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DOES CPEC BRING SPILLOVERS FOR SOCIO-ECONOMIC CONDITIONS?

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ABSTRACT

Infrastructure development is an essential component for sustainable development. Roads connectivity not only improves the travel facilities it has a huge positive spillover on surrounding districts. Socio economic conditions and infrastructure development has a positive correlation. China Pakistan Economic Corridor (CPEC) is considered game changer for Pakistan. Not only it improves the connectivity across region but the government is anticipating its positive spillover effect for zone of influence. The study would simulate impact of CPEC (Six districts in central route) on education and health conditions in zone of influence. Probit-simulation models based on micro accounting technique would be used to simulate the effect. Household dataset of Pakistan Standard of Living Measurement (PSLM) would be used for the simulation. The study found a very significant rise in all primary, middle and high school enrollment. The improved connectivity would equally help in uplifting the health services (LHW) utilization. 15.2% increase in LHW utilization would be observed in district Bhakkar. The findings of the study identified the impact of CPEC on education and health sector in six districts of central route and help policy makers to streamline the spillover to attain the maximum out of this game changer.

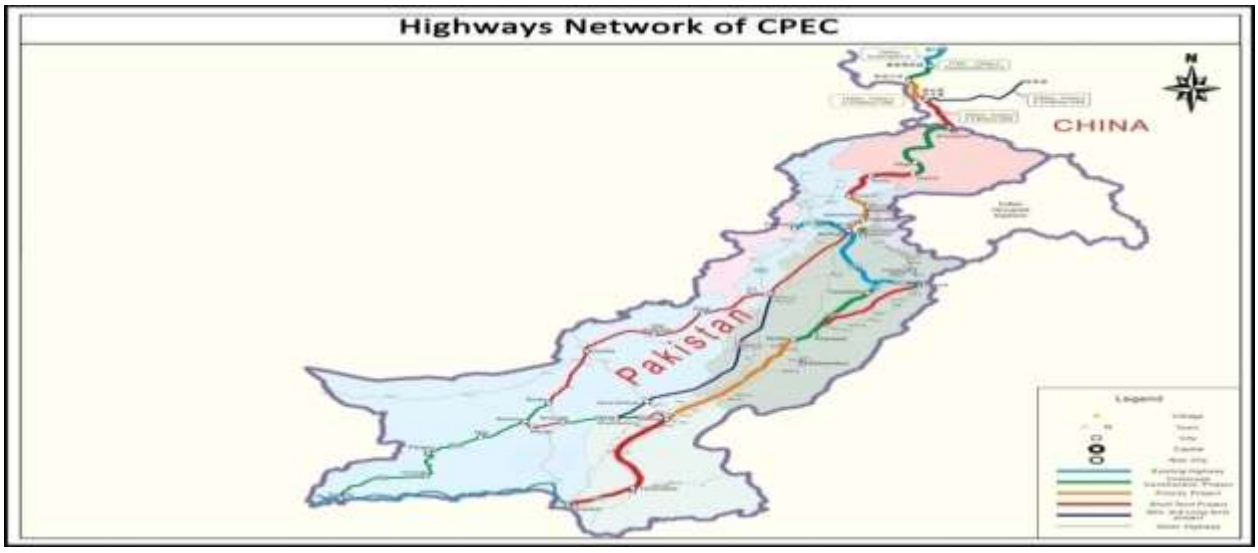
Introduction

Infrastructure development is an essential component for sustainable growth. The social uplift of the society is deeply linked with economic prosperity of the region. Construction of corridors improves connectivity of the region and has a spillover effect on social economic conditions. Road network offers a very unique opportunity for zone of influence districts. Generating economic prospects allows the residents to raise their social standards.

Construction of Bamyan-Dushi road in Afghanistan has improved the socio-economic conditions of people living in the districts around it (Islam and Adiv 2009). In underdeveloped areas, road network means improved transportation and travel conditions. This enhances convenience and access to the school, health units, markets, creates employment and raises community as a whole.

Education and health conditions of any region are interrelated to mobility and travel time. Mattson (2011) concluded that reduced travel time coupled convenience improve the utilization of education and health facilities by the dwellers of zone of influence. Howard and Masset (2004) stated that improved travel conditions and reduced travel time improved enrollment in Ghana.

