Travel Cost and Dropout from Secondary Schools in Nepal

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Abstract

The study relates the association between travel time to the lower secondary and secondary public schools of Nepal and the dropout grade before leaving secondary school using an ordered logit model. It is shown that as the travel time to the school increases, students are more likely to dropout from the school system in earlier grades. The results from this study will be useful to policymakers, especially from developing countries, as it places transport in the context of education.

1 Introduction

Transport is a vital issue in rural areas of Nepal where travel distances are large. Rural areas also have lack of transport facilities like trails, bridges and paved roads making accessibility more difficult. As a result, people in rural areas are more likely to have to travel long distances to get to basic services like health care and education. This can be a significant burden in terms of travel cost.

In Nepal, similar to many other developing countries, students are within walking distance of primary schools, while secondary schools are far away and require more travel time. Studies show that in developing countries although the availability of nearest primary schools ranges from 0.2 km in Bangladesh to over 7 km in Chad, the access to nearby secondary school ranges from 1.8 km in Bangladesh to over 71 km in Mali (Filmer, 2007). Mostly the distance has to be covered on foot and the cost of travel time may become a school enrollment decision. As a result of the obstacle due to lack of transport facility, there is a high dropout rate, mostly in rural areas.

The total road network in Nepal is 70,474 km and an area of 147,181 km^2. The road density is 47.88 km per 100 km^2 (Department of Local Infrastructure Development, 2016). Although the road network had grown from 256 km in 1956, Nepal still has one of the lowest road densities in the world. According to the New Rural Access Index published by the World Bank only around half of the rural population of Nepal lives within 2 km of a road. It implies that the other half of the population is deprived of easy road access (Iimi et al., 2016).

The formal education structure of Nepal is organized into levels (grades) as follows: Primary education from level 1 to 5, lower secondary from level 6 to 8, and secondary level from 9 to 10. A national level examination known as Secondary Education Examination is conducted at the end of level 10. Level 11 and 12 are considered as the higher secondary level which is supervised by a separate board.

Statistics show dropout of children from public schools in Nepal is very high. Two-thirds of all children in Nepal attend public schools and 70 percent of children dropout of the school system before taking the Secondary Education Examination (Teach for Nepal, 2017). Not being able to complete secondary school means the students will not have the same freedom to make choices about their future which they might have had.

Thus, the research questions that the study poses are:

1. Does travel time impact the likelihood of dropping out of secondary public schools?
2. What are the household characteristics of those children who dropout of school?
3. Is this dropout higher at low access locations?

The research aims to fulfill the gap in the literature on education and travel cost in Nepal. In turn this research address previous literature on educational participation and travel in developing countries, a description of the data and methods, and results from analysis of the three survey rounds from the Nepal Living Standards Survey. The research concludes with recommendations to improve educational outcomes.

2 Literature Review

Vasconcellos (1997) found that children, especially in developing countries, face many problems in getting to and staying in school due to distance and time-related hindrances, but these issues are mostly neglected in the literature.

Muralidharan and Prakash (2013) attempts to study access to transport and education. The authors studied the impact of a program in Bihar, India which aimed to reduce the gender gap in secondary school by providing girls who continued to study in secondary school with a bicycle to improve access to school. The study revealed that the cohort that was exposed to the cycle program increased girl's enrollment in secondary school by 32 percent and reduced the gender gap by 40 percent. There was also an increase of 18 percent in the number of girls who appear for secondary school certificate examination, and around 12 percent increase in the number of girls who passed. The authors conclude that there is strong evidence to suggest that the mechanism of impact was the reduction in travel cost of attending school enabled by the availability of a bicycle.

Aggarwal (2015) investigated the impact of road construction on school enrollment of 5-14 year old children in India and found that there is a 5 percentage point increase in enrollment due to rural road construction.

Salon and Gulyani (2010) surveyed 4375 slum residents in Nairobi, Kenya and found that poverty is one of the major factors that determined whether a child attends a school outside his or her settlement, and at the same time poverty determines whether a child has access to motorized transport options to attend school outside the settlement. The burden of reduced mobility is borne disproportionately by women and children. The authors conclude that it is important to either have schools in the neighborhood or to provide transport to children who do not have schools in their neighborhood.

Cervero (2013) argues that in poor cities placing basic service such as schools nearer students reduces the amount of time and energy devoted to transport, and thus allows children to attend school.

Using data 2000/2001 data from Tanzania, Kondylis and Manacorda (2012) showed that around one km increase in the distance to school was associated with a 0.4 percentage points decrease in the probability of school attendance. Hungi (2008) found grade 5 students in Vietnam who took a shorter time to travel to school or who lived near the school were more likely to attain better marks in mathematics and reading than students who took a long time to travel to school.

Pangeni (2014) conducted a study of 762 grade 8 students in 21 secondary schools in three geographic strata (mountain, hills, and plains) of Nepal. The author found a negative relationship between travel time to school and the learning achievement of children in mathematics, and the result was statistically significant when family characteristics were controlled in the model.

Another study by Hazarika and Bedi (2006) in rural Uttar Pradesh and Bihar of Northern India found that a decrease in one kilometer to the nearest middle and secondary school increases the probability of average girl's school enrollment by 2.5 to 2.7 percentage points and one standard deviation decrease in travel time to the nearest primary school increased the probability of boy's school enrollment by 3.3 percentage points.

Starkey, Tumbahangfe, and Sharma (2013) found that construction of a road led to the establishment of a secondary school in Nepal. The main requirement for funding of school was a presence of a road. Furthermore, schools also reported that absenteeism was reduced due to the availability of transport facility.

A World Bank study in Ghana found that travel time to the nearest school decreased from 1988 to 2003, and this led to higher education attainment in those areas (White & Masset, 2004). Another World Bank Study of Sub-Saharan Africa, including some of the poorest countries, revealed that the relationship between the school enrolment of 6-14 year olds and the distance to primary and secondary schools are related (Filmer, 2007).

Mingat (2007) showed that distance to school plays a major role in educational participation. The analysis found that, in all countries of Sub-Saharan Africa, chances of access to a school shrink after 2.5 km and becomes very small after 5 km. The analysis also found that a high proportion of people for whom schools are distant are living in poverty. Siddhu (2011) found that the most significant factor in transitioning to secondary schools in rural India is the additional distance required to access the nearest secondary school. Similarly, the study also found that the cost is most detrimental for girls. Handa (2002) showed that reducing the travel time to the nearest school in Mozambique will increase enrollment rates for both Male and Females by 17–20 percentage points.

