily life are less willing to pay for additional marginal reductions in risk. This proposition can be formulated as a non-linear relationship between the VSL and mortality risk itself.[4] A related formulation is presented by Oster (2009), who argues that the lack of behavioral change for HIV prevention in Africa could be conceptualized as the rational response of forward-looking agents, given that the marginal utility of investments to avoid infection risk is lower for individuals who already face a shorter expected life span.

While this mechanism may have some relevance in our setting, it also appears unable to explain most of our findings. Life expectancy at birth is indeed relatively low among Africans. However, most of this elevated mortality occurs within the first five years of life. Conditional on survival past this age, there is considerable convergence in life expectancy between Africans and

[3] Viscusi (2010) discusses recent research on the heterogeneity of VSL estimates. One of the most relevant dimensions of heterogeneity is income; he reviews studies that find an income elasticity of VSL above one (e.g., Evans and Smith 2010).
[4] Lavetti (2011) exploits data on commercial deckhands in the Alaskan Bering Sea to estimate the marginal willingness to pay to accept fatal risk. Partially controlling for unobserved individual heterogeneity and endogenous job switching with panel data on wages and mortality rates, he estimates a concave relationship between the marginal willingness to pay for risk reduction and the level of risk.

Westerners: Figure 1 presents an illustration for the U.S. versus Senegal (where we focus on Senegal because it has the most complete mortality statistics broken down by age in West Africa). Respondents in our sample are 40 years old on average, at which point the gap in remaining life expectancy is only a few years, and is likely to be even smaller when comparing Americans to African elites (like our sample), given they have better access to health care than the average African. Differences like those documented in Figure 1 appear unable to account for the large gaps in observed transport choices and VSL figures that we estimate between Africans and non-Africans in our data.

Further alternatives proposed in Dupas (2011) and elsewhere – including lack of information about transport risks, liquidity constraints, and within household agency problems – also appear unlikely to account for our findings. In terms of information, transport risks to and from the airport are extremely well-publicized in Sierra Leone. Moreover, our results hold when we exclude the first trip made by each traveler (in which they were arguably less informed than in later trips). In terms of liquidity constraints, our respondents are relatively well-off and thus less likely to be highly constrained. Finally, household agency problems are irrelevant because the travelers in our sample are making decisions for themselves rather than others.

A more promising, although admittedly speculative, explanation for these results lies in differences in cultural attitudes between Africans and non-Africans, and especially the pervasive view in West Africa that fate governs major life outcomes. Accounts highlight fatalism as a widespread cultural attitude in many African societies (Iliffe 1995; Gannon and Pillai 2010), recognizing the key role played by fate or destiny in life outcomes, prominently life or death (Fortes and Horton 1983). In the extreme, fatalistic beliefs can lead to a lack of perceived individual agency and personal responsibility over many dimensions of life.[5]

The accounts of African fatalism have gained particular relevance in recent years in explaining the rapid spread of HIV, and more generally, in accounting for the risky sexual behaviors that underlie this spread. To the extent that the timing of one's death is determined by

[5] For example, Bascom (1951), when describing social status and individual wealth differences among the Yoruba (in Nigeria), argues that "a person's luck and his success in economic and other affairs is also a matter of destiny (ayanmope, ayanmo) or fate (iwa)", and further "…diviners may be able to recommend sacrifices (ebo) which will influence events in the immediate future, they cannot alter the course of one's life or change his destiny" (p.492). Weprovide further discussion and quotes on this topic below.

destiny rather than individual decisions, there is little role for preventive behavioral change. Caldwell (2000) and Caldwell et al. (1992) analyze AIDS epidemic in sub-Saharan Africa, attributing a key role to fatalism beliefs in explaining the persistence of risky sexual behaviors even in the midst of the epidemic. For example, they mention that "the belief in destiny, stronger in West Africa than in the East and South,… holds that the date of death is written and changes in lifestyle will not put off the event" (p. 1179). Similarly, Meyer-Weitz and Steyn (1998) studied youth sexual behavior is South Africa and argue that "young people expressed a fatalistic attitude toward HIV prevention and were of the opinion that it was senseless to try and protect themselves from HIV/AIDS."

While there are obviously many other possible differences between Africans and non-Africans along other dimensions that could be contributing the VSL differences we estimate, it is plausible that widespread fatalistic beliefs are playing some role. Making further progress in disentangling the underlying mechanisms is an interesting route for future research.

The paper is organized as follows. In the next section we introduce the setting, section 3 discusses the model and estimation strategy, section 4 describes the data, section 5 presents the results, and the final section concludes.

2. Background on Sierra Leone

To reach Sierra Leone's Lungi International airport from the capital of Freetown, travelers must cross an estuary roughly twice the size of San Francisco Bay at its widest point (or about 10 miles). There is no bridge, and it is estimated that the best ground transport option around the estuary would take over six hours on unpaved and often dangerous roads, and thus we have heard of no travelers choosing this option (see map in Figure 2). All travelers arriving at Lungi Airport must choose between three (to four) distinct transportation alternatives – helicopter, water taxi, ferry and a hovercraft (when operational) – to cross the estuary.[6] Each of the alternatives varies in terms of accident risk, trip duration and monetary cost. Importantly for our estimation, fatal accidents on all modes of transport are widely reported in the local and

[6] The hovercraft has operated intermittently over the past decade. Most recently, after a crash at the Lungi docks, as well as an accident that led it to catch on fire in the estuary in early 2009, the service was discontinued indefinitely. In our data, which included retrospective reports on earlier trips, some travelers do choose the hovercraft option and so we do include it as an option in our estimation when appropriate.

international media and appear well-known to most travelers.[7] Passengers typically make their choice of transport mode on site, on the same day of the trip, taking into account current weather conditions. Further, in our experience there are typically few to no capacity constraints: if a given mode of transport is full at the scheduled time, there are more crafts available, or additional trips can be made by the existing fleet (i.e., the helicopter can simply make another trip between Lungi and Freetown).

Table 1 presents summary statistics. While the helicopter is the most expensive option (at US$70 until 2009, rising to US$80 in 2010), it is also the fastest, at only 10 minutes to cross, and has the worst accident record. The sole provider of the service uses poorly maintained Soviet-era helicopters.[8] Since 2005, there have been two helicopter crashes where all of the crew and passengers died, as shown in Table 2. Taking into account the frequency of the trips as well as the number of passengers per trip, the historical fatality rate over 2005-2010 for helicopter transport is roughly 22 per 100,000 passenger-trips, which is at least 30 times the fatal accident rate per 100,000 flying-hours in U.S. helicopters.[9]

The cheapest transport option is the ferry, at just US$2 per trip, though it takes approximately 70 minutes to cross the estuary. The ferry landings are also a greater distance from the airport on the Lungi side and from downtown on the Freetown side (relative to the helicopter), adding perhaps another 30 minutes per trip. The ferry has the second worst recent safety record: since 2005, there have been three major ferry accidents in Sierra Leone (including some on other routes), almost certainly due to passenger overcrowding, in which most

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[7] There is extensive coverage on the various transport options online. The British High Commission advises (www.fco.gov.uk): "Transport infrastructure is poor. None of the options for transferring between the international airport at Lungi and Freetown are risk-free. You should study the transfer options carefully before travelling". A Sierra Leone tourism site (www.visitsierraleone.org) writes that: "Helicopters and Sierra Leone have a bit of a notorious past, with a couple of crashes widely reported"; and: "The cheapest option of all is to take the ferry to Freetown but it is certainly not the quickest option". The BBC reported the following on one of the helicopter accidents: "A helicopter ferrying passengers to Freetown airport in Sierra Leone has crashed, killing 19 people, including Togo's Sports Minister Richard Attipoe." (BBC News 2007). Similarly, Bloomberg News reported on a ferry accident: "105 people are feared to have drowned in Sierra Leone when a boat capsized." (Bloomberg News 2009). Local newspapers also regularly report on transport safety, including on a water taxi accident (in another part of Sierra Leone's coast): "A passenger speed boat, Sea Master I, plying the Kissy Ferry Terminal/Tagrin route capsized at about 10:00 p.m. on Friday 27th February 2009 after making several distress calls to the pilot office of the Sierra Leone Ports Authority" (New Citizen Press, Freetown 2009).

[8] There are anecdotal reports that quality control on the helicopter service has improved since late 2010, and one of the old helicopters has been replaced with a newer model, but this occurred after the data used in this paper was collected.

[9] U.S. helicopter accident figures come from the 2009 Annual Report on www.helicopterannual.org (accessed October 2011).

passengers drowned. Accounting for the frequency of ferry trips and the number of passengers per trip, this translates into a fatality risk of 9.5 per 100,000 passenger-trips.