China and Pakistan has signed a $ 46 billion* project named China Pakistan Economic Corridor (CPEC). The project includes building of road networks, energy projects, special industrial zones etc**. The term 'Game Changer'** is coined by government of Pakistan as it is expected to uplift the socio economic condition of Pakistan. However, this is a mutually beneficial project where China is expected to gain by reducing transit time and cost. It gives Chinese with products competitive advantage and easier access to Central Asian/ African markets.



This study is an extension of our previous work Shahid et al. (2015) where we calculated the socio-economic impact of districts in western route. This study would simulate the impact of CPEC on education and health conditions in the districts falling under central route. The districts includes Khuzdar, Jaffarabad (DeraAllahyar), Shahdadkot, Bhakkar(Darya Khan), DG Khan and DI khan.

The Upliftment of education and health conditions is expected by government of Pakistan on zone of influence. Improving travel conditions and reducing travel time is expected to increase access to education and health conditions. The study develops a probit model to simulate the socio-economic impact. Enrollment and access to lady health worker* (LHW) are used as a proxy for education and health conditions.

Objective of the Study:

- To identify the impact of CPEC on education indicator in zone of influence.
- To identify the impact of CPEC on health indicator in zone of influence.

Literature Review

Vuri (2008) studied the effectiveness of reduced travel time on student enrollment in Ghana and Guatemala. The study concluded that in Ghana parents are likely to enroll their children to primary and middle school if the school were built nearby. Whereas, in Guatemala parents consider travel cost as well as distance before enrolling their child to primary or middle school.

Francisco and Helble (2017) estimated the impact of affordable transportation system in Philippines. Household income, education and health were examined after an implementation of roll-on / roll-off policy. The policy improved interconnectivity between island through a public ferry system. The result reveals that this improved mobility enhances the socioeconomic condition of the locality. Overall income rises of the region significantly after 2003 (When policy implemented). Enrollment and health unit utilization improved that highlights the importance of transportation system to socioeconomic development. Travel distance from school negatively effects school enrollment (King and Lillard 2011).

Phyrum, Sothy and Horn (2007) argued that improvement in road network enhances the access to education, health care and market surrounding to the road network. Japsen and Montgomery (2009) developed a probit model to estimate the relationship between distance of college and its enrollment in Baltimore, United States. They found the distance of the college has significant impact on college enrollment. Filmer (2004) also developed a probit model for rural areas of low income countries and analyzed the impact of school distance on enrollment. Twenty-one rural areas were selected and the study reveals that distance of school has a statistically significant impact on primary and secondary enrollment both.

Lubetzky et al. (2011) state that number of patients visits Clinics has an inverse relationship with its distance to clinic. Mattson (2004) analyzed the impact of transportation and mobility on health care service utilization. The study developed a probit model and concluded that convenient mobility and road network improves the health services utilization. Road network plays a critical role in case of emergency.

Methodology

Pakistan Social and Living Standard Measurement (PSLM) 2014-15 data is used for six districts falling under zone of influence in central route. Enrollment is used as a dependent variable for estimating the impact of reduced travel time on primary, middle and high school education.

Lady Health Worker (LHW) utilization is used for estimating the impact of reduced travel time on health services. The Key variable that pivots the model is travel time. The study transforms current travel distance to travel time, this gives a scale to simulate the improved travel time and convert it back to distance. This conversion of distance to travel time standardizes regardless of mode of transportation. PSLM categorize mode of transportation into three category i.e (On foot, Bicycle and Car)[1].

TABLE 1

DESCRIPTION OF VARIABLES USED IN THE PROBIT MODEL

Variable	Description	Unit	Obs
dpschool*	Distance from Primary School	Km	12,462
dmschool*	Distance from Middle School	Km	4,374
dhschool*	Distance from High School	Km	5,368
attend*	Current or past enrollment of school-age children	Yes/No (1/0)	20,213
Dhealth	Distance from Health Unit	Km	5,412
Lhw	Visit of a Lady Health Worker to the household	Yes/No (1/0)	5,412
Hwealth	Market value of total household assets	PKR	23,556

*****The observationsfor each variable are taken only according to the children of respective age groups (Primary School: 4-11 years; Secondary School: 11-14 years; High School: 14-18years).