Huisman and Smits (2015) have shown bad school quality has a negative effect on the decision to stay in school. Hanushek, Lavy, and Hitomi (2007) shows that quality of school and grade completion of the student is directly linked and a student attending a high-quality school will more likely tend to stay in school and a student attending low-quality school is more likely to dropout

and only complete fewer grades.

3 Data and Methodology

3.1 Data

The data of this study is taken from three rounds of the cross-sectional survey of Nepal Living Standard Survey (NLSS) conducted by the Central Bureau of Statistics (CBS). The survey follows the World Bank's Living Standards Measurement Survey (LSMS) methodology and used a two-stage stratified sampling method. The method for a household level survey generates high-quality data on many dimensions of the well-being of household which is used to understand household behavior, household welfare and evaluate policies of government on the living condition of the population for evidence-based policy making (Grosh & Glewwe, 1998).

- NLSS I data was collected from June 1995 to June 1996 from 3373 households throughout the country.
- NLSS II data was collected from April 2003 to April 2004 from 3912 households of 326 Primary Sampling Units (PSU) throughout the country.
- NLSS III data was collected over a time period of twelve months from Feb. 2010 to Feb. 2011 from a stratified random sample of 5988 households.

The surveys collected information about individual household access to various facilities, though access to the nearest secondary school in terms of travel time was only collected for NLSS III. As Nepal consists of mostly hilly and mountainous terrain, the travel time measures are more meaningful than the actual distance measured from satellite measurements from a transport perspective (Shrestha, 2012).

3.2 Methods

3.2.1 Ordered Logit

In this study Ordered Logit Model is used as the econometric model as the dependent variable (dropout grade) has more than two categories and each category has a sequential order where the value is higher than the previous value. The model is used to estimate the effect of the independent variable (travel time) on the log odds that a child will dropout of school.

The equation used to estimate regression coefficients for dropping out of the school is:

$$\ln(\frac{p}{1-p}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n \tag{1}$$

where p denotes the probability of dropping out of school and the left-hand side of the equation refers to the natural logarithm of the odds (the log odds) of children dropping out of the school, and where the β's are parameter estimates corresponding to the effects of the independent variables i.e the X's (Kazeem, Jensen, & Stokes, 2010).

According to Baetschmann, Staub, and Winkelmann (2015), the ordered logit has distinct features that makes it the first choice for regression analysis of discrete and originally measured variables. It features flexible parametrization that uses the ordering information while it also allows drawing inferences on the entire distribution of outcomes.

We assess the dropout grade through a series of logistic regressions modeling the effect of travel time on dropout grade.

3.2.2 Step-wise regression

A step-wise regression method is used to find a model to predict the travel time to the nearest secondary school based on the travel time to the various public services recorded in the survey, as rounds I and II did not record travel time to the nearest secondary school but had travel times to other facilities.

Step-wise regression is a variable selection procedure for independent variables based on a series of steps designed to find the most useful independent variables to include in the regression model. At each step the independent variable is evaluated to see if it should remain in the model. The least statistically significant variable was removed each round and the regression repeated until only significant variables (at the 90% confidence interval) remained.

4 Results

4.1 Explaining travel time

Only Round III of the NLSS included travel time to secondary school, so a model to predict that from variables that are available in Rounds I and II is estimated for application to the earlier years.

4.1.1 Correlation Among access to facilities

In NLSS 2010/11 survey the travel time to various public services and the the mode of transport used to reach the facility is recorded. A correlation matrix is developed to quantify the strength of linear relationship among the various variables of access. The variable travel time to secondary school and travel time to health post correlate with each other where the Pearson product-moment correlation is +0.65.