The third major mode of transport is the water taxi, which is a small craft able to accommodate 12 to 18 passengers. Although there have been multiple reports of these boats sailing without proper lights or navigations systems, it appears to be the safest option, with just one recorded accident during 2005-2010 and a mortality risk of 4.5 per 100,000 passenger-trips. The water taxi crosses the estuary in approximately 45 minutes and costs US$40.

Finally, the intermittently available hovercraft had a fatality risk of 4.4 per 100,000 passengers-trips (in four separate accidents with 17 passenger deaths overall), and its cost was US$35, with an estimated travel time of 40 minutes. In the analysis below, we consider the hovercraft as a possible alternative only during periods in which we know it was operating.

3. The Model

In a random utility model, individual i obtains the following utility from using transport alternative *j* at time *s* to travel between Lungi Airport and Freetown:

(1) $$U_{ijs} = v_i - (c_{js} + w_i t_j) + \varepsilon_{ijs}$$

where v_i represents the value to individual i from successfully completing the trip (alive), c_{js} is the monetary cost of the trip in transport mode j, $w_i t_j$ is the opportunity cost of time expressed in terms of the time it takes to complete the trip (t_j), and the value of the individual's time (their wage, w_i). and ε_{ijs} is an i.i.d. type I extreme value error term unobserved by the researcher.

Every transport mode has an associated fatal accident probability at time s, p_{js}. The expected utility derived from choosing transport choice j is the survival probability times the value of survival minus the total travel cost (normalizing the utility in a fatal accident to zero):

(2) $$E(U_{ijs}) = (1 - p_{js})v_i - \ (c_{js} + w_i t_j)$$

An individual's choices between transport modes provide information on the implicit valuation that she assigns for completing the trip alive. In particular, if we have a choice situation where transport options have known fatality risks and we have information on individual time values, we are able to model the trade-off facing the individual to obtain an estimate of her willingness to pay to avoid additional fatality risk. Formally, the individual chooses alternative j at time s if and only if $E(U_{ijs}) \geq E(U_{iks}),\ \forall\, k$. A revealed preference lower bound on the value of individual i's statistical life, v_i, is:

(3) $$v_i \geq -\frac{w_i\,(t_j - t_k) + (c_{js} - c_{ks})}{(p_{js} - p_{ks})} \approx -\frac{\Delta Cost}{\Delta Risk}$$

where ΔCost denotes the difference in total travel costs (monetary and in terms of time) between the alternatives and ΔRisk is the gap in mortality risk. This constitutes a lower bound since we know individual i is willing to make this trade-off but we do not know how much greater his or her valuation might be.

Figure 3 illustrates the intuition with two loci that correspond to equal utility for the main transport modes.[10] The horizontal axis represents the passenger's hourly wage, and the vertical axis plots the value of a statistical life (VSL). The relative risk and cost profiles of each transportation alternative determine the intercepts and slopes. The water taxi is the least risky option but lies between the ferry and helicopter in terms of ticket price and time (Table 1). The fastest but riskiest option is the helicopter, which is also the most expensive. As shown graphically, individuals with high wages effectively choose between the helicopter and the water taxi (since the long travel time on the ferry generates high disutility). Those with sufficiently high value of life always choose the water taxi since it is safest, while those with low valuations choose the helicopter (if their wage is high) or ferry (if the opportunity cost of time is low). Panel B of Figure 3 presents the same loci using the actual data on accident risk and transport costs in our data as an illustration.

To make more progress on pinning down the actual value of v_i rather than a bound, we employ a discrete choice model that imposes some necessary distributional assumptions. The dependent variable, y_{ijs}, is the observed transport choice, which is determined by risk and cost characteristics. The probability that individual i choose transportation mode j at time s is given by the conditional logit formula (McFadden 1974):

[10] For clarity, the loci corresponding to equal utility for the ferry and helicopter is not shown since it lies in a region where both are dominated by the water taxi. We ignore the hovercraft for simplicity since it was not an option for most of our study period.

(4) $$P\left(y_{ijs}\right) = P\left(U_{ijs} \geq U_{iks},\ \forall k\right) = \frac{\exp\left[\propto_j + \beta_1(1-p_{js}) + \beta_2 Cost_{ijs}\right]}{\sum_k \exp\left[\propto_k + \beta_1(1-p_{ks}) + \beta_2 Cost_{iks}\right]},\ \ k \in \{1,2,3,4\}$$

where $1\text{–}p_{js}$ is the probability of a safe trip in alternative *j* at time *s*. β_1 represents the marginal change in the likelihood of choosing a certain transport mode due to a change in the probability of survival, and intuitively this corresponds to the utility value of completing a trip. The $Cost_{ijs}$ term captures total travel costs including the monetary cost of the ticket itself (c_{js}) and the opportunity cost of time $\left(w_i t_j\right)$. β_2 thus captures how the likelihood of choosing a mode changes with cost, and corresponds to the monetary value of a unit of utility. The negative of the ratio of these coefficients captures the trade-off between exposure to fatal risk and cost, which can be interpreted as the value of statistical life. Formally:

(5) $$-\frac{\beta_1}{\beta_2} = -\frac{\partial P\left(y_{ijs}\right)/\partial(1-p_{js})}{\partial P\left(y_{ijs}\right)/\partial Cost_{ijs}} = -\frac{\partial Cost_{ijs}}{\partial(1-p_{js})} \approx -\frac{\Delta Cost}{\Delta Risk}.$$

The alternative specific constants, α_k, that we also add to the specification capture any characteristics of transport mode *k* that affect its desirability other than accident risk or cost, e.g., comfort or other amenities. If these attributes are correlated with either the risk or cost of an alternative, the resulting estimates of β_1 and β_2 could be biased, as discussed further below.

The use of alternative specific constants is possible since the probability of completing a trip in each transport mode varies over time depending on daily weather conditions. For example, water-based travel is plausibly riskier in the rainy season, while helicopter accidents are more likely when there is denser cloud cover. We exploit the variation provided by daily weather conditions, obtained from the local weather station in Lungi (available at www.wunderground.com), to predict the risk of a fatal transport accident in each transport alternative. In practice, we regress the occurrence of a fatal accident in mode *j* on passenger-trip *i* in day *s* (F_{ijs}) on a vector of daily weather conditions (Z_s), including precipitation, cloud cover, temperature, visibility and wind speed (among others):

(6) $$Prob(F_{ijs} = 1|Z_s) = \alpha + Z_s{}'\beta + \varepsilon_{ijs}$$

where ε_{ijs} is an idiosyncratic error term clustered by day. We estimate equation (6) separately for each transportation alternative using a probit model to generate daily predicted fatal risk probability for a representative passenger on day s in mode j, or $\hat{p}_{js}$. Given that this accident risk variable is itself estimated, we bootstrap standard errors in the main conditional logit analysis.

The results are presented in Table 3. The average predicted risk of mortality in each mode is close to the observed mortality rate, and tests of joint significance for all the weather regressors reject that they are equal to zero for all four modes. Precipitation significantly increases mortality risk in ferry and hovercraft trips, while cloud cover affects accident risk in the ferry, helicopter and hovercraft (although with differing signs). Similarly, temperature, visibility and humidity all affect accident risk for certain transport modes. Overall, the helicopter is clearly the riskiest mode of transport, followed by the ferry and the hovercraft, with the water taxi the safest choice.

Figure 4 plots the monthly predicted risk of a fatality in each of the three main transportation alternatives from 2005 to 2010, years when the bulk of reported trips in our sample occur. There are clear seasonal patterns in the data. While it is generally safer to travel in the dry months of the year (December through March), the rainy season (June through September) is much riskier due to the rain, low visibility, gusty winds, etc. This variation is also somewhat heterogeneous across transport options: the helicopter is much riskier than other modes during the rainy season. The water taxi is the safest mode of transport year round.

4. Data

The transport choice survey data was collected in August 2009 and June 2010 at both Lungi Airport and at the Freetown among travelers arriving to or departing from Sierra Leone. We verified that all respondents had the option of the three main transportation modes on survey days. Enumerators recorded each respondent's transport choice before conducting the interview. The 2010 survey round added self-reported transport choices on earlier trips, namely on their immediately previous trip, and on their first two trips (if applicable). Thus we have data on one trip for each 2009 respondent, and up to four trips for 2010 respondents.[11]

[11] To provide incentives to complete the survey for passengers who were in a rush to get to the airport or home, each respondent received free cell phone air time worth about US$1 (enough for roughly 10 minutes of calls).

