



HOW HAVE PUBLIC TRANSPORT FACILITIES IN LAHORE DIMINISHED THE EFFECTS OF SPATIAL MISMATCHING



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Table of Contents

Abbreviations	3
Conversions	4
Abstract	5
1.0 Introduction	6
2.0 Literature Review	7
3.0 Research Methodology	9
3.1 Methodology	9
3.1.1 Research Questions	9
3.1.2 Data Collection	9
3.2 Research Groups	9
3.3 Research Model	10
3.4 Significance of Research	10
3.5 Research Hypothesis	11
4.0 Analysis & Results	12
4.1 Response Timings	12
4.2 Demographics	13
4.3 Purpose of travel	14
4.4 Sustainability of Job	15
4.5 People whose jobs were contingent (Group A)	15
4.5.1: Pay Difference	16
4.5.2: Efficiency	17
4.5.3: Motivation	18
4.6 People whose jobs were not contingent (Group B)	19
4.6.1: Cost and Time Saving	19
4.6.2: Comfort Rating	20
4.7 Simple Regression Analysis	21
4.7.1: Group A	21
4.7.2: Group B	23
4.8 A Qualitative Outlook	27
4.8.1 Rationality	27
4.8.2 Nature of Job	28
5.0 Conclusion	29
5.1 Policy Takeaways	29
6.0 Limitations of the study	30
Acknowledgements	34
Appendix	34

Abbreviations

<i>Abbreviation</i>	<i>Meaning</i>
LMBS	Lahore Metro Bus System
OLMRTS	Orange Line Metro Rail Transit System
PMA	Punjab Mass-transit Authority

Conversions

- Standard Exchange rate used: 1 USD = 219.43 PKR

Abstract

With the highest nominal GDP at \$778 billion (International Monetary Fund, 2022) and the largest labor force out of all provinces in Pakistan (Pakistan Bureau of Statistics, 2021), Punjab has established itself as the most prominent center for economic activity in the country. Given the presence of a substantially large labor force, a subsidized transportation system that enables

this sector of the population to be more geographically mobile and broaden their employment opportunities is the need of the hour. This is due to a plethora of reasons, including but not limited to: easier access to a wider range of job opportunities in different areas of the province; increased accessibility to industrial hubs; lower fuel consumption costs; convenient access to vocational institutes; prospects of increased income; and hence, an upward trajectory of the standard of living.

The mismatch between housing locations in the rural outskirts of Lahore and job locations in central urban Lahore inhibits labor from the outskirts to access better employment opportunities. This report, in association with the Punjab Mass Transit Authority, explores the implications of

public transport ROW (right of way) A and B systems in Lahore, Punjab (*namely: The Orange Line Train and The Metro Bus System*) on the geographical mobility of labor as a tool to inhibit the detriments of spatial mismatching.

1.0 Introduction

Income inequality and inequality of opportunities have been the hallmark of the labor markets and households in Pakistan. As of 2015, the top 1% were responsible for holding 30% of the national income (Ahmed, n.d). In recent policy terms there has been much debate around the world in using public transport as a means of increasing labor mobility and therefore overcoming the threats of spatial mismatching, a theory presented by John F Kain in 1968, that is a mismatch between housing location and fruitful job opportunities.

According to a research, titled “*Labour Mobility*” in the Oxford Encyclopedia of Economic History, “*At the individual level, mobility allows for improvements in the economic circumstances of those whose skills or aspirations are a poor match for the job or location in which they find themselves*”, (Long & Ferrie, n.d.) hence this study will also be delving into the economic and social benefits that the labor force is able to derive due to an increment in geographic mobility and the extent of these benefits derived.

A way to increase the geographical mobility of labor on a mass level is to introduce mass transit lines of public transport. The Punjab Mass Transit Authority currently has 3 projects running in Lahore: Lahore Metro-Bus System, Orange Line Metro Rail Transit System, and Lahore Feeder Routes. The fare for each service per trip is PKR 30 (\$0.14), PKR 40 (\$0.18), and PKR 15 (\$0.068) respectively, each laced with their own benefits to its consumers but all are central in increasing labor mobility.

With these recent fruitful developments by the government in the public transport system that have paved the path for hundreds of thousands of people daily at an enormous scale, it was only natural that this level of mobility would have unlocked immense economic benefits to every individual part of the labor force, directly or indirectly.