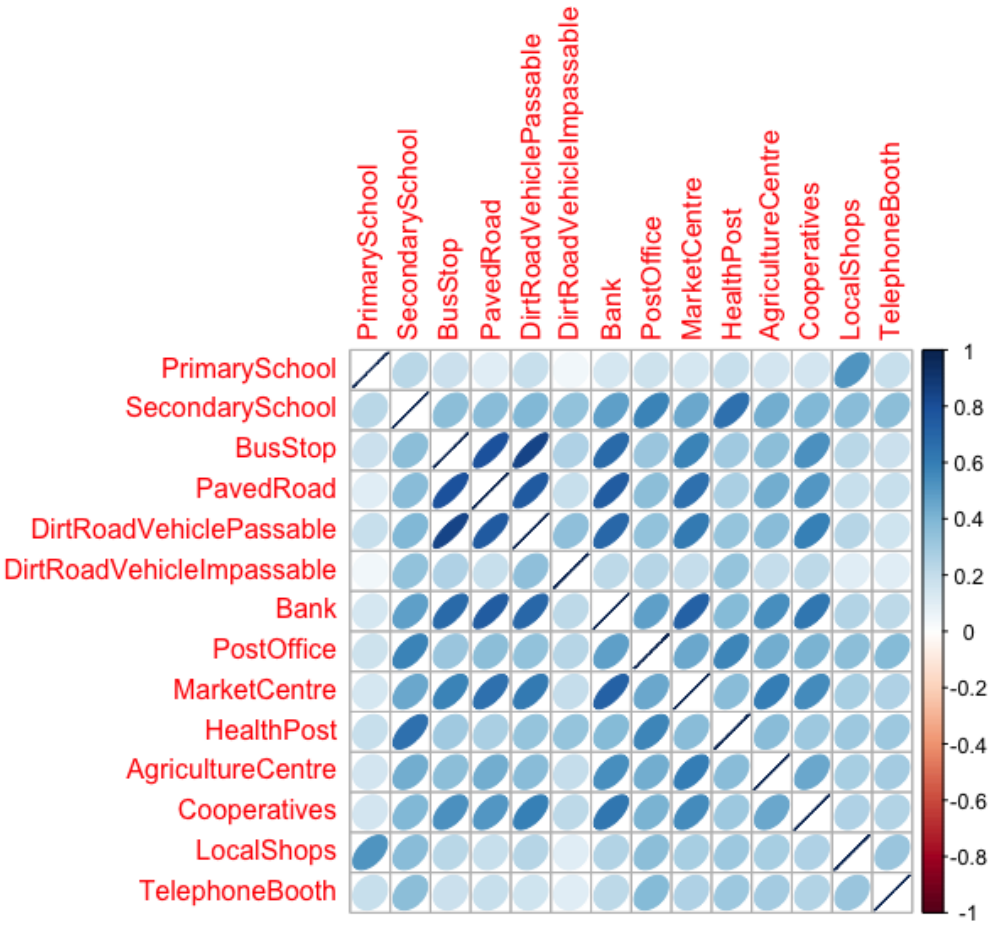

Figure 1: Correlation Plot

	Primary School	Secondary School	Bus Stop	Paved Road	Dirt Road Vehicle Passable	Dirt Road Vehicle Impassable	Bank	Post Office	Market Centre	Health Post	Agriculture Centre	Cooperatives	Local Shops	Telephone Booth
Primary School	1.00	0.24	0.18	0.11	0.20	0.04	0.15	0.18	0.15	0.20	0.15	0.15	0.53	0.20
Secondary School	0.24	1.00	0.37	0.37	0.39	0.34	0.48	0.58	0.45	0.65	0.43	0.40	0.38	0.36
Bus Stop	0.18	0.37	1.00	0.79	0.84	0.27	0.68	0.33	0.59	0.30	0.37	0.53	0.24	0.18
Paved Road	0.11	0.37	0.79	1.00	0.75	0.20	0.75	0.36	0.65	0.27	0.43	0.52	0.20	0.20
Dirt Road Vehicle Passable	0.20	0.39	0.84	0.75	1.00	0.35	0.69	0.35	0.61	0.33	0.37	0.60	0.24	0.17
Dirt Road Vehicle Impassable	0.04	0.34	0.27	0.20	0.35	1.00	0.23	0.25	0.20	0.33	0.20	0.23	0.10	0.11
Bank	0.15	0.48	0.68	0.75	0.69	0.23	1.00	0.49	0.72	0.39	0.55	0.64	0.25	0.22
Post Office	0.18	0.58	0.33	0.36	0.35	0.25	0.49	1.00	0.45	0.58	0.44	0.41	0.37	0.39
Market Centre	0.15	0.45	0.59	0.65	0.61	0.20	0.72	0.45	1.00	0.38	0.61	0.56	0.28	0.26
Health Post	0.20	0.65	0.30	0.27	0.33	0.33	0.39	0.58	0.38	1.00	0.38	0.32	0.32	0.32
Agriculture Centre	0.15	0.43	0.37	0.43	0.37	0.20	0.55	0.44	0.61	0.38	1.00	0.46	0.28	0.29
Cooperatives	0.15	0.40	0.53	0.52	0.60	0.23	0.64	0.41	0.56	0.32	0.46	1.00	0.26	0.25
Local Shops	0.53	0.38	0.24	0.20	0.24	0.10	0.25	0.37	0.28	0.32	0.28	0.26	1.00	0.33
Telephone Booth	0.20	0.36	0.18	0.20	0.17	0.11	0.22	0.39	0.26	0.32	0.29	0.25	0.33	1.00

Table 1: Correlation Matrix

4.1.2 Step-wise Regression

The final model obtained from step-wise regression is shown in Table 2.

Table 2: Stepwise Regression Predictive Model Results

	Dependent variable:TravelTime (Secondary School)
	Overall Rating
Travel Time Health Post	0.403^{***}
	(0.012)
Travel Time Bank	0.035^{***}
	(0.005)
Travel Time Local Shops	0.168^{***}
	(0.016)
Travel Time Nearest Road	0.433^{***}
	(0.040)
factor(Type Nearest Road) Vehicle Passable	-0.143^{***}
	(0.026)
factor(Type Nearest Road) Paved Road	-0.229^{***}
	(0.035)
Travel Time Agriculture Centre	0.038^{***}
	(0.008)
Travel Time Market Centre	0.015^{**}
	(0.007)
Travel Time Bus Stop	-0.010^{**}
	(0.005)
Travel Time Cooperatives	0.011^{*}
	(0.006)
Constant	0.243^{***}
	(0.029)
Observations	4,032
R^2	0.537
Adjusted R^2	0.535
Note:	Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01

4.2 Travel time and dropout grade

4.2.1 NLSS Round I

A regression equation is used to estimate regression coefficients for dropping out of the school Round I data. An ordered logit model is used, with the dependent variable dropout grade. The model is used to estimate the effect of independent variable (estimated travel time), derived by applying the stepwise regression model on Round I data on the log odds that a child will drop out of school. The model considers the strength of relationship of travel time to the school and transport mode and considers whether it is modified by geographical stratum and socio-demographics such as gender, age, father education, mother education. The poverty is controlled using annual per-capita household consumption data.The description of the variables are shown in Table 3. The log odds and odds ratio results are shown in the first two columns of Table 4 and Table 5 respectively.

Table 3: Description of variables used in the Round I model

Variable	Description	Min.	1st Q	Median	Mean	3rd Q	Max.
Travel Time (Health Post)	Time taken (in hours) for one-way travel to the Health Post.	0.0000	0.1667	0.5000	0.7430	1.0000	10.0000
Travel Time (Secondary School)	Predictive Time taken (in hours) for one-way travel to the Secondary School.	0.01435	0.21860	0.45253	0.71095	0.81496	9.09356
LastGrade	Highest Class completed before leaving school	6.000	7.000	9.000	8.389	10.000	10.000
ModeTransport	0:Foot	0	1	1	0.868	1	1
	1:Bicycle	0	0	0	0.0202	0	1
	2:Mixed(foot+vehicle)	0	0	0	0.0849	0	1
	3:Motorised	0	0	0	0.0273	0	1
Strata	0:Mountains	0	0	0	0.0545	0	1
	1:Urban Hills	0	0	0	0.328	1	1
	2:Rural Hills	0	0	0	0.256	1	1
	3:Plains	0	0	0	0.361	1	1
Gender	0:Female/1:Male	0.0000	0.0000	1.0000	0.6854	1.0000	1.0000
Father Education	0:Illiterate/ 1:Literate	0.0000	0.0000	1.0000	0.6145	1.0000	1.0000
Mother Education	0:Illiterate/1:Literate	.0000	0.0000	0.0000	0.1212	0.0000	1.0000
Age	Present Age	10.00	21.00	27.00	29.83	36.00	80.00
HH Size	Size of Household	1.000	4.000	6.000	6.741	8.000	29.000
Poor	0:Non Poor/1:Poor	0.0000	0.0000	0.0000	0.1854	0.0000	1.0000

4.2.2 NLSS Round II

As with Round I, for Round II a regression equation is used to estimate regression coefficients using the same specification and methodology. The description of the variables are shown in Table 6. The log odds and odds ratio results are shown in the middle columns of Table 4 and Table 5.