Beyond their actual transportation choices, data was collected on respondents' demographic characteristics (including gender, age, nationality, permanent residence, and educational attainment), and current employment status and earnings.[12]

We complement the survey data with information on all transportation accidents and associated fatalities between January 2005 and July 2010. This information was collected from the U.N.'s Engineering Department in Freetown, and cross-checked with multiple local and international newspapers. The list of all accidents is presented Table 2.[13]

Table 4 presents the descriptive statistics of the analysis sample focusing on our 721 African respondents for now. Two thirds of African travelers are from Sierra Leone with the remainder mainly from Nigeria (35% of non-Sierra Leoneans), Ghana (10%), Guinea (8%) and Liberia (8%), with smaller numbers from South Africa (5%), Senegal (4%), Gambia (4%), Kenya (3%) and other countries. Overall, 81% used the ferry, 13% the water taxi, and 6% chose the helicopter, with negligible number using the hovercraft. African airport travelers in Sierra Leone are an average of 40.5 years old and 67% male. They are highly educated – 45% hold a university degree and 22% have post-graduate education – and have high incomes by local standards, with average hourly wages of US$22 (in PPP) or $45,000 per year, which is comparable to median U.S. levels. They are a mixture of local and international business people, aid workers and government officials.[14]

Respondents report making their own transportation choices based on what appear to be objective characteristics of each mode, indicating that travelers appear quite well-informed about their respective pros and cons. Most travelers who chose the helicopter mention that they chose it because it is the fastest option (82%, Appendix Table A.1). Helicopter travelers are also the most educated (49% have a post-graduate degree), and tend to be better-off (earning US$37/hour). On the other hand, those who chose the ferry claim to do so because of its lower cost (62%) and its safety (87%). Ferry passengers are poorer on average (US$23.5/hour) and less educated on

[12] About one third of respondents have missing values for their earnings and wages. We impute missing observations with the average wage of respondents with the same educational attainment category (namely, less than university, some/completed university, post-graduate), continent of origin (African or non-African), and employment sector (international organization/business, local organization/ business, unemployed).
[13] There were additional helicopter accidents during 2001 and 2002 during the tail end of the civil war and its immediate aftermath, but we restrict attention to the period when the war was definitively over.
[14] Appendix Table A.2 presents comparable descriptive statistics for non-Africans in the sample.

average. Finally, passengers choosing the water taxi mention that their decision was based primarily on safety (53%) and speed (71%), and these passengers fall between the helicopter and ferry clientele in terms of education and earnings. These patterns are broadly consistent with the intuitions provided by Figure 3.

5. Main Results

5.1. Estimating the Value of a Statistical Life

An advantage of our dataset is that we observe transportation choices made on different dates where the risks associated with the various options differ due to weather fluctuations, as well as observing multiple choices per traveler for some respondents. This allows us to estimate the discrete choice logit model including alternative specific constants, which isolate the effect of specific unobserved attributes of each mode. For example, if travelers perceive that one of the alternatives is more “comfortable” (e.g., the hovercraft) than the others, or if there is a higher risk of being robbed while riding a crowded ferry, say, these differences will be captured by the constant terms.

Table 5 shows the main results of the choice model specified in equation 4 for African respondents. In all specifications, we regress the transportation choice indicator on the predicted probability of successfully completing the trip (x1000) and the total travel cost. Each observation is weighted to represent the true proportion of passengers travelling on each of the available modes of transport; that is, we weight each observation by the inverse of its sampling probability.[15] We first display results in column 1without including alternative specific constants. The results suggest that transport modes with lower accident risk ($\hat{p}_{js}$) are less likely to be chosen by respondents, a counter-intuitive result. More expensive alternatives are less likely to be chosen, as expected. The coefficient estimates imply a negative VSL estimate of US$-48,138, where the negative sign is driven by the unexpected “preference” for riskier transport modes.

The results in column 1 are likely to be biased to the extent that there are unobserved mode specific attributes correlated with either travel safety or costs, which seems likely. For example, the ferry is generally the most crowded mode while also safer that the helicopter. Not

[15] The sampling probabilities for each transport mode are defined as: (Overall proportion of travelers using transport mode *j*) / (Proportion of survey respondents using transport mode *j*).

accounting for this correlation would lead to a downward biased coefficient on the safety term. Similarly, many passengers (including the authors) dislike the loud rotor noise of the helicopter. Since the helicopter is also the most expensive option, there is an unaccounted correlation between cost and an amenity that would bias estimates on the cost term downward.

Column 2 accounts for alternative specific attributes by including indicator variables for the ferry, helicopter and water taxi (with the hovercraft serving as the excluded category), and the resulting coefficient estimates conform more closely with theory. Transportation options that have a higher likelihood of a safe trip are more likely to be chosen by respondents (although the positive effect is not statistically significant)[16], while costlier options are less preferred. The alternative specific constants are all statistically significant determinants of respondent choices, justifying their inclusion. Following the choice model presented above, we use these coefficient estimates on the safety and cost terms to generate an estimated average VSL, which is just US$1,736, and not statistically different from zero.

5.2. What Explains the Low VSL for Africans?

There are three leading explanations for the low estimated value of life (and relatedly, low observed willingness to pay for health expenditures) in developing countries, and especially in Africa. Some scholars argue that expenditures in life-prolonging technologies are highly sensitive to income (Hall and Jones, 2007), and thus poorer individuals will demonstrate a far lower VSL. Second, it is argued that people with a shorter remaining life span rationally invest less in marginal reductions in mortality risk (Oster 2009). Third, in the African context it has sometimes been argued (mainly by non-economists) that a low observed willingness to pay for health services results from high levels of "acceptance" of morbidity and mortality, which itself is an expression of pervasive fatalism (Fortes and Horton 1983; Caldwell 2000). In what follows, we present evidence that casts doubt on the first two hypotheses, and provide suggestive evidence that fatalism could instead be a partial explanation for the patterns in our data.

If it is indeed the case that the demand for health is highly income elastic (with elasticity greater than one), we should observe that the choices of respondents with higher earnings are

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[16] The lack of any meaningful relationship between accident risk and transport preference serves as a justification for our use of a linear indirect utility function that imposes risk neutrality.

more sensitive to marginal changes in life expectancy. We test this hypothesis in column 3 of Table 5, where we include interaction terms between the hourly individual wage and our two main regressors (the probability of completing a trip, and total cost). The hypothesis implies a positive coefficient on the interaction between the wage and the probability of completing a trip, but we find that the point estimate is close to zero and not statistically significant. The average VSL remains positive but not statistically significant in column 3.[17] This specification also includes the age and gender-specific remaining life expectancy (for Senegal, the only West African country with reliable data as judged by the Human Mortality Database, as discussed above). If it were the case that marginal reductions in risk were more valuable for those who expected to live longer, we would observe a positive coefficient on the interaction term between remaining life expectancy and the trip safety term. However, the interaction term is statistically insignificant (and even negative). The bottom line is that variation in earnings and life expectancy does little to account for the low estimated value of life among African travelers.

In Table 6, we estimate the value of a statistical life among 364 non-African travelers to Sierra Leone. Non-Africans have average earnings roughly 50% higher than Africans, at US$33/hour (see Appendix Table A.2) and are somewhat more likely to have completed university, but are similar in terms of average age and gender proportions. The estimated average VSL for this group is considerably higher at US$0.53 million (column 2), which, while on the low side, is still of the same order of magnitude as many of the most credible U.S. estimates; for instance, Ashenfelter and Greenstone (2004a) present a range of estimates from US$1.0 to 1.3 million. The results indicate that the differences across Africans and non-Africans are due mainly to different preferences for accident risk. Column 3 tests for the equality of the coefficients on the probability of completing a trip and the cost between Africans and non-Africans, while simultaneously controlling for the full set of interactions with wages and remaining life expectancy, to make sure those effects are not driving any differences. Africans are not any more sensitive to differences in trip costs (even conditional on earnings). More important, African travelers appear indifferent to greater fatal accident risk, while non-Africans strongly prefer safer modes. Taken together, this leads to large differences in estimated VSL's for the two groups.

[17] In this specification, the wages and remaining life expectancy are de-meaned, such that the main effect for the probability of survival and cost remains unchanged. Additionally, we include interactions between the alternative specific constants and both variables (not shown), which capture their average effect on the probability of choosing a given option. This applies also to the regression in column 3 of Table 6.

Further evidence against the income and life expectancy hypotheses is presented in Table 7, where we compare the VSL estimates and relevant characteristics for our respondents (African and non-African) with the 1986 U.S. population analyzed in Ashenfelter and Greenstone (2004b). African respondents in our sample have an average hourly wage of US$22.26 (in PPP 2009 dollars), while our non-African sample (of which the largest national group are from the UK at 31%, followed by US citizens at 22%) has earnings of US$33.27, and the average U.S. resident in 1986 had a wage of US$16.05.[18] Even though the African elites included in our sample have similar living standards to both samples of non-Africans, they reveal a much lower VSL at US$1,736, compared to estimates ranging from US$0.5 to 1.5 million for non-Africans.