In the field of public policy, the development of transit routes and rapid transit is rampantly being used recently to combat unemployment in urban areas by making jobs more spatially accessible to residents in and out of the city. Lahore’s case is as unique as it is because the transit lines help connect labor from lesser developed cities like Shahdra and Gajumata to the economic hub of Punjab, which is Lahore.

This paper will expand on previous iterations of literature that apply the theory of spatial mismatching in different parts of the world and further show how public transport systems are a key in diminishing its outcomes. Such literature is not available for the projects in Lahore and this paper aims to fill that gap

2.0 Literature Review

In 1968, John F. Kain provided the first attempt in literature to make empirical connections between housing location and the prospect of employment (Kain, 1968, 175-197). Kain for the first time distinguished his argument from the predominant argument regarding blaming discrimination as the reason for gaps in employment of white and black neighborhoods to providing empirical evidence connecting the location of housing and propensity of employment.

Since the proposition of this theory, many researchers have come forward in testing this hypothesis in different regions of the world beyond Detroit (as Kain's study was focused in Detroit) using different research methodologies.

Subsequently, there has been a mixture of conclusions: Bennett Harrison, in 1972, challenged that *"there is, therefore, reason to doubt that the economic opportunities of minorities would be enhanced by suburbanization, as has been argued by Kain."* when he found no conclusive evidence linking spatial isolation to causing unemployment in black populations after looking at many large US metros (Harrison, 1972, 23-43). Conversely, in a 1982 study, John E. Farley used regression analysis to suggest the *"differential in unemployment rates between blacks and whites in U. S. SMSAs (and particularly SMSAs outside the South) is substantially influenced both by segregation patterns restricting blacks to the central city and by job decentralization"* strengthening the claim of John Kain- in fact, Farley attributed 15% of the white-black unemployment gap to this spatial isolation. Further, a research investigation in Chicago by Daniel Immergluck in 1997 proved that the effect of labor's close proximity to jobs on neighborhood employment was at best modest but when paired with occupational levels of the nearby jobs and the match of residents' skills, the effect on neighborhood employment was much more concrete. (Immergluck, 1998, 7-23). But perhaps the most convincing research comes in 2003 from Jan K. Brueckner and Yves Zenou, who-through their comprehensive analysis-drew a connection between "space" and unemployment, *"providing the first well-rounded theoretical treatment of this important element of the spatial mismatch hypothesis."* (Brueckner & Zenou, 2003, 242-262).

Moving the argument to public transport, there has also recently been done substantial research on how public transport aids in employment using the theory of spatial mismatching. A prime example of this is present in the literature of Thomas Sanchez where he first argues that *"As this distance increases, low-skill workers with low levels of personal mobility are not able to meet the travel requirements of these new, dispersed employment locations."* and provides evidence from Portland, Oregon, and Georgia, Atlanta to show that unemployment is higher for those residents who live more than 400 meters from a public transit node. (Sanchez, 1999, 284-296). Sanchez further expanded on his study in 2003 to draw more conclusive evidence from a larger sample of cities to support his 1999 research. (Sanchez et al., 2004, 1313-1331)

In fact, John Kain himself advocated for increased mobility as a mode to surmount the problems caused by spatial mismatching. In his review of the literature surrounding his theory, 3 decades after its proposition, John Kain rebutted the argument -of authors, Mark Alan Hughes and Jannice Fanning Madden- that transportation-based policies are untenable because they accept persistent segregation (Hughes & Madden, 1991, 28-49) by arguing that the experience

of spacial isolation is actually reduced when increasing the access to suburbs for the inner city residents (Kain, 1992, 371-392).

Further evidence for the positive effects of transport networks on employment is provided in the research of Keith R. Ihlanfeldt and David L. Sjoquist on Philadelphia's transport networks (Ihlandeldt & Sjoquist, 1990, 267-276) and even stronger evidence is found in the series of papers, from Katherine M. O'Regan and John M. Quigley, linking better job market outcomes for youth with the central location of neighborhoods (O'Regan & Quigley, 1996, 692-702) (O'Regan & Quigley, 1998, 1187-1205).

Expanding this theory to more cities in America, in 2003, authors Harry J. Holzer, John M. Quigley, and Steven Raphael studied the exogenous effect on employment in nearby areas after an expansion in the Bay Area Rapid Transit (BART) line. The study found compelling evidence linking the growth in Hispanic employment in neighborhood areas to the extension however ruled the evidence as inconclusive owing to the number of external factors that had to be accounted for (Holzer et al., 2003, 415-441). Perhaps this was because the primary data collected was surveying employers and not commuters of the BART system. This paper will aim to consider data from actual commuters so to eliminate any exogenous effect.