Table 4: Summary of Log Odds Logistic Regression Results All Rounds

	Dependent variable:Last Grade Attended				
	Last Grade				
	(Round I)	(Round I Predictive)	(Round II)	(Round II Predictive)	(Round III)
Travel Time (Secondary School)		-0.166^{*}		-0.136	-0.255^{**}
		(0.094)		(0.108)	(0.108)
Travel Time (Health Post)	-0.214^{**}		-0.158^{**}		
	(0.086)		(0.076)		
Gender	0.609^{***}	0.615^{***}	0.365^{***}	0.346^{***}	-0.052
	(0.170)	(0.170)	(0.133)	(0.132)	(0.106)
Poor	-0.446^{*}	-0.486^{**}	-0.836^{***}	-0.828^{***}	-0.669^{***}
	(0.230)	(0.228)	(0.212)	(0.214)	(0.143)
Years					-0.007^{*}
					(0.004)
factor(Strata)1	0.304	0.399	0.395	0.279	0.506^{**}
	(0.404)	(0.407)	(0.284)	(0.296)	(0.256)
factor(Strata)2	-0.212	-0.154	0.335	0.281	0.268
	(0.388)	(0.385)	(0.282)	(0.291)	(0.262)
factor(Strata)3	-0.289	-0.175	-0.075	-0.103	-0.233
	(0.391)	(0.392)	(0.259)	(0.260)	(0.236)
factor(Strata)4			0.413	0.290	0.558^{**}
			(0.281)	(0.289)	(0.257)
factor(Strata)5			-0.276	-0.383	0.156
			(0.262)	(0.271)	(0.242)
factor(ModeTransport)1	0.748		-0.217		-0.256
	(0.490)		(0.216)		(0.161)
factor(ModeTransport)2	0.189		-0.262		-0.135
	(0.252)		(0.200)		(0.565)
factor(ModeTransport)3	0.315		0.215		-0.302
	(0.399)		(0.258)		(0.431)
Age	-0.007	-0.007	-0.007	-0.007	0.524^{***}
	(0.007)	(0.007)	(0.005)	(0.005)	(0.023)
FatherEducation	0.495^{***}	0.499^{***}			
	(0.151)	(0.151)			
MotherEducation	0.763^{***}	0.738^{***}			
	(0.231)	(0.230)			
factor(FatherEducation)1			0.184	0.171	0.246^{**}
			(0.126)	(0.126)	(0.100)
factor(FatherEducation)2			0.340	0.291	0.340^{**}
			(0.209)	(0.208)	(0.172)
factor(FatherEducation)3			0.692^{**}	0.693^{**}	0.712^{***}
			(0.272)	(0.271)	(0.228)
factor(MotherEducation)1			0.375^{**}	0.350^{**}	0.299^{**}
			(0.175)	(0.173)	(0.133)
factor(MotherEducation)2			0.552	0.566	0.251
			(0.418)	(0.417)	(0.342)
factor(MotherEducation)3			-0.008	0.093	0.673
			(0.988)	(0.987)	(1.175)
HH Size	0.011	0.013	-0.0003	0.005	0.032^{*}
	(0.026)	(0.026)	(0.021)	(0.021)	(0.020)
Observations	696	696	1,045	1,045	1,789
McFadden Pseudo-R^2:	0.490	0.488	0.414	0.413	0.416

Note: [10]Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01

Table 5: Summary of Odds Ratio Logistic Regression Results All Rounds

	Dependent variable:Last Grade Attended				
	Last Grade				
	(Round I)	(Round I Predictive)	(Round II)	(Round II Predictive)	(Round III)
Travel Time (Secondary School)		0.847*		0.872	0.775**
		(0.094)		(0.108)	(0.108)
Travel Time (Health Post)	0.807**		0.854**		
	(0.086)		(0.076)		
Gender	1.838***	1.850***	1.440***	1.414***	0.949
	(0.170)	(0.170)	(0.133)	(0.132)	(0.106)
Poor	0.640*	0.615**	0.433***	0.437***	0.512***
	(0.230)	(0.228)	(0.212)	(0.214)	(0.143)
Years					0.993*
					(0.004)
factor(Strata)1	1.355	1.491	1.485	1.321	1.659**
	(0.404)	(0.407)	(0.284)	(0.296)	(0.256)
factor(Strata)2	0.809	0.858	1.398	1.325	1.307
	(0.388)	(0.385)	(0.282)	(0.291)	(0.262)
factor(Strata)3	0.749	0.840	0.928	0.902	0.792
	(0.391)	(0.392)	(0.259)	(0.260)	(0.236)
factor(Strata)4			1.511	1.337	1.747**
			(0.281)	(0.289)	(0.257)
factor(Strata)5			0.759	0.682	1.168
			(0.262)	(0.271)	(0.242)
factor(ModeTransport)1	2.113		0.805		0.774
	(0.490)		(0.216)		(0.161)
factor(ModeTransport)2	1.208		0.769		0.874
	(0.252)		(0.200)		(0.565)
factor(ModeTransport)3	1.370		1.239		0.739
	(0.399)		(0.258)		(0.431)
Age	0.993	0.993	0.993	0.993	1.689***
	(0.007)	(0.007)	(0.005)	(0.005)	(0.023)
FatherEducation	1.641***	1.648***			
	(0.151)	(0.151)			
MotherEducation	2.144***	2.093***			
	(0.231)	(0.230)			
factor(FatherEducation)1			1.202	1.187	1.279**
			(0.126)	(0.126)	(0.100)
factor(FatherEducation)2			1.406	1.337	1.405**
			(0.209)	(0.208)	(0.172)
factor(FatherEducation)3			1.998**	2.000**	2.038***
			(0.272)	(0.271)	(0.228)
factor(MotherEducation)1			1.455**	1.420**	1.348**
			(0.175)	(0.173)	(0.133)
factor(MotherEducation)2			1.737	1.761	1.285
			(0.418)	(0.417)	(0.342)
factor(MotherEducation)3			0.992	1.098	1.960
			(0.988)	(0.987)	(1.175)
HH Size	1.011	1.013	1.000	1.005	1.033*
	(0.026)	(0.026)	(0.021)	(0.021)	(0.020)
Observations	696	696	1,045	1,045	1,789