At age 40 (the average age of our respondents), the average Senegalese can expect to live 33.5 more years, while the U.S. population in Ashenfelter and Greenstone (2004b) could expect to live an additional 38.7 years (again using information in the Human Mortality Database). These moderate observed differences in life expectancy are certainly not large enough to explain the massive gap in VSL under any reasonable level of intertemporal discounting.

An alternative hypothesis that has been proposed to explain the low demand for health in less developed countries is that a pervasive lack of information about health risks leads to too little investment in prevention (Madajewicz et al 2007). Yet this seems unlikely to be a leading explanation in our setting. First, the accidents presented in Table 2 were widely reported in Sierra Leonean and West African media. A more formal assessment of this hypothesis would test whether the estimated VSL is higher for those travelers who are better informed about travel risks. While we cannot compute this directly, it is reasonable to assume that first-time travelers to or from Lungi airport are likely to be less knowledgeable about the relevant risks than more seasoned travelers. When we carry out the estimation excluding all reported trips by first-time Lungi travelers, we find that all of the main patterns described above remain unchanged with an estimated VSL still close to zero (results not shown), suggesting that better information alone is not sufficient to boost the valuation of life.

5.3. Can Fatalism Explain the Low VSL among Africans?

[18] The hourly wages are expressed in 2009 US dollars. We use the GDP deflator from the World Development indicators (World Bank, 2011) to express the hourly wage in Ashenfelter and Greenstone (2004a) in 2009 PPP dollars.

There is apparently a difference in Africans and non-Africans' preferences for taking on additional accident risk that cannot be explained away by the obvious candidates of differences in income, baseline mortality risk, or information. A more promising, though admittedly speculative, explanation for these results could lie in different cultural attitudes. While there may be many such differences, and we are unable to definitively pin down "the" channel, a promising candidate explanation is fatalism, the important role fate is held to have in governing major life outcomes in West Africa.

African cultural historians have long pointed to the important role of fatalism in many societies (Iliffe 1995). A belief in fate or destiny is understood as "an innate, though not necessarily impersonal, determinant of an individual's life-history" (Fortes and Horton 1983, p. 7). These beliefs cut across ethnic groups and religions (Gannon and Pillai 2010), but are more prominent in West Africa than other African regions.[19] Among the Tallensi (Northern Ghana) Fortes and Horton (1983) argue that people believe that fate is the key determinant of major life outcomes: "everything that happens has material causes and conditions, but they are effective only by grace of the mystical agencies which are the ultimate arbiters of nature and society. So they say that if a man wishes to prosper he must have skill, industry and thrift. But these are not enough; without the beneficence of Destiny they will be abortive." (p. 24).[20]

Comparable cross-country opinion data in the World Values Survey (WVS) confirms that beliefs about the role of fate differ sharply between African and U.S. populations. The WVS contains a question that captures fatalism in multiple countries in sub-Saharan Africa including Ethiopia, Ghana, Mali, Rwanda, South Africa and Zambia, although unfortunately there is no WVS data for Sierra Leone. Figure 5 shows that about 15% of the African respondents believe that literally "everything in life is determined by fate", versus only 2% in the U.S. population. A full 36.5% of Africans report an answer between 1 to 4 on a 10 point scale (where 1 corresponds to "everything being determined by fate" and 10 means that "people shape their fate

[19] While Fortes and Horton (1983) study the Tallensi, in Northern Ghana, they are emphatic that their conclusions also hold in many other West African cultures. Bascomb (1951), in analyzing the Yoruba (in Nigeria) associates a person's luck with her destiny, arguing that men could work hard and still remain poor if fate mandates so; Bradbury (1957) reports similar findings among the Bini (in Benin), while Herskovits and Herskovits (1938), studying the Dahomeans, also in Benin, document widespread fatalistic attitudes.

[20] In the economic literature, Bernard, et al. (2011) use experimental evidence from Ethiopia to argue that fatalism is closely related to low future life aspirations, and show that individuals with more fatalistic world views show less demand for credit.

themselves"), while the comparable proportion of Americans is just 7.4%. The distribution of attitudes among Americans is clearly much more strongly tilted towards individual agency and away from fate, with an average of 7.1, compared to 5.6 among Africans.[21]

The belief that life outcomes are predetermined in Africa has lately been held up as a leading cultural explanation for the rapid spread of the HIV/AIDS epidemic, along with the acceptance of the high mortality and morbidity (Caldwell 2000). Some have tied these beliefs to the sometimes passive resignation observed regarding HIV prevention, since "forces outside their control have more power to cause or block HIV infection than do the individuals themselves" (Hess and McKinney 2007, p. 118).[22] These fatalistic beliefs are present even at a young age, including among the South African youth analyzed by Adebowale (2001). In their sample, those who express more doubts about their ability to control whether or not they contract HIV/AIDS are also more likely to have riskier sexual encounters and have a higher number of casual sexual partners.[23]

6. Conclusion

This paper exploits a unique transportation setting to estimate the value of statistical life (VSL) in an Africa setting. Using revealed preferences from choices between options with different mortality risk, and monetary and time costs allows us to estimate the trade-offs individuals are willing in a discrete choice framework. We estimate that the willingness to pay for reduced mortality risk is close to zero among African respondents. The comparable VSL estimate among non-African travelers is half a million U.S. dollars, which is of the same order of magnitude as existing VSL estimates among residents of rich countries.

The finding of a low VSL in Africa is consistent with the well documented low demand for health in less developed countries, and especially in Africa. The leading proposed explanations for this are related to lack of information about new health technologies (Madajewicz et al 2007), a high income elasticity of demand for health expenditures (Hall and Jones 2007), pervasive liquidity constraints (Tarozzi et al 2011), time inconsistent preferences (DellaVigna and

[21] Hess and McKinney (2007) use the Powe Fatalism Inventory to compare their sample of Malian married men to Midwestern U.S. men, and find that the former had three times more prevalent fatalism beliefs than the former.
[22] A similar argument is proposed by Latham (1993) and Meyer-Weitz (2005).
[23] Bandura (1997) and Moore and Rosenthal (1991) also document similar testimony along the same lines.

Malmendier 2006), agency problems within the household (Ashraf et al. 2010), or short life expectancy (Oster 2009). Our data allow us to assess many of these hypothesis, and indicate that the very low estimated VSL in our sample is unlikely to be due to a high income elasticity of health expenditures, lower remaining life expectancy, or poor information about relevant risks.

A more promising explanation for these results lies in differences in socio-cultural attitudes between Africans and non-Africans, and especially the perceived role of fate in governing major life outcomes. Overall, our results highlight the potentially important role of particular cultural perspectives on economic (and other) behaviors in low income countries. Exploring precisely which cultural attitudes are most influential, and why, is an interesting route for future research in the field.

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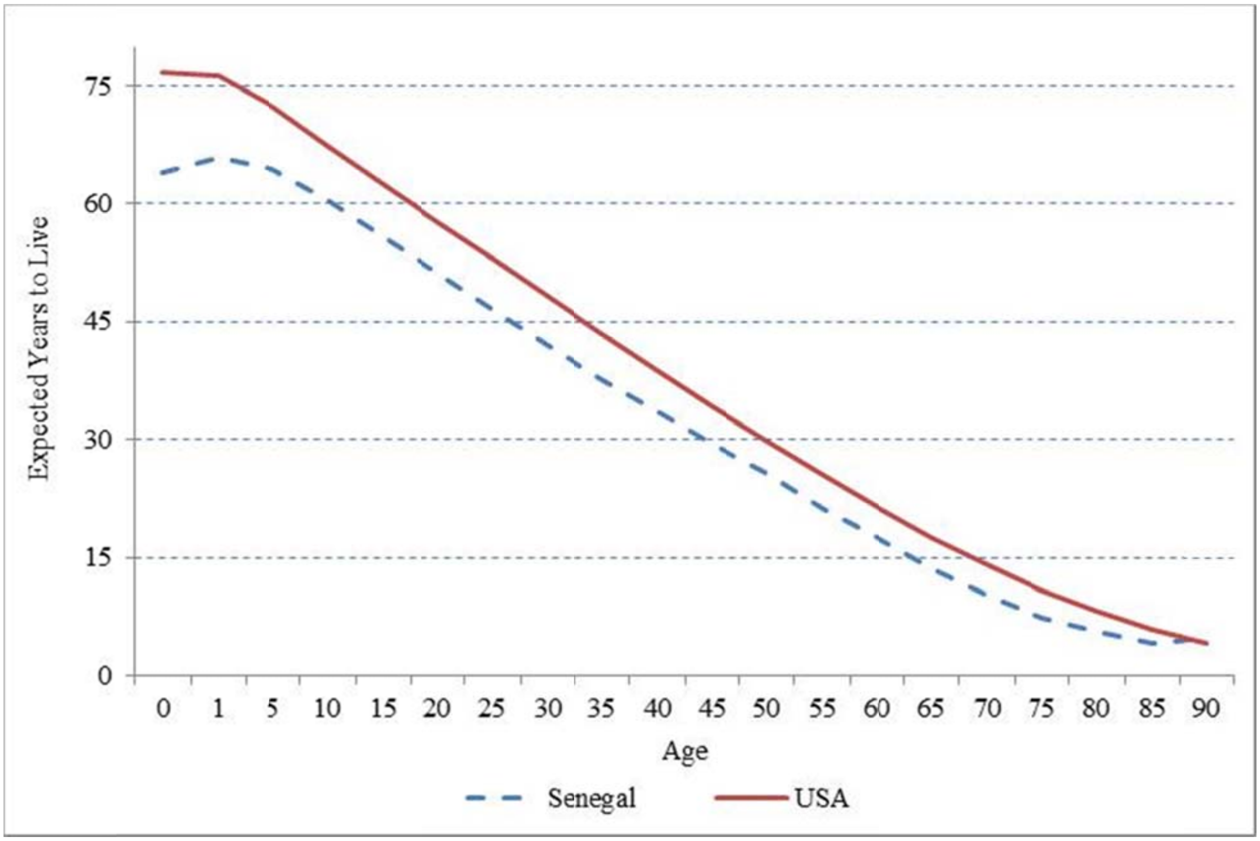
Figure 1: Remaining Life Expectancy, By Age