More recently however, a 2015 paper by Justin Tyndall studied the 2012 Hurricane Sandy in New York as an exogenous shock that ceased operations of Public transport and consequently the effect on employment. Using data collected by the US Census Bureau, the author says *"There is compelling evidence that a sudden decrease in public transportation triggered a significant hardship for the job market prospects of affected workers"* and in many points during the paper linking the operations of Public Transport with local levels of employment. (Tyndall, 2015, 1-18)

The most recent study however comes from Ryan Dery in 2022 which analyzed the impact of many variables on labor force participation (LFP). In line with the spatial mismatch hypothesis, the study noted that *"longer commute times and less dense urban environments result in lower LFP rates"*. (Dery, 2022)

A major aim of our research is to eliminate the effects of any exogenous variable and strictly study public transport systems as a means of eliminating the effects of spatial mismatching, by that end, this paper will be using primary responses from surveys collected right from the daily commuters on public transport systems. Moreover while other papers have studied spatial mismatching with unemployment rates, this paper uses a different model. It reflects on the wage increase, skill application, and motivation of labor and to the extent they are affected by spatial mismatching. This paper also exploreas the costs that workers have to incur due to spatial mismatching and to the extent public transport diminishes these costs (monetary and time).

Secondly, no literature on evidence of spatial mismatching exists in the academia of Pakistan, considering the inauguration of new projects in BRT and LRT around Pakistan it is cardinal that we first study the effects from projects that have been up and running for a while now. This research aims to prove the pivotal role public transpiort systems play in the elimination of spatial mismatching by quanitifying the benefits in terms of superior job opportunities for workers in terms of wage raises, skill application, and motivation increase.

3.0 Research Methodology

3.1 Methodology

The present research aims to assess and explore the plethora of opportunities and amenities that are made accessible by increased geographical mobility, which connects people to areas previously inaccessible to them. This was done by comprehending the role of set socio-economic indicators ([Monetary and social benefits](#)) that quantified the benefits to these people. Another aim of this research was to understand what socio-economic variables caused a difference of opinion and perception among these people; to this end, the problem statement was made to be:

"To what extent does an increment in the mobility of labor economically benefit the labor class?"

3.1.1 Research Questions

The research was carried out to assess what percentage of the labor class is only able to hold on to their jobs due to the presence of public transport facilities. The research dove further into questions to assess the effects of these jobs on worker motivation, efficiency, and pay. For the workers who did not attribute the security of their jobs to the public transport system, the research questioned the cost saving, time saving and comfort benefits public transport had brought in comparison to private transport all problems relating to the temporal mismatching between their houses and job areas. The list of questions is attached in the [Appendix](#).

3.1.2 Data Collection

The research was conducted on a random quota sample of 1200 people inside vehicles and on the waiting platforms of the Metro-Bus System and the Orange Line Train System. The research was conducted from 22 September 2022 to 9 October 2022 by a research team of 8 field researchers, with special permission from the Punjab Mass Transit Authority, following a schedule of shifts on randomized times. The research was conducted by approaching people and asking them a set of verbal questions that were then input into a Google Sheets document uniquely identified to each field researcher. The questions were either option based or were quantitative responses. A total of 9 questions were asked to people who **did not** regularly use public transport for **work purposes**, while a total of 14 questions were asked to people who commuted daily for **work purposes** on the public transport facilities. A copy of the survey is attached in the [Appendix](#).

3.2 Research Groups

The focus of the research was to study two different groups of people: people who would not be able to sustain their jobs without public transport facilities (*i.e people whose jobs were contingent*) and people who would continue in the same work they are doing regardless of the provision of public transport facilities (*i.e people whose jobs were not contingent*). Set

socio-economic quantitative variables were attached in the research questions to assess the benefit or loss derived by the use of public transport to each laborer.