Source: Pakistan Social and Living Standard Measurement 2014-15

To simulate the impact, probit models are used. A probit model is a binary technique that uses 1 or 0 as input values. Based on latent variable, the model estimates,

$$Y_i = \begin{cases} 1, Y_i^* > 0 \\ 0, Y_i^* \leq 0 \end{cases}$$

$$Y_i^* = X_i \beta + \varepsilon_i$$

Estimating the probability values of actual, the latent model defines it with estimated value.

$$P(Y_i = 1|\, x) = P(Y_i^* > 0|\, x)$$
$$= P(x_i'\beta + \varepsilon_i > 0|\, x)$$
$$= P(\varepsilon_i > -x_i'\beta|\, x)$$
$$= 1 - F(-x_i'\beta)$$

The model has a prime assumption that error term are normally distributed represented by,

$$P(Y_i = 1|\, x) = 1 - \emptyset\left(\frac{x_i'\beta}{\sigma}\right), \sigma \equiv 1$$
$$= \emptyset\,(x_i'\beta)$$

[1]PSLM used the word on foot, mechanized and non mechanized

This represents the symmetrical distribution. For marginal effect the model estimates;

$$P(Y_i = 1|\, X = x\,)$$

$$\frac{\partial P(Y_i = 1|x_i)}{\partial x_i} = \frac{\partial E\,(Y_i|x_i)}{\partial x_i} = \emptyset(\, x_i'\beta\,)\beta$$

This representation was transformed to analyze these two models;

$$Enrollment_{ij} = \beta_0 + \beta_1 D_{ij} + \beta_2 GHH_{ij} + \beta_3 Asset_{ij} + \varepsilon \text{ ----------Model 1}$$

$$LadyHealthWorker_{ij} = \beta_0 + \beta_1 D_i + \beta_2 GHH_i + \beta_3 Asset_i + \varepsilon \text{ -------Model 2}$$

Model 1 estimates the relationship between enrollment and distance travel to that school. Here, enrollment represents number of students enrolled; D is used for distance (Transformed into traveling time), GHH and Assets are control variable representing gender of head of household and assets owned by household. In model 1 i in subscript represents districts and j in subscript represents grade of school i.e primary, middle or high school.

Model 2 represents Lady Health worker utilization and impact of distance traveled by her. LHW utilization is represented by LHW and D is used for distance she travels to visit household. GHH and Assets are used as a control variable and represents gender of head of household and assets owned by household. 'i' in subscript represents district of the household.

Results and Analysis

Estimation Results

Table 4.1demonstrates the marginal effects of distance from primary, middle, and high schools (a proxy to travel time) on the probability of the respective-agestudents to be enrolled. The table also specifiesthe marginal effects of the distance from health units on the probability of lady health worker (LHW) to visit households (a proxy to utilization of LHW facilities by the households).

TABLE 2
MARGINAL EFFECTS OF DISTANCE

Variables	Marginal Effects of Distance from home*
Enrollment (primary school)	-.1008
	(0.000)
Enrollment (middle school)	-.0296

	(0.000)
Enrollment (high school)	-.0319
	(0.000)
Visit of LHW to households	-.0500
	(0.000)

*Significant at 5 percent

The distance from all primary, secondary, and high schools is significant and inversely related to the probability of the respective age students to be enrolled.

Secondly, the p-value of the distance from health unit also indicates that thetravel time from a health unit is significant andinversely related to the probability of the nearest Lady Health Workers to visit a household.

Simulation Results

The estimation results are used to evaluate the impact of simulated decrease in distances (proxy to travel time) on probability to be enrolled in schoolsand probability to utilize lady health worker facility by the households.Then, the estimated values of the pre and post-simulation modelsare averaged out for each of the six districts of Pakistan for the purpose of comparison.

Impact of Travel Time to Schools on Enrollment

Figure 1-3 illustrates the impact of simulated decrease in distances from school on the probability of the respective age students to be enrolled in primary, middle, and high schools accordingly. The top left panel of the graphsindicates the simulated impact of reducing the travel time on the respective variable for each district. Points farther from the 45-degree line are indicative of the more significant impact of the reduced travel time on the respective variable, as compared to the points nearer to the line.Overall, the results imply that reducing the travel time from primary, middle, and high schools would have a note worthy impact on the probability of the current and potential students to be enrolled in schools for all the six districts.