Note: Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01

Table 6: Description of variables used in the Round II model

Variable	Description	Min.	1st Q	Median	Mean	3rd Q	Max.
Travel Time (Health Post)	Time taken (in hours) for one-way travel to the Health Post.	0.0000	0.1667	0.3333	0.5935	0.7292	14.0000
Travel Time (Secondary School)	Predicted Time taken (in hours) for one-way travel to the Secondary School.	0.02135	0.19260	0.35776	0.60074	0.72473	9.86551
Last Grade	Highest Class Completed before leaving school	6.000	7.000	8.000	8.217	10.000	10.000
Mode Transport	0:Foot	0	1	1	0.788	1	1
	1:Bicycle	0	0	0	0.088	0	1
	2:Mixed(foot+vehicle)	0	0	0	0.0754	0	1
	3:Motorised	0	0	0	0.0489	0	1
Strata	0:Mountains	0	0	0	0.0696	0	1
	1:Urban Capital	0	0	0	0.136	0	1
	2:Urban Hills	0	0	0	0.119	0	1
	3:Rural Hills	0	0	0	0.231	0	1
	4:Urban Plains	0	0	0	0.157	0	1
	5:Rural Plains	0	0	0	0.288	1	1
Gender	0:Female/1:Male	0.0000	0.0000	1.0000	0.5852	1.0000	1.0000
Father Education	0:Illiterate	0	0	0	0.41	1	1
	1:Primary	0	0	0	0.431	1	1
	2:Secondary	0	0	0	0.0998	0	1
	3:Beyond	0	0	0	0.0591	0	1
Mother Education	0:Illiterate	0	1	1	0.827	1	1
	1:Primary	0	0	0	0.146	0	1
	2:Secondary	0	0	0	0.0217	0	1
	3:Beyond	0	0	0	0.00452	0	1
Age	Present Age	13.00	21.00	27.00	30.21	36.00	88.00
HH Size	Size of household	1.000	4.000	6.000	6.104	7.000	28.000
Poor	0:Non Poor/1:Poor	0.0000	0.0000	0.0000	0.1157	0.0000	1.0000

4.2.3 NLSS Round III

The comparison of travel times of the children enrolled in the lower secondary and secondary school versus the children who are not enrolled in the school system is given in Figure 3. The mode of transport used to access the school by the students who dropped out is given in Table 7. Around 26.6% of the children who dropped out had access to secondary school within walking distance of their home and most students who dropped out were male. The figures reflect that while expanding the number of schools, and thereby reducing the average distance and time to the nearest school might be necessary for enrollment once a child enrolls, other policy interventions is also often required to reduce inequalities by gender or economic status in enrollment and those that raise the quality of school system (Filmer, 2007).
We assess the dropout grade through a series of logistic regression models. The description of the variables for Round III is shown in Table 8.

Model I is a simple model where only travel time to the school and mode of transport is considered as the independent variable. The log odds and odds ratio result are shown in the first column of Table 9 and 10

Model II considers the strength of relationship of travel time to the school and transport mode and considers whether it is modified by socio-demographics such as gender, age, father education, mother education. Poverty is controlled using annual per-capita household consumption data, which was previously used to construct a poverty profile for Nepal. According to the Central Bureau of Statistics, an individual was considered poor if per-capita total annual consumption was below Rs. 19,261 (in local currency). The log odds and odds ratio result are shown in the second column of Table 9 and 10

Model III controls locational features such as geographic stratum. The log odds and odds ratio results are shown in the third column of Table 9 and 10

Model IV includes years since dropout to estimate the coefficient and its effect on the dropout grade. The log odds and odds ratio result are shown in the fourth column of Table 9 and 10