3.3 Research Model

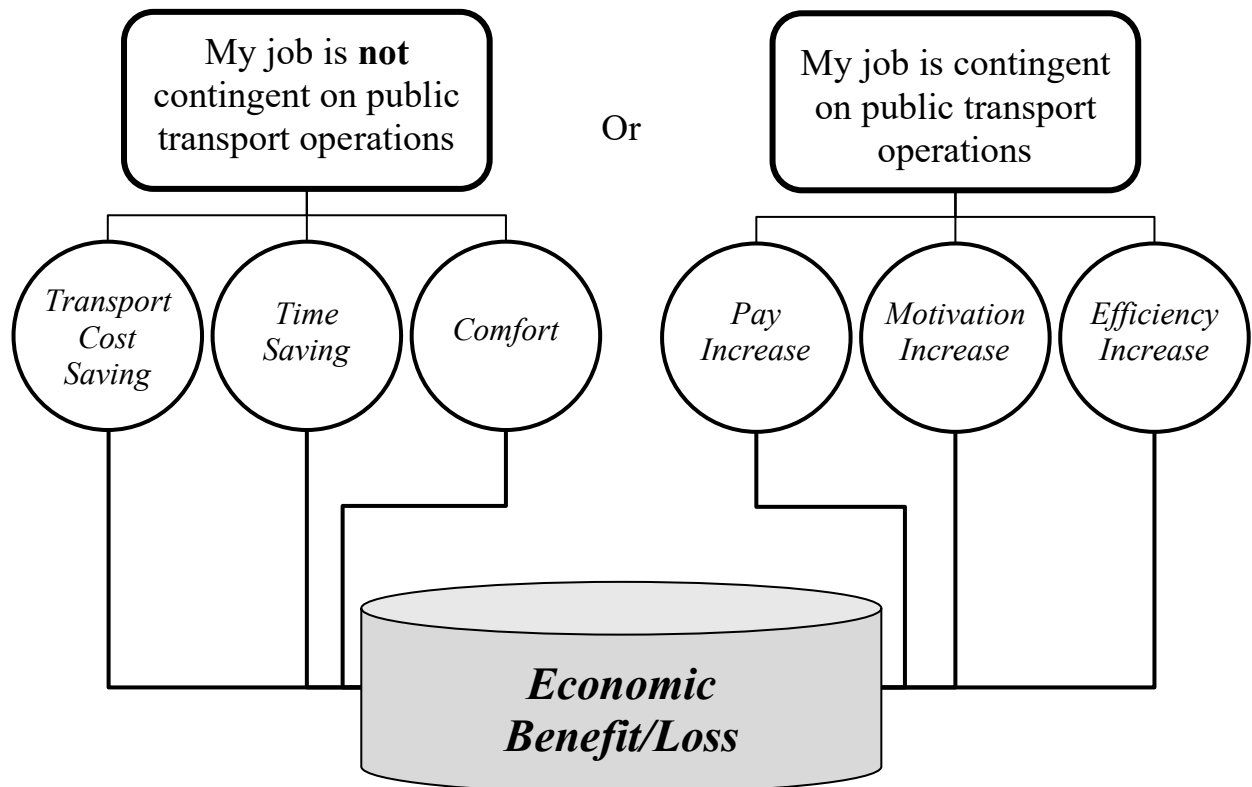


Fig 1: Research Model and indicators

The figure shows a visual of the research model used to assess and determine economic benefit to a laboring individual in this research. This model was used due to its simple comprehension in understanding results and also to be as simple as it can be for the survey respondents.

3.4 Significance of Research

While this research does not aim to provide and focus on cost-benefit analysis of new public transport projects in Lahore, it is still beneficial in the sense that it helps realise the detrimental effects of spatial mismatching in terms of unemployment and if not that then the costs that are incurred in commuting from a household to a workplace. This will help policy makers in realising the dire need of urban transit system in city regional planning and as a tool of eliminating income inequality.