Figure 1:

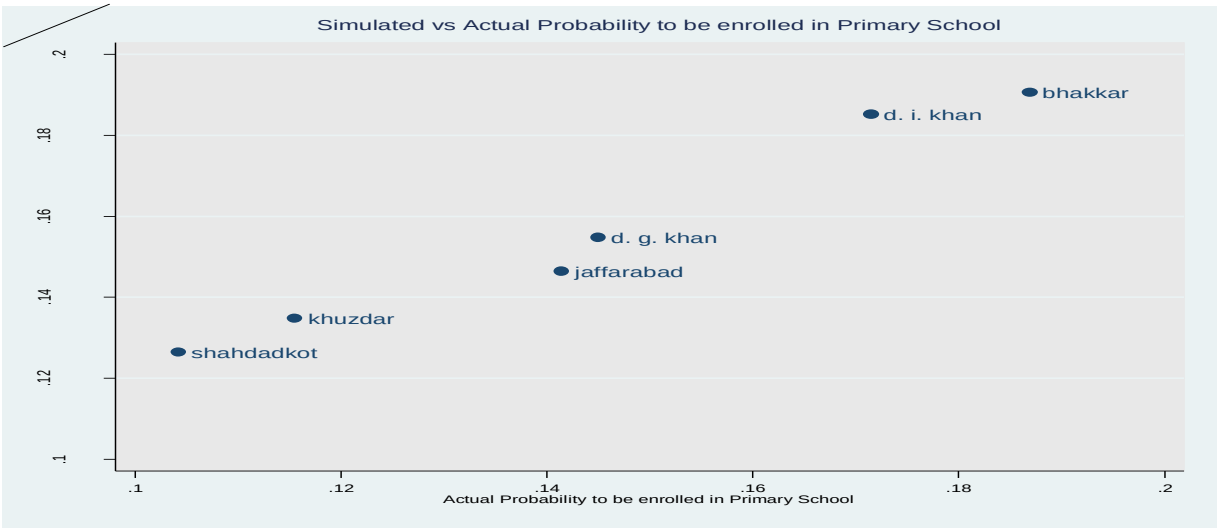


Figure 2

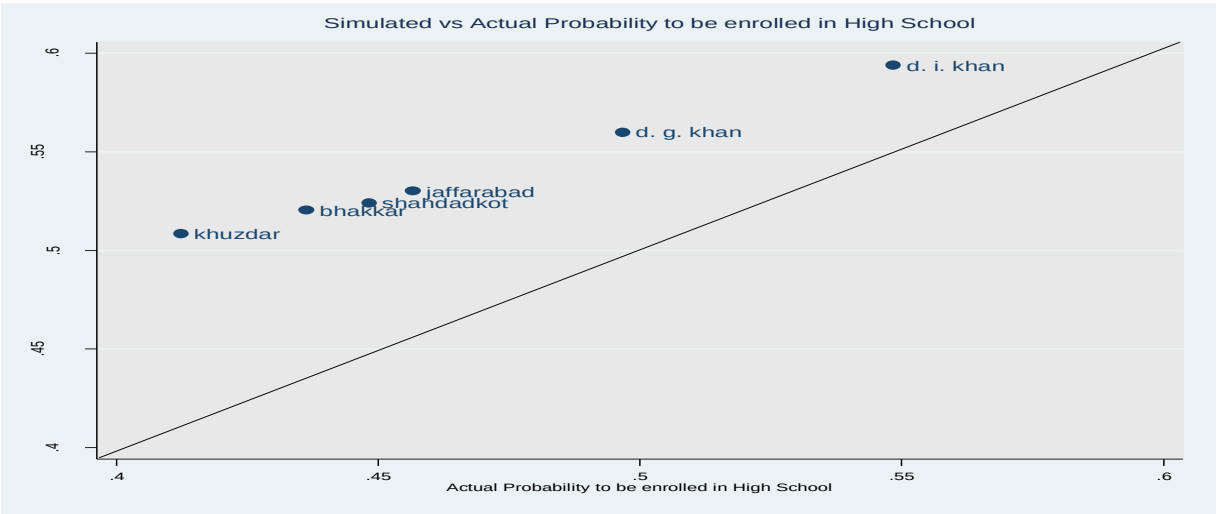


Figure 3

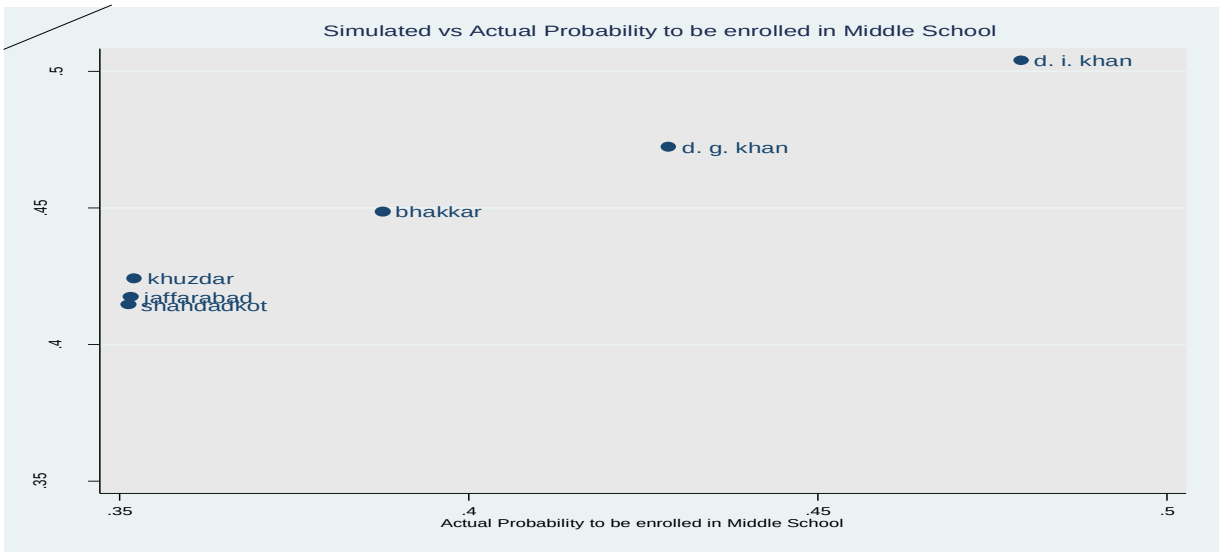


Table 3 compares the base value ofaverage travel with the effects of the decreased travel timeon probability of the students to be enrolled (percentage point increase in enrolment) for each district.On average, districts with alreadylargerbase travel time from schools would experience greater increase in number ofenrolled students after the reduction in travel time, as compared to the districts with smallerbase values of travel time (Figure 4 in Appendix).