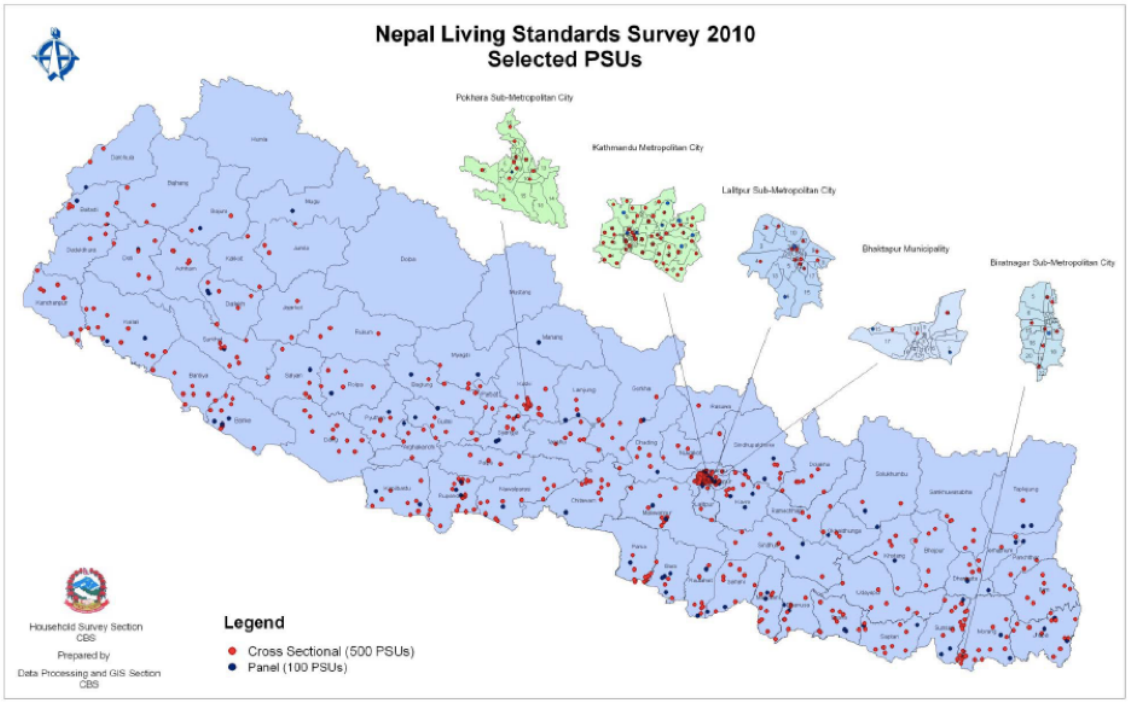

Figure 2: Location of Selected Primary Sampling Units of the Survey. Source: (Central Bureau of Statistics, 2011)

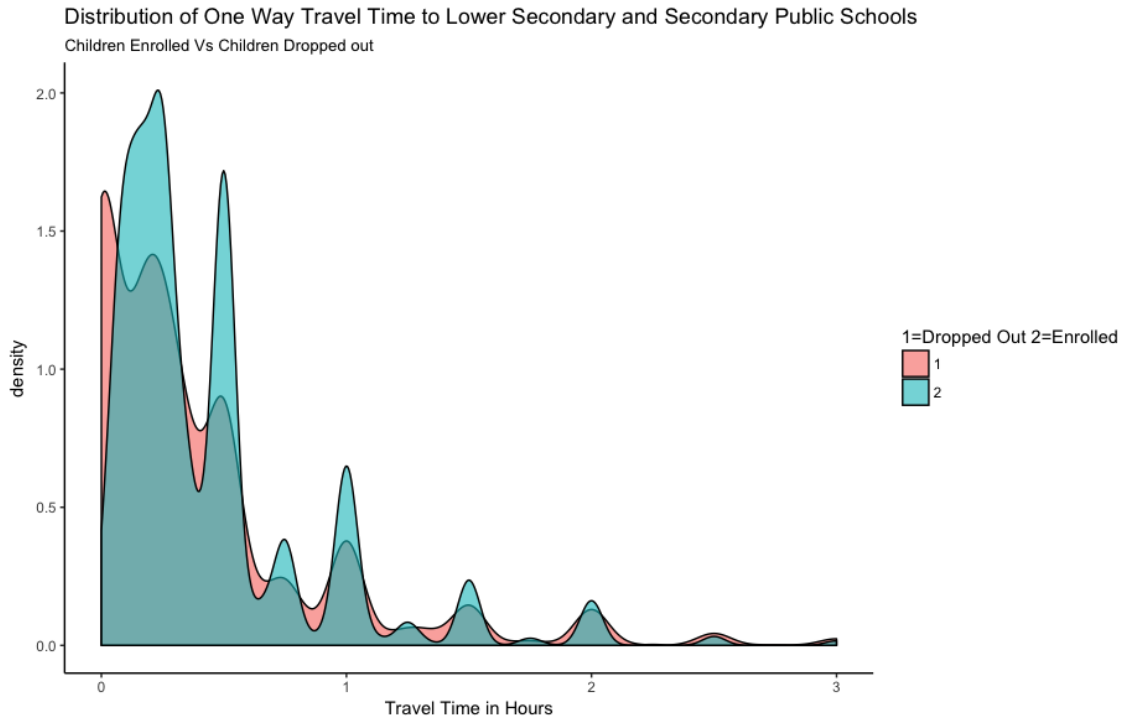

Figure 3: Distribution of Travel Time of Children Enrolled Versus Dropped out.

Table 7: Percentage of each transport mode of children who dropped out

	Dropped Out		Continuing	
	Female	Male	Female	Male
Foot (Without Load)	26.014	36.67	41.40	39.11
Bicycle/Rickshaw	4.162	5.992	4.01	4.47
Motorcycle/Tampoo*	0.108	0.502	0.00	0.00
Car/Bus	0.108	0.179	0.21	0.21
Mixed (Foot+Vehicle)	0.287	0.323	0.13	0.13
Present next to household	11.984	13.671	5.59	4.76

* A *tampoo* is a three-wheeled, motorized, roofed vehicle with the driver up front and passengers in the rear, common in Nepal.

Table 8: Description of variables used in the Description of variables used in the Round III model

Variable	Description	Min.	1st Q.	Median	Mean	3rd Q.	Max.
TravelTime (Secondary School)	Time taken to walk (in hours) for one-way travel to the Secondary school.	0	0	0.25	0.41	0.5	3
LastGrade	Last Grade attending before leaving school	6	7	8	8.063	9	10
ModeTransport	0:Foot	0	1	1	0.884	1	1
	1:Bicycle	0	0	0	0.101	0	1
	2:Mixed(foot+vehicle)	0	0	0	0.00641	0	1
	3:Motorised	0	0	0	0.00904	0	1
Strata	0:Mountains	0	0	0	0.0448	0	1
	1:Urban Capital	0	0	0	0.141	0	1
	2:Urban Hills	0	0	0	0.095	0	1
	3:Rural Hills	0	0	0	0.275	1	1
	4:Urban Plains	0	0	0	0.143	0	1
	5:Rural Plains	0	0	0	0.301	1	1
Gender	0:Female/1:Male	0	0	1	0.579	1	1
FatherEducation	0:Illiterate	0	0	0	0.456	1	1
	1:Primary	0	0	0	0.406	1	1
	2:Secondary	0	0	0	0.0875	0	1
	3:Beyond	0	0	0	0.0507	0	1
MotherEducation	0:Illiterate	0	1	1	0.832	1	1
	1:Primary	0	0	0	0.149	0	1
	2:Secondary	0	0	0	0.0181	0	1
	3:Beyond	0	0	0	0.00159	0	1
Age	Age when left School	10	14	16	16.04	18	33
HH Size	Size of Household	1	4	5	5.808	7	20
Poor	0:Non Poor/1:Poor	0	0	0	0.1601	0	1
Years	Number of years since dropping out	0	7	14	17.15	25	75

Note: 14 entries having travel time greater than 3 hours were excluded from the model