3.5 Research Hypothesis

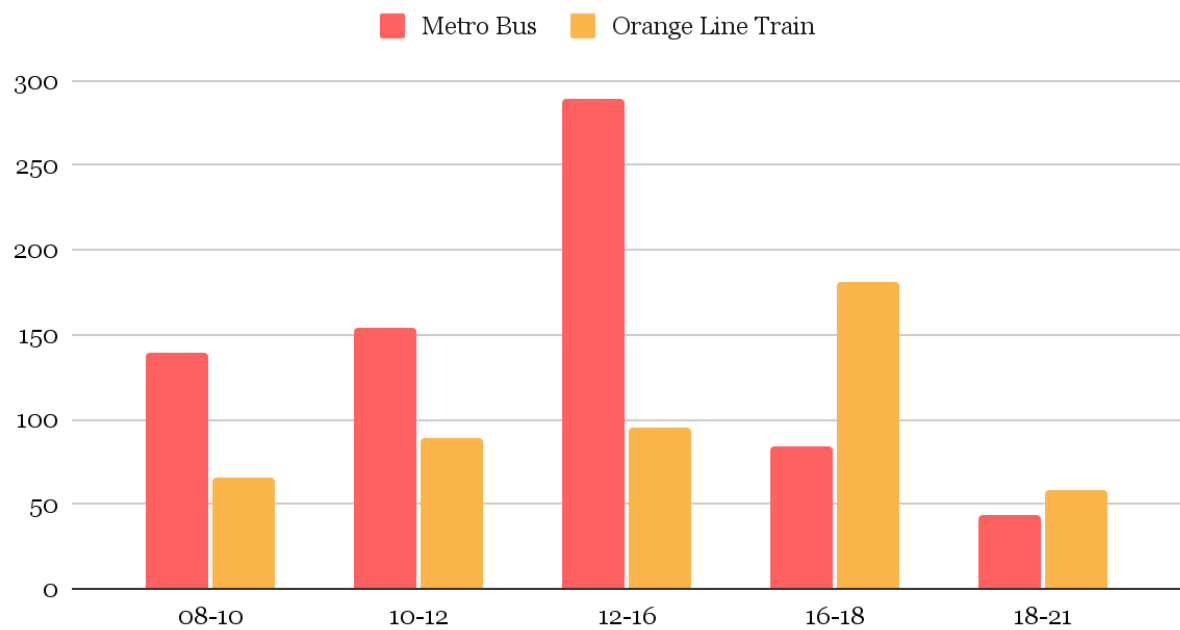
Based on online articles, research, and conversing with officials of the Mass Transit Authority, it was hypothesized that this increased mobility should have led to new jobs for at least 30% of the Labor class. Further, It was also hypothesized that at least 80% of these people would be more efficient, motivated, and paid higher at these new jobs. All in all the research should be able to prove public transport as a suitable means of diminishing the effects of spatial mismatching.

4.0 Analysis & Results

4.1 Response Timings

To get a sense of rush hours and to minimize bias, the study was conducted during several different hours over different repeated days.

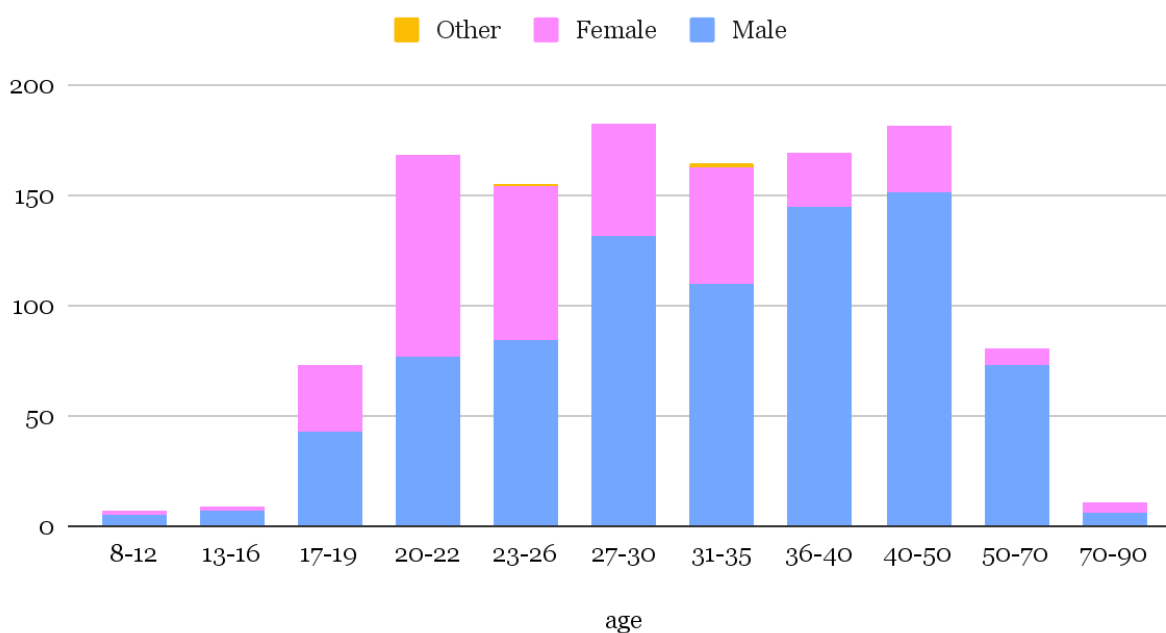
Fig 2: Responses by time of day



4.2 Demographics

Out of the 1200 respondents, there were a total of 832 male respondents (69.33%), 366 female respondents (30.5%) and 2 who did not fall in either category (0.167%), which was reflective of the division of males and females using the facilities. The mean age was 33.12, with a standard deviation of ± 12.11 .