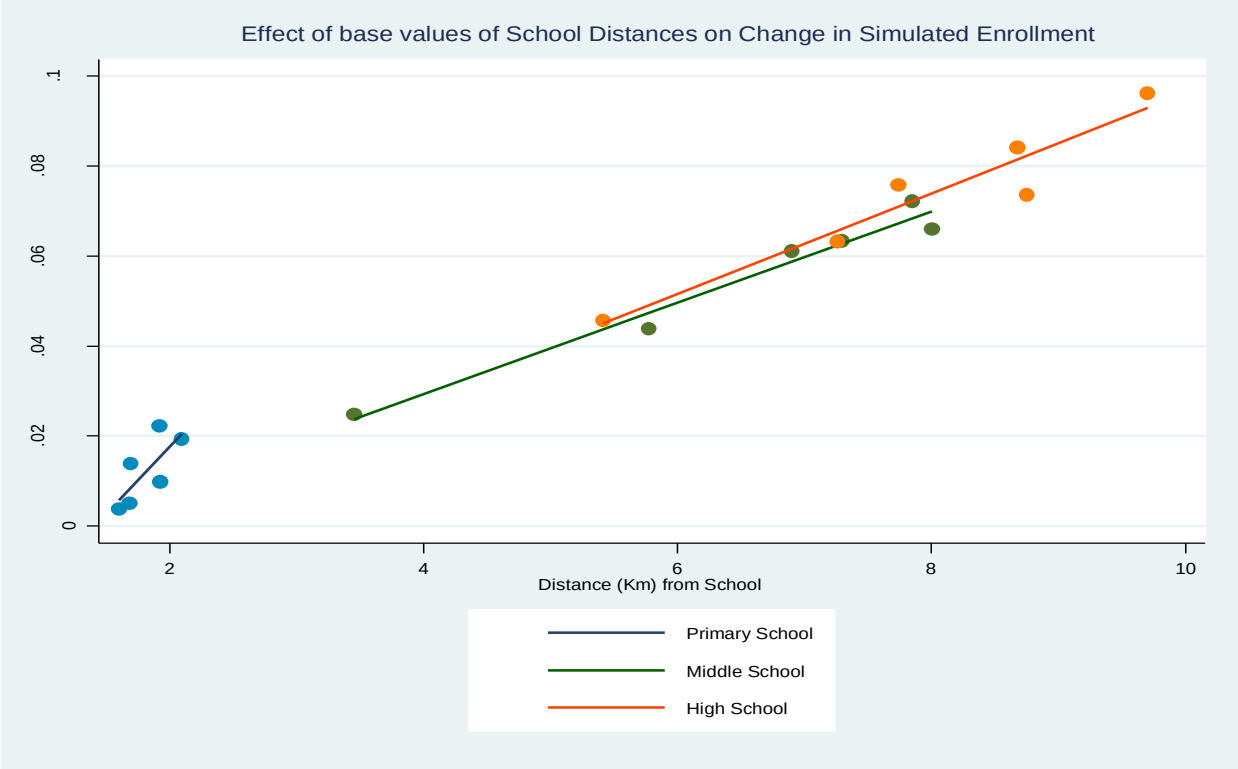
Table 3

Average Travel Time from Schools and Effects of Simulated Reduction in Travel Time on Probability of students to be enrolled

District	**Distances from Households (Kilometers)**			**Percentage Point Increase in Enrollment**		
	Primary	Middle Sch	High Sc	Primary	Middle Sch	High Sc
D.I. Khan	1.70	3.45	5.41	1.4%	2.5%	4.6%
Bhakkar	1.60	6.90	8.67	0.4%	6.1%	8.4%
D.G. Khan	1.93	5.77	7.26	1.0%	4.4%	6.3%
Shahdadkot	1.92	7.29	7.74	2.2%	6.3%	7.6%
Jaffarabad	1.68	8.00	8.75	0.5%	6.6%	7.4%
Khuzdar	2.09	7.85	9.70	1.9%	7.2%	9.6%

Source: Authors' estimation

Figure 4



Impact of Travel Time from Health Units on Utilization of LHW Facilities

Figure 5 shows that reducing travel time from health units has a significant impact on utilization of the Lady Health Worker (LHW) facility by the households for all the Zone of Influence districts.