Table 9: Log Odds Logistic Regression Results Round III

	Dependent variable:Last Grade Attended			
	Overall Rating			
	(Model I)	(Model II)	(Model III)	(Model IV)
Travel Time(Secondary School)	−0.336***	−0.517***	−0.248**	−0.255**
	(0.069)	(0.095)	(0.107)	(0.108)
factor (Mode Transport)1	0.013	−0.160	−0.261	−0.256
	(0.115)	(0.150)	(0.161)	(0.161)
factor (Mode Transport)2	−0.063	−0.084	−0.160	−0.135
	(0.439)	(0.565)	(0.566)	(0.565)
factor (Mode Transport)3	0.192	−0.288	−0.310	−0.302
	(0.355)	(0.428)	(0.430)	(0.431)
Age		0.510***	0.530***	0.524***
		(0.022)	(0.023)	(0.023)
factor (Father Education)1		0.245**	0.243**	0.246**
		(0.099)	(0.100)	(0.100)
factor (Father Education)2		0.369**	0.352**	0.340**
		(0.171)	(0.171)	(0.172)
factor (Father Education)3		0.719***	0.698***	0.712***
		(0.226)	(0.227)	(0.228)
factor (Mother Education)1		0.382***	0.297**	0.299**
		(0.131)	(0.133)	(0.133)
factor (Mother Education)2		0.271	0.274	0.251
		(0.338)	(0.341)	(0.342)
factor (Mother Education)3		0.880	0.637	0.673
		(1.155)	(1.161)	(1.175)
hhsize		0.031	0.033*	0.032*
		(0.019)	(0.020)	(0.020)
poor		−0.591***	−0.635***	−0.669***
		(0.141)	(0.142)	(0.143)
Years				−0.007*
				(0.004)
Gender		−0.108	−0.146	−0.052
		(0.092)	(0.092)	(0.106)
factor (Strata)1			0.490*	0.506**
			(0.256)	(0.256)
factor (Strata)2			0.249	0.268
			(0.262)	(0.262)
factor (Strata)3			−0.233	−0.233
			(0.237)	(0.236)
factor (Strata)4			0.534**	0.558**
			(0.257)	(0.257)
factor (Strata)5			0.142	0.156
			(0.242)	(0.242)
Observations	2,654	1,789	1,789	1,789
McFadden Pseudo R^2	2.90e-03	0.412	0.415	0.416
Note:	Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01			

Table 10: Odds Ratio Logistic Regression Results Round III

	Dependent variable: Last Grade Attended			
	LastGrade			
	(Model I)	(Model II)	(Model III)	(Model IV)
Travel Time (Secondary School)	0.714***	0.596***	0.780**	0.775**
	(0.069)	(0.095)	(0.107)	(0.108)
factor (Mode Transport)1	1.013	0.852	0.770	0.774
	(0.115)	(0.150)	(0.161)	(0.161)
factor (Mode Transport)2	0.939	0.919	0.852	0.874
	(0.439)	(0.565)	(0.566)	(0.565)
factor (Mode Transport)3	1.212	0.750	0.734	0.739
	(0.355)	(0.428)	(0.430)	(0.431)
Age		1.666***	1.699***	1.689***
		(0.022)	(0.023)	(0.023)
factor (Father Education)1		1.278**	1.275**	1.279**
		(0.099)	(0.100)	(0.100)
factor (Father Education)2		1.446**	1.422**	1.405**
		(0.171)	(0.171)	(0.172)
factor (Father Education)3		2.052***	2.011***	2.038***
		(0.226)	(0.227)	(0.228)
factor (Mother Education)1		1.465***	1.345**	1.348**
		(0.131)	(0.133)	(0.133)
factor (Mother Education)2		1.311	1.315	1.285
		(0.338)	(0.341)	(0.342)
factor (Mother Education)3		2.410	1.891	1.960
		(1.155)	(1.161)	(1.175)
hhsize		1.032	1.033*	1.033*
		(0.019)	(0.020)	(0.020)
poor		0.554***	0.530***	0.512***
		(0.141)	(0.142)	(0.143)
Years				0.993*
				(0.004)
Gender		0.898	0.865	0.949
		(0.092)	(0.092)	(0.106)
factor(Strata)1			1.633*	1.659**
			(0.256)	(0.256)
factor(Strata)2			1.283	1.307
			(0.262)	(0.262)
factor(Strata)3			0.792	0.792
			(0.237)	(0.236)
factor(Strata)4			1.706**	1.747**
			(0.257)	(0.257)
factor(Strata)5			1.153	1.168
			(0.242)	(0.242)
Observations	2,654	1,789	1,789	1,789

Note: Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01

4.3 Comparative Model Results

Results from the ordered logit model are presented in this section. Table 4 and 5 shows the results from the modeling results for all the rounds.

The coefficients given are in the units of ordered log odds, so it is difficult to interpret. But we can say that a negative coefficient shows a negative association with the last grade attended. A one unit increase in the independent variable can be associated with a decrease in the log-odds of

being in higher grade or as the travel time to the school increases the students are more likely to dropout in the earlier grades from the school system.

Odds ratio provides easier interpretation of the logit coefficients. They are the exponentiated value of the logit coefficients. The assumption behind ordered logit model is that the relationship between each pair of the dependent variable is same i.e coefficients that describe the relation between lowest versus all higher category is same as those that describe the relation between next lower category and all higher categories, this is called proportional odds assumption (UCLA, Accessed November 20, 2017)).

4.4 Travel Time

Travel Time from home to school is a variable related to transportation and has been found significant in the model. Using results from the Table 5 (Round III model) for an example, as an odds ratio, less than 1 denotes negative relationship, the odds of moving to a higher grade category in the outcome variable is 22.5% (1-0.775) less likely when travel time increases by one hour.

4.5 Household Characteristics

Household characteristic variables, namely poverty, the gender of the students, parental educational level, are found to be significant in the models.
For example, using results from the Table 5:
Taking the Round III model shows that the odds of moving to a higher grade category in the outcome variable is 48.8% (1-0.512) less likely when the household of the student is poor. Similarly, the Round II result as an example shows that the odds of boys moving to a higher grade is 44% (1.440-1) more likely than girls. As expected, students with parents having higher education levels are more likely to study till higher grades.