Source: Life Tables Dataset (http://www.lifetable.de) contained in the Human Mortality Dataset (http://www.mortality.org/). For the US, the data corresponds to the year 1999. The only point available in Africa is Senegal, and we use data from 1995-1999.

Figure 2: Map of the Study Setting, Lungi Airport and Freetown, Sierra Leone

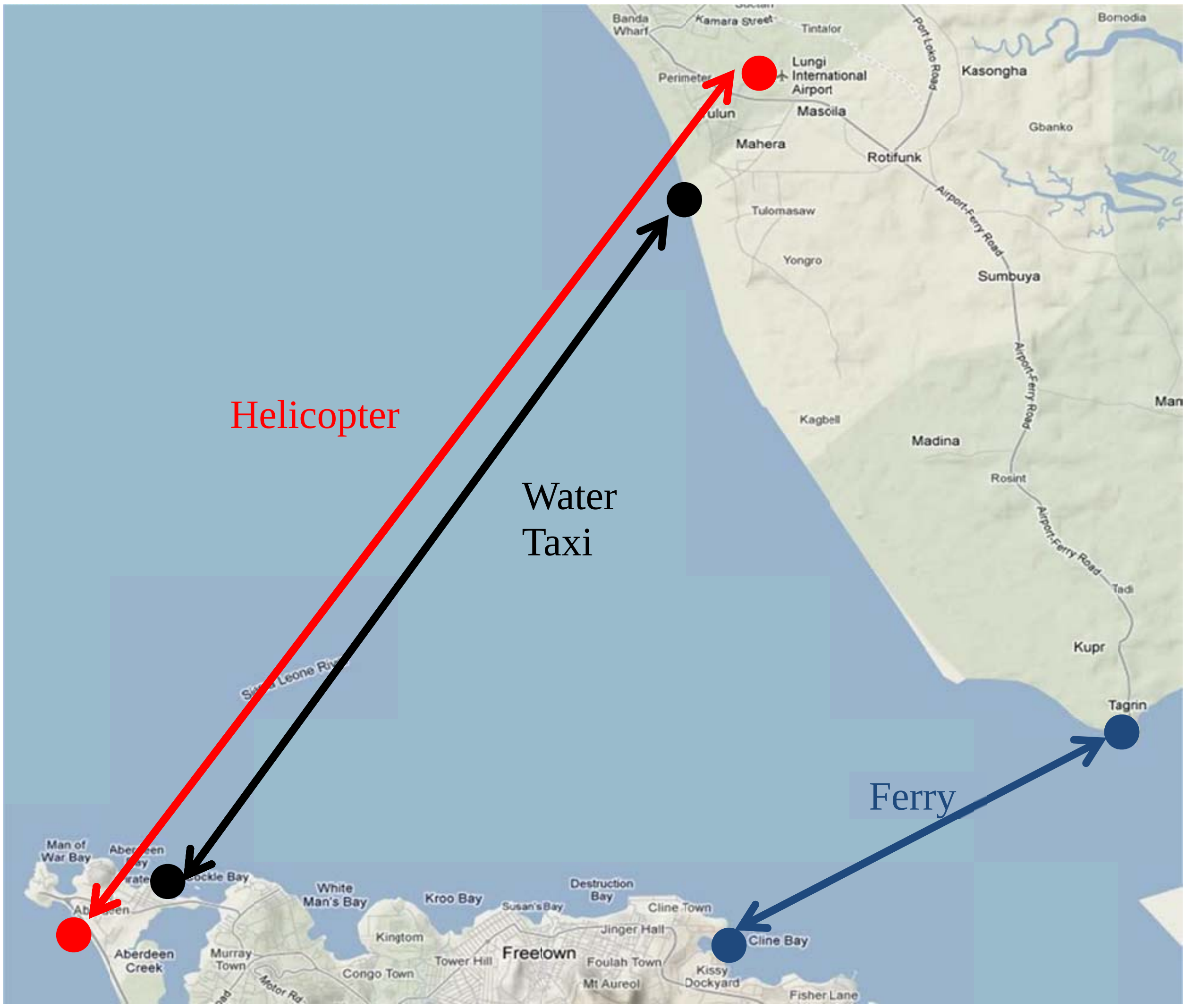
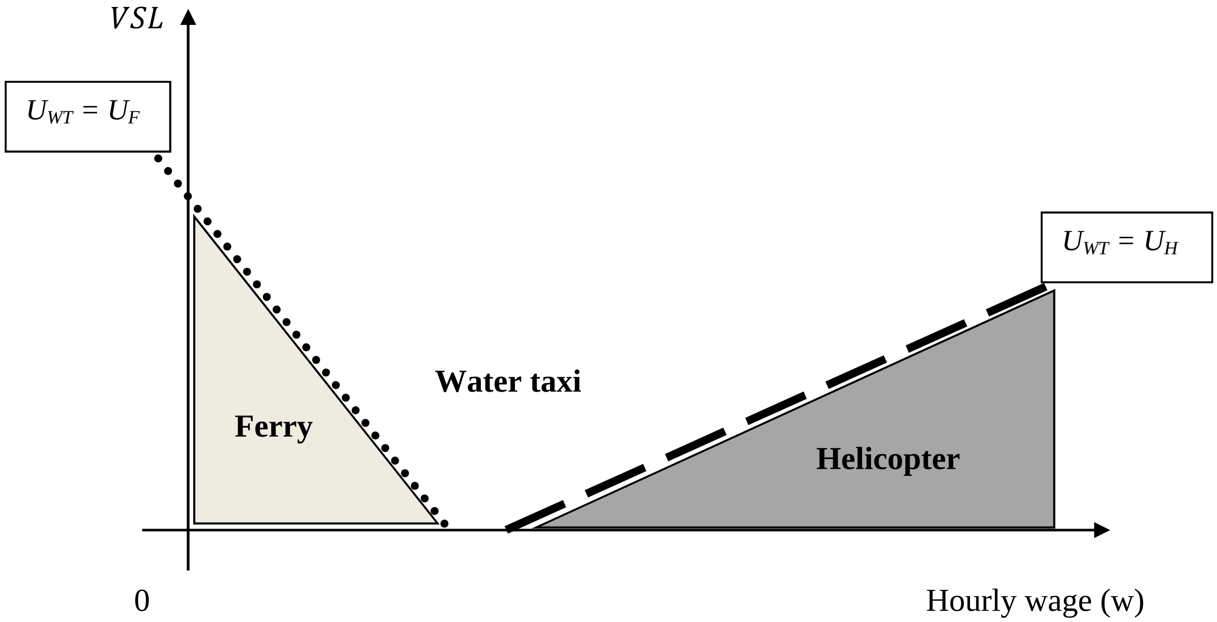
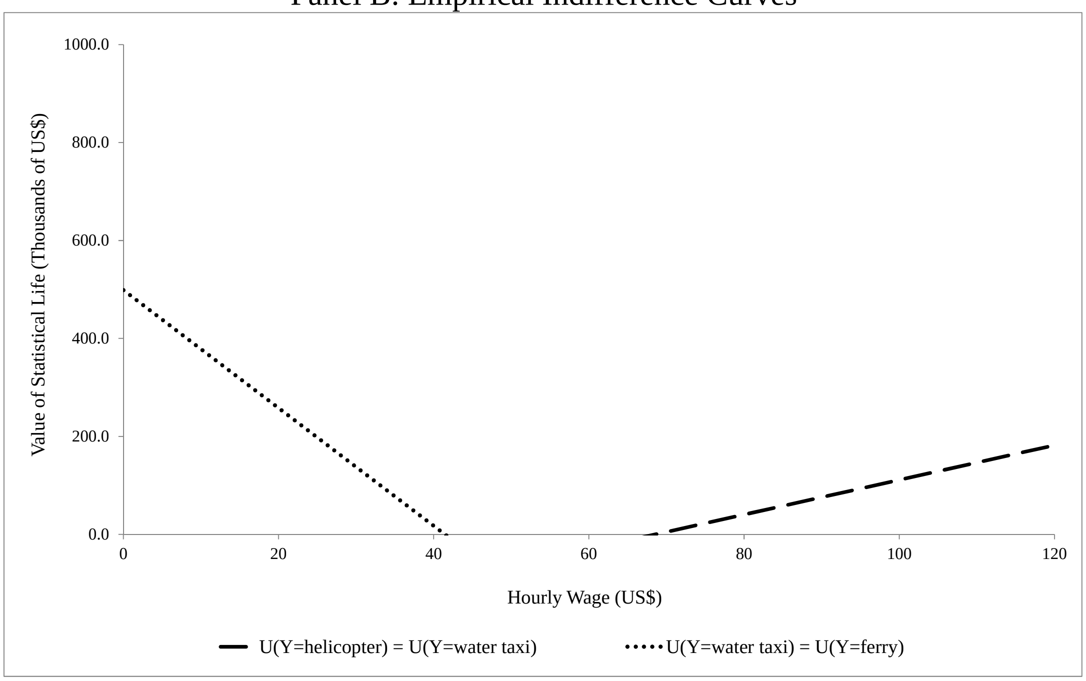