Figure 5

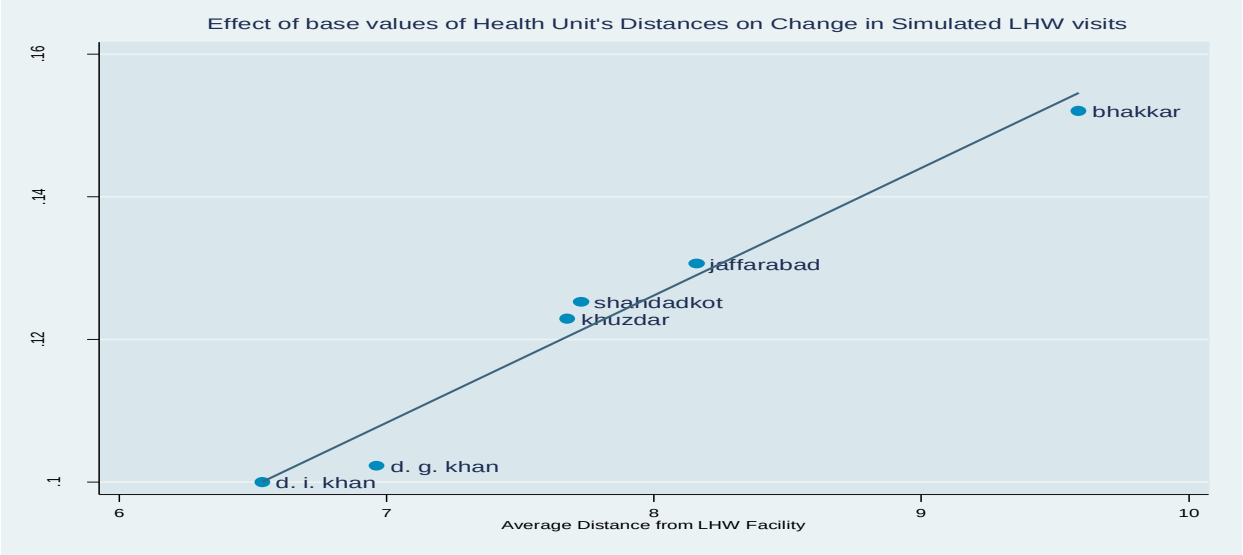


Table 4 compares the average travel time from health units with the effects of reduced travel time on utilization of LHW service, for each district.On average, districts with greater base travel time from health units experience greater utilization of LHW service after the reduction in travel time, as compared to the districts with smaller base travel time from the health units, as shown in Figure .

TABLE 4:AVERAGE TRAVEL TIME FROM HEALTH UNITS AND EFFECTS OF SIMULATED REDUCTION IN TRAVEL TIME ON LHW UTILIZATION

District	Distances from Households	Percentage Point Increase of
D.I. Khan	6.54	10.0%
Bhakkar	9.59	15.2%
D.G. Khan	6.96	10.2%
Shahdadkot	7.73	12.5%
Jaffarabad	8.16	13.1%
Khuzdar	7.68	12.3%

Source: Authors' estimation

Discussion

Road network improves socioeconomic condition of the specified districts in zone of influence. The reduction envisage that in travel time it improves access to education and health. The existing fact where enrollment rate and health services utilization improved is the result after a road network was developed between Kabul – Kandahar (Islam and Wieland 2008). Six districts on central route of CPEC were analyzed to estimate the

impact of development of road network on education and health indicators. The study simulated the impact of convenient improved mobility on enrollment in schools (primary, middle and high) and improved accessibility/reach to lady health worker.

Impact of enrollment can be seen notable significant in middle and high school. Districts with greater average distance from school would experience more significant impact than others. The impact on primary school ranges from 0.4% to 2.2% increase. In middle school, enrollment percentage increase ranges to 2.5% to 7.2%. The study simulates the highest increase in high school ranging from 4.9% to 9.6%. Shahdadkot would recieve the highest percentage increase in primary schools i.e 2.2% whereas Khuzdar would be expected to have 7.2% and 9.6% increase in enrollment on middle and high school respectively.

A very glaring significant impact has been estimated by the model in health conditions. Minimum 10% increase in LHW utilization would be observed by improving road network and reducing travel time. The highest impact is simulated for district Bhakkar where 15.2% increase in LHW utilization would be achieved.

Conclusion

The study simulates the impact of CPEC (Development of Road Network) on education and health indicators. The study found a very significant rise in all primary, middle and high school enrollment. The districts having greater average distance has greater impact. Significant simulated increase can be seen in district Shahdadkoti.e 2.2% in primary schools. In middle and high school 7.2% and 9.6% increase can be observed in district Khuzdar. The improved connectivity would equally help in uplifting the health services (LHW) utilization. 15.2% increase in LHW utilization would be observed in district Bhakkar.

Policy Recommendations

The study helps identifying the simulated spillover impact of CPEC on zone of influence. Education sector policy makers should visualize and make efforts cater this impact of increased enrollment due to improved connectivity. Educational services, basic facilities in school and other determinants in education should be improved to retain and absorb this influx.

Health sector is been proxies by LHW utilization. Access of LHW strongly relies on distance / travel conditions and time. Improving it would uplift health conditions but policy makers can amplify its effect by improving health unit productivity and facilitating LHWs in mobility.

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facilities in underdeveloped areas, improved connectivity would increases lady health workers to reach more number of households.

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