4.6 Geographic Location

The results show that students from low access areas are likely to drop out in earlier grades than higher access areas. For example, using results from from the Table 5, in Round III the odds of moving to a higher grade is 65.9% more (1-1.659) likely when the student is from the urban capital than mountainous areas of the county and is 74.7% more (1-1.747) likely when the student is from Urban Plains than Rural Hills.

4.7 Comparative Model Fit

In logistic regression, the R^2 statistic does not exist which represents the percentage variation in the dependent variable that can be explained by the independent variables. The Pseudo-R^2 value is a McFadden's Adjusted pseudo-R^2 that takes values from 0 to 1 and higher values indicate a better model fit, but it cannot be interpreted as one would do in OLS R^2. It denotes the relative improvement of the model log likelihood over the null model with a penalty for too many predictors (UCLA, Accessed April 25, 2017)).

Examining the values of Pseudo R^2 from Table 9 compares the importance of each set of independent variables. Model I only considered Travel Time and Mode of Transport and has a very low Pseudo-R^2 (0.0029), as we add socioeconomic variables such as gender, age, father education, mother and education and poverty the Pseudo-R^2 increases to 0.4 indicating that these are the important variables in the model. McFadden's Adjusted Pseudo-R^2 values have been reported for all the models, but we should be cautious while interpreting it.

5 Conclusion

The effect of travel time over drops out grade was analyzed for Rounds I, II, and III of the Nepal Living Standard Survey. The results show that travel time is significant with the last grade attended. Relatedly, students from low access areas are more likely to drop out in earlier grades than higher access areas.

The analysis also showed that socio-economic characteristics such as poverty, gender, father's, and mother's education also affected whether the children remain in school. If the family is not poor, and parents have more education, their children are more likely to remain in school until a higher grade. The analysis also corroborate earlier studies from developing countries that girls are likely to dropout at an earlier grade than boys.

The implications of the analysis are that reducing the travel time to secondary school can improve the educational attainment, as the students will study till a higher grade. Hence, expanding the number and quality of secondary schools in lower access areas to reduce school access costs emerges as a policy recommendation from this research.

While the availability of school might be necessary for higher level of educational attainment other factors such as those quality of schooling is not considered in the analysis. If urban schools are higher quality, that may also increase the likelihood of urban students to remain in school compared with rural areas.

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Appendix: Measures of Collinearity

One of the major problem for logistic regression when there are more than two independent variables is presence of covariates which are not independent and when there are two covariates that are highly correlated it is called collinearity and it can distort the interpretation of the model (Tu, Kellett, Clerehugh, & Gilthorpe, 2005).

The collinearity between the independent variables is checked by calculating the Variance Inflation Factors (VIF). VIF can be calculated as

$$VIF = (\frac{1}{1 - R^2}) \tag{2}$$

where R is the coefficient of correlation According to (Alin, 2010) A large value of VIF indicates collinearity and the threshold value of 10 is taken to deviate from small from large.

Independent Variables(Round Three)	Independent Variable(Predictive Model Step Wise Regression)	Independent Variables(Round One)	Independent Variable(Round One Predictive)	Independent Variables(Round Two)	Independent Variable(Round Two Predictive)
Travel Time(Secondary School) 1.36	HealthPost 1.45	TravelTime(HealthPost) 1.33	TravelTime(SecondarySchool) 1.44	TravelTime(HealthPost) 1.15	TravelTime(SecondarySchool) 1.55
factor(Strata 1) 4.62	Bank 3.26	Gender 1.48	Gender 1.48	Gender 1.43	Gender 1.43
factor(Strata 2) 3.28	LocalShops 1.21	poor 1.21	poor 1.19	poor 1.10	poor 1.13
factor(Strata 3) 5.62	Travel Time Nearest Road 1.22	factor(Strata 1) 9.50	factor(Strata1) 9.78	factor(Strata 1) 3.31	factor(Strata 1) 3.58
factor(Strata4) 4.10	factor(Type Nearest Road) Vehicle Passable 2.10	factor(Strata 2) 6.59	factor(Strata 2) 6.57	factor(Strata 2) 3.24	factor(Strata 2) 3.45
factor(Strata 5) 5.88	factor(Type Nearest Road)Paved Road 2.02	factor(Strata 3) 8.26	factor(Strata 3) 8.40	factor(Strata 3) 3.71	factor(Strata 3) 3.72
factor(ModeTransport 1) 1.20	AgricultureCentre 2.14	factor(ModeTransport 1) 1.06	Age 1.35	factor(Strata 4) 3.29	factor(Strata 4) 3.51
factor(ModeTransport 2) 1.02	MarketCentre 2.66	factor(ModeTransport 2) 1.06	factor(FatherEducation 1) 1.14	factor(Strata 5) 3.99	factor(Strata 5) 4.25
factor(ModeTransport 3) 1.02	BusStop 2.16	factor(ModeTransport 3) 1.03	factor(MotherEducation 1) 1.12	factor(ModeTransport 1) 1.17	Age 1.33
Age 1.05	Cooperatives 1.92	Age 1.36	hhsize 1.18	factor(ModeTransport 2) 1.16	factor(FatherEducation 1) 1.26
factor(FatherEducation 1) 1.26	factor(FatherEducation 1) 1.15	factor(ModeTransport 3) 1.13	factor(FatherEducation 2) 1.27		
factor(FatherEducation 2) 1.23	factor(MotherEducation 1) 1.13	Age 1.34	factor(FatherEducation 3) 1.36		
factor(FatherEducation 3) 1.24	hhsize 1.19	factor(FatherEducation 1) 1.27	factor(MotherEducation 1) 1.18		
factor(MotherEducation 1) 1.19		factor(FatherEducation 2) 1.27	factor(MotherEducation 2) 1.18		
factor(MotherEducation 2) 1.15		factor(FatherEducation 3) 1.36	factor(MotherEducation 3) 1.07		
factor(MotherEducation 3) 1.03		factor(MotherEducation 1) 1.19	hhsize 1.06		
Gender 1.46		factor(MotherEducation 2) 1.18			
hhsize 1.12		factor(MotherEducation 3) 1.08			
poor 1.14		hhsize 1.08			
Years 1.40					