Figure 3: Transportation Choices and the Value of a Statistical Life in Sierra Leone

Panel A: Optimal transport choice as a function of wages and value of life

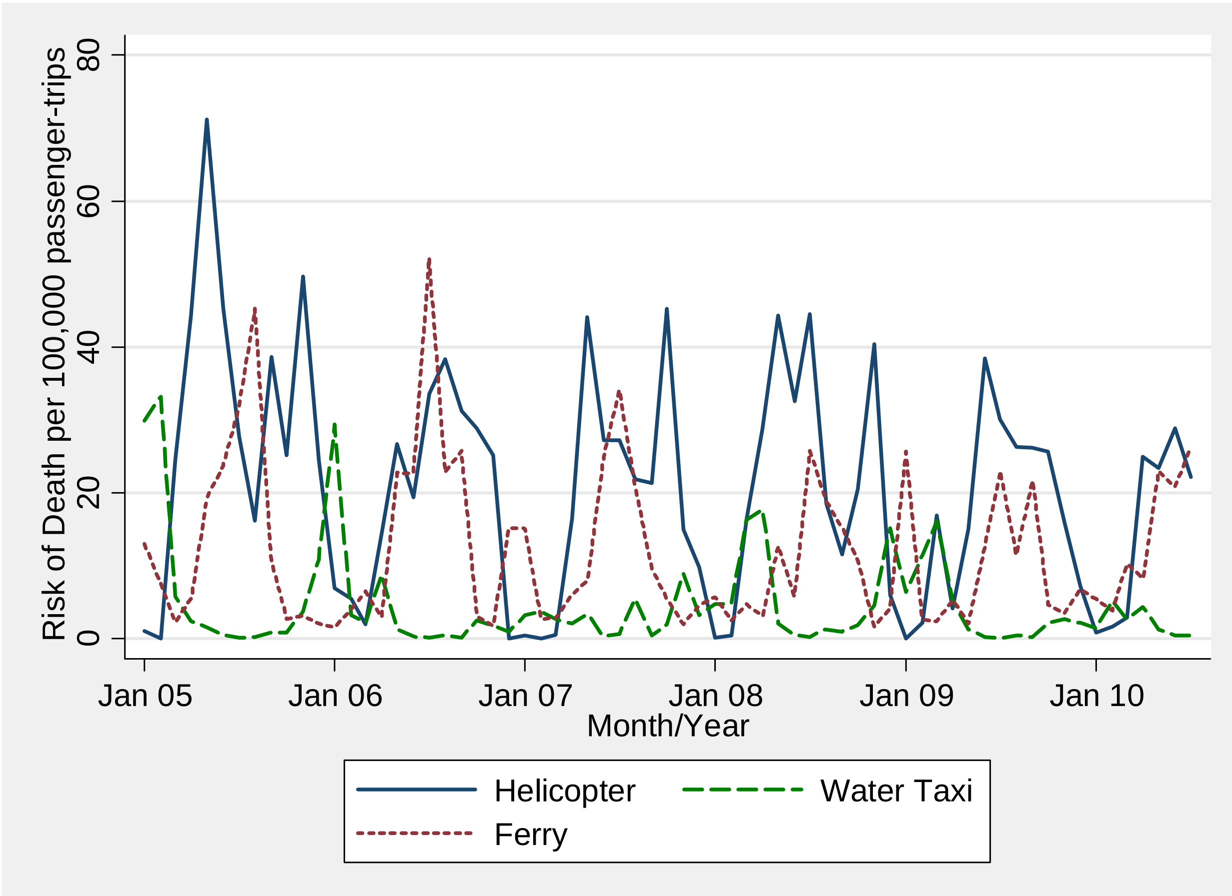


Panel B: Empirical Indifference Curves



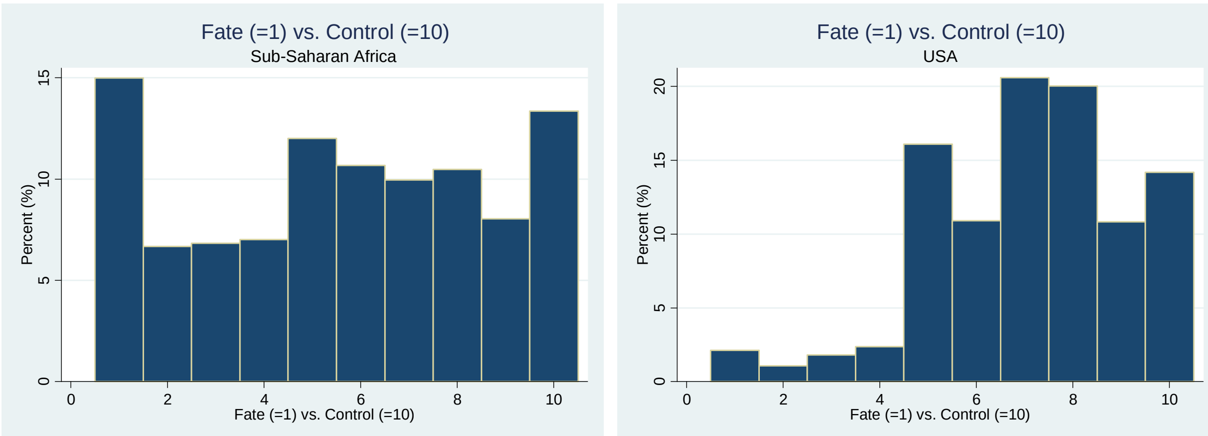
Notes: Each line represents the locus of VSL–Wage for which an individual is indifferent between two transportation options. The figure is computed using the observed mortality risk, transportation cost, and trip duration for each of the modes of transport.

Figure 4: Predicted Risk of a Fatality, by Month and Mode of Transport



Notes: The figure shows the monthly predicted risk of dying by transport mode based on the results in Table 2.

Figure 5: Self-Expressed Fatalism



Source: World Values Survey v.20090901, 2009. World Values Survey Association (www.worldvaluessurvey.org). Aggregate File Producer: ASEP/JDS, Madrid.

Notes: Fate vs. Control comes from the latest round of the World Values Survey. The question is worded as follows: "Some people believe that individuals can decide their own destiny, while others think that it is impossible to escape a predetermined fate. Please indicate which comes closest to your view on this scale on which 1 means “everything in life is determined by fate,” and 10 means that “people shape their fate themselves.” The reported average for Africa comes from surveys in Ethiopia, Ghana, Mali, Rwanda, South Africa, and Zambia. The U.S. mean value is 7.1, and the Sub-Saharan Africa sample average is 5.6.