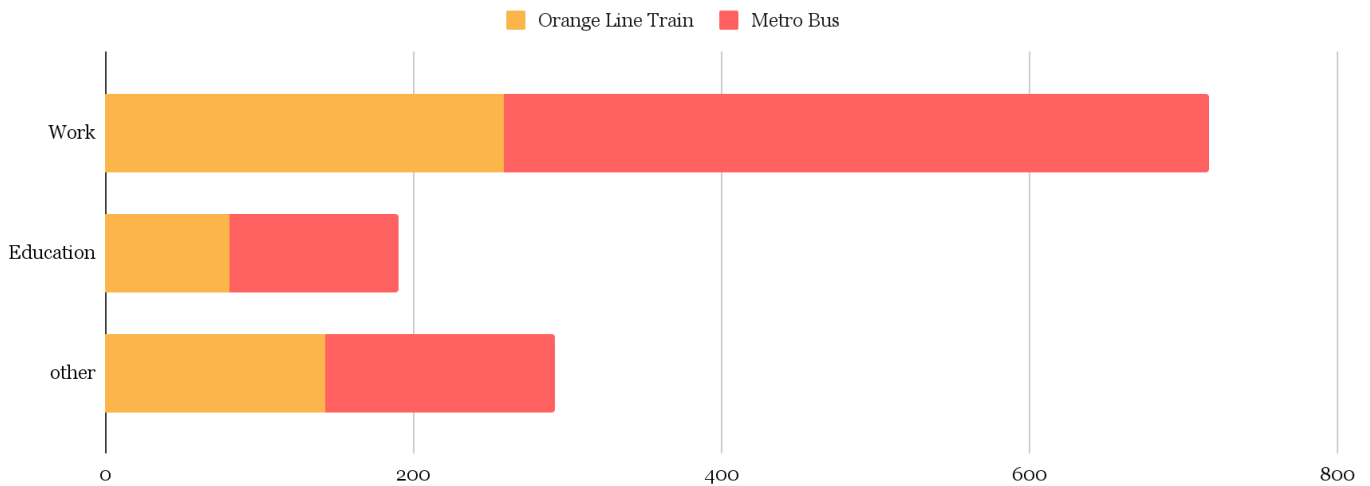
Fig 3: Age of Respondents



4.3 Purpose of travel

Out of the **1200** total respondents, **717 (59.75%)** were traveling in relation to their work, including both traveling from home to their jobs as well as returning to their homes after their work-shift.

Fig 4: Purpose of Travel



4.4 Sustainability of Job

When asking the people who were traveling for work reasons, 567 (79.1%) stated that they used this service daily to commute to and from work. Respondents were then asked whether they would be able to sustain their jobs and keep working the same job that they are if public transport facilities were not present. The results are presented in Table 1.

Table 1

Jobs sustained due to public transport

	Regular Labor Commuters	Job Sustained without Public Transport?	
		yes	no
Metro Bus	351	319 (90.88%)	32 (9.12%)
Orange Line Train	216	128 (59.3%)	88 (40.7%)
Total	567	447 (78.84%)	120 (21.16%)

4.5 People whose jobs were contingent (Group A)

Out of the 567 regular commuters for work, 120 people (21.16%) said they would not be able to commute and hence retain their jobs if public transport facilities were not present or available. This is a statistically significant finding considering a rational worker would only be doing a job that is for their best benefit. To further determine the benefit each of these individuals was deriving, they were surveyed further to determine the extent to which individuals

- i) were earning higher at their new job,
- ii) were more efficient at their new job, and
- iii) were more motivated at their new job

These individuals were also asked about their next best alternative job that they would have worked at, if not for increased geographical mobility. They were then asked about the pay difference between their current and alternate jobs. Afterwards, a scale was presented to them from 0-5 to rate their motivation and skill application in their current job against their alternate job. The results are summarized as follows.