Table 1: Transportation Options, Descriptive Statistics and Accidents

	Mode of Transportation				
	Helicopter	Water taxi	Ferry	Hovercraft	Road
Average passenger traffic					
# of trips per week	32	42	74	54	
# of passengers per week	640	924	3700	1350	
% of travelers choosing this mode	12.2%	17.6%	70.3%	-	
% of sample respondents choosing this mode	18.9%	18.8%	61.4%	0.9%	-
Costs					
Ticket cost in US$ (c_{js})	70-80	40	2	35-50	N/A
Transit time in minutes (to/from Freetown dock/helipad)	10	45	70	40	240 +
Waiting time in minutes	0	0	30	0	
Total travel time in minutes (t_j)	10	45	100	40	
Accident risk					
Probability of fatal accident per 100,000 passenger-trips (p_{js})	22.57	4.58	9.48	4.44	N/A
Probability of accident per 100,000 passenger-trips	22.02	8.39	14.28	26.10	N/A
Predicted probability of accident per 100,000 passenger-trips	21.55	8.32	18.47	55.70	N/A

Information on fatal accidents was obtained by a comprehensive search of Sierra Leone and international newspapers during the period Ja
ough June 2010, the UN engineering department in Freetown, as well as several news sources. Information on the monetary cost and trave
ained during field work in June 2010. Travel time and cost between the dock/helipad and the destination/origin in Sierra Leone is the aver
avelers who used each mode of transport. The probability of an accident is computed as the ratio of the total number of accidents observe
ence period, divided by the number of trips made by transport. Similarly, the probability of a fatal accident is computed as the ratio of the
ies observed during the reference period, divided by the estimated number of passengers that made a trip during the same period. Informat
was collected in the 2010 Sierra Leone Survey on Transportation Choices. To get information about the time of the trip, the authors we dic
ral times.

Table 2: Transportation Accidents (January 2005 – June 2010)

Transportation Mode	Type of accident	Location	Date	Weather	Deaths	Source
Helicopter	Crash	Freetown → Lungi	June 3rd, 2007	Rain	19	wikinews.org
	Crash	Lungi Airport	Oct. 18th, 2007	No Rain	22	UN
Ferry	Wreck	Ocean	Mar. 12th, 2006	No rain	120	UN
	Accident	Bailor	Aug. 2nd, 2007	Rain/Thunder	158	Yahoo news
	Wreck	Ocean	Sept. 9th, 2009	Rain	120	Bloomberg
Water Taxi / Speed boat	Accident	Freetown →Lungi	Feb. 27th, 2009	No rain	12	New citizen press
Hovercraft	Accident	Lungi	May 5th, 2006	No rain	6	UN
	Accident	Lungi	Aug., 18th, 2006	Rain	11	UN
	Fire	Lungi → Aberdeen	Nov. 13, 2007	No Rain	0	Awareness times
	Crash	Lungi	May 23rd, 2008	Thunder	0	VSL

Sources: Information on fatal accidents was obtained by a comprehensive search of Sierra Leone and international newspapers during the period January 2005 through June 2010, the UN engineering department in Freetown, as well as several news sources.

Table 3: Predicted Risk of a Fatality, probit estimates

	(1)	(2)	(3)	(4)
		Dep. Var: Fatality=1		
	Ferry	Helicopter	Hovercraft	Water Taxi
Indicator for occurrence of Rain or Drizzle	0.839	0.508	0.761	
	(0.343)**	(0.483)	(0.256)***	
Cloud Cover (%)	0.180	-1.305	-3.024	-0.016
	(0.052)***	(0.599)**	(0.588)***	(0.022)
Mean Temperature (°F)	0.069	-0.094	0.223	-0.092
	(0.017)***	(0.067)	(0.086)***	(0.022)***
Mean Dew Point (°F)	0.009	0.165	0.115	0.037
	(0.052)	(0.170)	(0.118)	(0.020)*
Mean Humidity (%)	-0.024	-0.053	0.121	-0.004
	(0.032)	(0.020)***	(0.060)**	(0.009)
Mean Sea Level Pressure (In.)	5.089	-0.914	-9.709	-10.136
	(2.024)**	(3.596)	(1.931)***	(1.097)***
Max Visibility (Miles)	-0.020	1.582	3.520	-0.109
	(0.060)	(0.408)***	(0.695)***	(0.028)***
Mean Wind Speed (MPH)	-0.025	-0.009	-0.013	-0.006
	(0.040)	(0.070)	(0.031)	(0.009)
Chi-sq test for joint significance	162.58	135.45	52.49	94.11
(p-value)	<0.01	<0.01	<0.01	<0.01
Observations	3,260,800	186,240	179,900	268,884
Log Likelihood	-3490.59	-329.16	-129.08	-111.73
Predicted risk (per 100,000 passenger-trips) - mean	12.25	21.11	11.21	4.63
Predicted risk (per 100,000 passenger-trips) – s.d.	31.90	38.73	76.00	21.94

Notes: Each observation in the regression represents a passenger-trip in each mode of transport. The period considered starts with the availability of weather data (Jan-2005), and only considers those dates in which each of the transportation modes was available. The weather data corresponds to the Lungi weather station, as recorded on http://www.wunderground.com (accessed in May 2011). Missing values were imputed using the average weather values from the exact same date for years with recorded data. Standard errors clustered at the day level are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Descriptive statistics, African respondents

Variable	Obs.	Mean	Std. Dev.
Transportation Choices			
Transport taken: Ferry	721	0.81	0.39
Transport taken: Helicopter	721	0.06	0.24
Transport taken: Water Taxi	721	0.13	0.34
Demographic Characteristics			
Gender (male=1)	720	0.67	0.47
Age	713	40.45	13.38
Educational level: less than completed university	714	0.34	0.47
Educational level: complete university	714	0.45	0.50
Educational level: post-graduate	714	0.22	0.41
Nationality: Sierra Leonean	721	0.73	0.44
Nationality: Other African	721	0.27	0.44
Additional information			
Hourly wage (US$ PPP) - measured	522	17.69	46.81
Hourly wage (US$ PPP) - imputed	721	22.26	44.19

Sources: Information on choices was collected in the 2009 and 2010 Sierra Leone Survey on Transportation Choices.

Notes: Descriptive statistics use the data from the observed trips only (one unique individual per observation), and are weighted to represent the actual proportion of travelers. The exchange rate, and the rate of conversion to PPP comes from the World Bank's World Development Indicators, and we assign these conversion rates by the country of permanent residence. We input the missing observations for wages with the average hourly wage of people in the same education category (Less than some university, Some/Completed University, Post-graduate), region of residence (African/Non-African), and job type (International organization or international private business/Local NGO or local business/Unemployed).

Table 5: Transportation Choices and the Value of a Statistical Life in Africa

	(1)	(2)	(3)
Predicted prob. of completing the trip (1-p_{js})	-0.87	0.01	0.06
	(0.26)***	(0.34)	(0.34)
Total transportation cost (*$Cost_{ijs}$*)	-0.02	-0.01	-0.01
	(0.001)***	(0.002)***	(0.002)***
(1-p_{js}) * Wage (divided by 100)			0.87
			(1.14)
$Cost_{ijs}$ * Wage (divided by 100)			0.01
			(0.002)***
(1-p_{js}) * Remaining life expectancy (divided by 10)			-0.31
			(0.29)
$Cost_{ijs}$ * Remaining life expectancy (divided by 10)			-0.003
			(0.002)*
Alternative Specific Constant (Ferry)		3.36	5.59
		(0.92)***	(1.08)***
Alternative Specific Constant (Helicopter)		2.05	3.77
		(0.92)**	(0.98)***
Alternative Specific Constant (Water taxi)		1.94	3.76
		(0.91)**	(0.91)***
Number of observations (respondent-alternative options)	3889	3889	3889
Number of trips	1237	1237	1237
Number of respondents	717	717	717
Log-Likelihood	-1081.53	-982.39	-970.25
Value of a statistical life (in '000 US$ PPP)	-48.132	1.736	7.420
[95% confidence interval]	[-73.072 , -23.191]	[-113.939 , 117.412]	[-81.961, 96.801]

Notes: The data are from a survey applied to travelers in July-August 2009 and June 2010. The probability of completing the trip is defined as the one minus the predicted probability of being in an accident (x1000). Each observation in is a unique traveler-transportation mode pair in the current choice. The dependent variable is an indicator equaling 1 if the traveler chose the transportation mode represented in the traveler-transportation mode pair. In every choice situation, we consider only the transportation modes available (i.e., the hovercraft is often unavailable), and limit the sample to trips that took place in 2005 of later. All regressions are weighed to be representative to the actual share of travelers taking each individual mode of transport. Regressions in Columns (2) and (3) include alternative specific constants, and Columns (3) also includes the corresponding interactions between the ASC's and the relevant variables (wage and remaining life expectancy). The interactions shown in Column (3) use deviations from the mean. Life expectancy at age and gender is taken from the Life Tables Dataset (http://www.lifetable.de) contained in the Human Mortality Dataset (http://www.mortality.org/), and we use the reports for the only country in West Africa available (Senegal). The reports are from 1995-1999, and detailed for gender and 5-year age groups. Standard errors below each point estimate are clustered at the level of the individual decision-maker and bootstrapped 1000 times to account for the prediction of the probability of dying, significantly different than zero at 90% (*), 95% (**), 99% (***) confidence. The VSL is the ratio of the coefficient estimates on the predicted risk term over the total cost term, and its standard error is estimated using the delta method.

Table 6: Transportation Choices and the Value of a Statistical Life in Africa

	(1) Africans	(2) Non-Africans	(3) All
Predicted prob. of completing the trip (1-p_{js})	0.01	1.60	1.55
	(0.34)	(0.366)***	(0.33)***
Total transportation cost ($Cost_{ijs}$)	-0.005	-0.003	0.003
	(0.002)***	(0.002)	(0.002)
(1-p_{js}) * African			-1.71
			(0.55)***
$Cost_{ijs}$ * African			-0.003
			(0.003)
(1-p_{js}) * Wage (divided by 100)			-0.34
			(0.77)
$Cost_{ijs}$ * Wage (divided by 100)			0.004
			(0.001)***
(1-p_{js}) * Remaining life expectancy (divided by 10)			-0.29
			(0.21)
$Cost_{ijs}$ * Remaining life expectancy (divided by 10)			-0.001
			(0.001)
Number of observations (respondent-alternative options)	3889	2051	5808
Number of trips	1237	657	1852
Number of respondents	717	364	1056
Log-Likelihood	-982.39	-544.79	-1474.78
Value of a statistical life (in '000 US$ PPP)	1.736	532.424	129.433
[95% confidence interval]	[-113.939 , 117.412]	[-143.137 , 1207.986]	[-12.227 , 271.092]

Notes: The data are from a survey applied to travelers in July-August 2009 and June 2010. The probability of completing the trip is defined as the one minus the predicted probability of being in an accident (x1000). Each observation in is a unique traveler-transportation mode pair in the current choice. The dependent variable is an indicator equaling 1 if the traveler chose the transportation mode represented in the traveler-transportation mode pair. In every choice situation, we consider only the transportation modes available (i.e., the hovercraft is often unavailable), and limit the sample to trips that took place in 2005 of later. All regressions are weighed to be representative to the actual share of travelers taking each individual mode of transport. All regressions include alternative specific constants, and Columns (3) also includes the corresponding interactions between the ASC's and the relevant variables (African, wage and remaining life expectancy). The interactions shown in Column (3) use deviations from the mean. Life expectancy at age and gender is taken from the Life Tables Dataset (http://www.lifetable.de) contained in the Human Mortality Dataset (http://www.mortality.org/), and we use the reports for the only country in West Africa available (Senegal). The reports are from 1995-1999, and detailed for gender and 5-year age groups. Standard errors below each point estimate are clustered at the level of the individual decision-maker and bootstrapped 1000 times to account for the prediction of the probability of dying, significantly different than zero at 90% (*), 95% (**), 99% (***) confidence. The VSL is the ratio of the coefficient estimates on the predicted risk term over the total cost term, and its standard error is estimated using the delta method.

Table 7: Comparing African and non-African populations

	African respondents	Non-African respondents	U.S. (Ashenfelter and Greenstone 2004a)
Value of a statistical life (US$ PPP) [a]	$1,736	$532,424	$1,030,000 to $1,540,000
Wage/hour (2009 US$ PPP) [b]	$22.26	$33.27	$16.05
Remaining life expectancy at age 40 [c]	33.55		38.74
	Africans		U.S.
Fate vs. Control (1 to 10) [d]	5.60		7.09

Notes:

[a] The reported VSL for the US is the one estimated by Ashenfelter and Greenstone (2004a). Even though they do not provide the confidence interval, the numbers reported correspond to the results from two different estimations. The VSL from Africans and Non-Africans comes from our own estimates reported in Table 6.

[b] Wage per hour reported in Ashenfelter and Greenstone (2004a). The mean hourly wage in 1986 is calculated from the 1986 Current Population Survey Outgoing Rotation Group, and it is expressed in 1997 US$ in the original paper ($12.33), to make it comparable, we express it in 2009 US$ using the GDP deflator. For Africa, we use the reported wages in our sample (expressed in US$ PPP).

[d] Fate vs. Control comes from the most recent round of the World Values Survey (2009). The question is worded as follows: "Some people believe that individuals can decide their own destiny, while others think that it is impossible to escape a predetermined fate. Please indicate which comes closest to your view on this scale on which 1 means “everything in life is determined by fate,” and 10 means that “people shape their fate themselves.” The reported average for Africa comes from all available surveys, including Ethiopia, Ghana, Mali, Rwanda, South Africa, and Zambia.

SUPPLEMENTARY APPENDIX (NOT INTENDED FOR PUBLICATION)

Table A.1: Descriptive Statistics, by mode of transportation

	Ferry			Helicopter			Water Taxi		
Variable	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Reason for choosing transport mode									
Safer	446	0.87	0.34	304	0.17	0.37	336	0.53	0.50
Faster	446	0.02	0.13	304	0.82	0.38	336	0.71	0.46
Cheaper	446	0.62	0.49	304	0.02	0.14	336	0.32	0.47
Demographic Characteristics									
Gender (male=1)	446	0.69	0.46	304	0.65	0.48	335	0.67	0.47
Age	444	40.48	13.67	302	40.37	12.98	332	39.56	12.65
Educational level: less than completed university	441	0.33	0.47	304	0.17	0.38	333	0.22	0.41
Educational level: complete university	441	0.46	0.50	304	0.33	0.47	333	0.51	0.50
Educational level: post-graduate	441	0.21	0.41	304	0.49	0.50	333	0.27	0.44
Nationality: Sierra Leonean	446	0.62	0.49	304	0.35	0.48	336	0.30	0.46
Nationality: Other African	446	0.19	0.39	304	0.24	0.43	336	0.25	0.43
Nationality: Non-African	446	0.19	0.39	304	0.41	0.49	336	0.46	0.50
Additional information									
Hourly wage (US$ PPP) - measured	346	20.49	49.45	184	29.80	51.91	225	22.11	50.41
Hourly wage (US$ PPP) - imputed	446	23.51	45.75	304	37.19	44.98	336	26.50	43.21

Sources: Information on choices was collected in the 2009 and 2010 Sierra Leone Survey on Transportation Choices.

Notes: Descriptive statistics use the data from the observed trips only (one unique individual per observation), and are weighted to represent the actual proportion of travelers. The exchange rate, and the rate of conversion to PPP comes from the World Bank's World Development Indicators, and we assign these conversion rates by the country of permanent residence. We input the missing observations for wages with the average hourly wage of people in the same education category (Less than some university, Some/Completed University, Post-graduate), region of residence (African/Non-African), and job type (International organization or international private business/Local NGO or local business/Unemployed).

Table A.2: Survey Sample Descriptive Statistics, By Nationality

Variable	African Obs.	African Mean	African Std. Dev.	Non-African Obs.	Non-African Mean	Non-African Std. Dev.	All Obs.	All Mean	All Std. Dev.
Transportation Choices									
Transport taken: Ferry	721	0.81	0.39	365	0.56	0.50	1086	0.75	0.44
Transport taken: Helicopter	721	0.06	0.24	365	0.12	0.33	1086	0.08	0.27
Transport taken: Water Taxi	721	0.13	0.34	365	0.32	0.47	1086	0.18	0.38
Demographic Characteristics									
Gender (male=1)	720	0.67	0.47	365	0.70	0.46	1085	0.68	0.47
Age	713	40.45	13.38	365	39.90	13.62	1078	40.31	13.44
Educational level: less than completed university	714	0.34	0.47	364	0.18	0.38	1078	0.30	0.46
Educational level: complete university	714	0.45	0.50	364	0.50	0.50	1078	0.46	0.50
Educational level: post-graduate	714	0.22	0.41	364	0.32	0.47	1078	0.24	0.43
Nationality: Sierra Leonean	721	0.73	0.44				1086	0.54	0.50
Nationality: Other African	721	0.27	0.44				1086	0.20	0.40
Nationality: Non-African							1086	0.26	0.44
Additional information									
Hourly wage (US$ PPP) - measured	522	17.69	46.81	233	33.77	57.14	755	21.33	49.76
Hourly wage (US$ PPP) - imputed	721	22.26	44.19	365	33.27	47.74	1086	25.08	45.36

Sources: Information on choices was collected in the 2009 and 2010 Sierra Leone Survey on Transportation Choices.

Notes: Descriptive statistics use the data from the observed trips only (one unique individual per observation), and are weighted to represent the actual proportion of travelers. The exchange rate, and the rate of conversion to PPP comes from the World Bank's World Development Indicators, and we assign these conversion rates by the country of permanent residence. We input the missing observations for wages with the average hourly wage of people in the same education category (Less than some university, Some/Completed University, Post-graduate), region of residence (African/Non-African), and job type (International organization or international private business/Local NGO or local business/Unemployed).