4.5.1: Pay Difference

Table 2

Economic benefit to group A

	Metro Bus	Orange Line Train	Total
Higher Pay?			
Yes	68.75% (22)	76.14% (67)	<u>74.17% (89)</u>
No	31.25% (10)	23.86% (21)	<u>25.83% (31)</u>

These responses showed that out of the total ridership of the OLMRTS and LMBS, 7.46% of riders are people who are participating in higher paying jobs due to the availability of public transport services, which enables them to increase their short-distance geographical mobility.

The respondents were then asked to compare the annual income they earn right now with the annual income they would earn at their next best alternative job. The results are summarized in Table 3.

Table 3

Annual pay difference between current job and alternate job without public transport

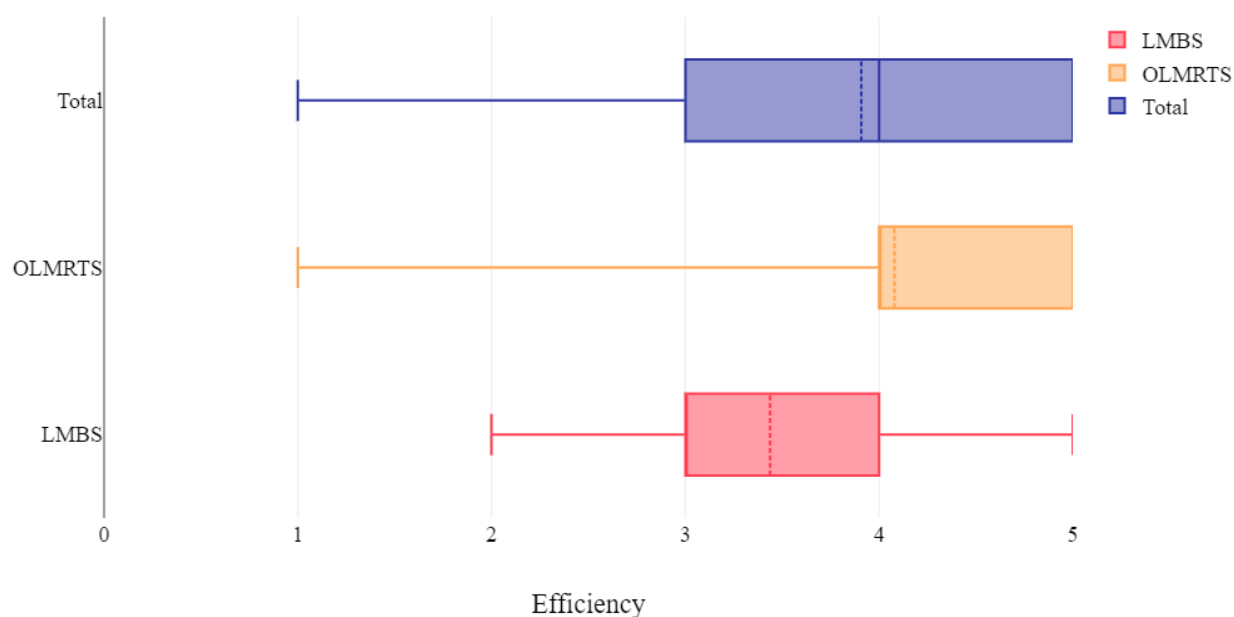
Pay increase	Percentage	Monetary (PKR)
Metro Bus	138.54%	112,375.68
Orange Line Train	137.10%	100,275.84
Public Transport	137.82%	106,325.76

It was calculated that an average laborer who attributes their current job to increased geographical mobility earns an average of 137.82% of what they would earn otherwise; this translates to an extra 106,326 PKR (\$480.01) per year on their income. While this may not seem significant at the individual level, when applied to the total ridership of these services using data from the PMA documents (Attached in the [Appendix](#)), this number translated to an addition of 680,851,283.43 pkr (\$3,073,704.48) into the national income. It is important to keep in mind that these are the calculations from just one city.

4.5.2: Efficiency

When asked to compare their personal skill application in their current job to their next best alternative job, no respondent responded with a '0'. This means that 100% of respondents from Group A were to some degree more efficient in their current job as compared to their next best alternative job. The extent of their efficiency varied and is represented in the below figure.

Fig 5: Efficiency Scale

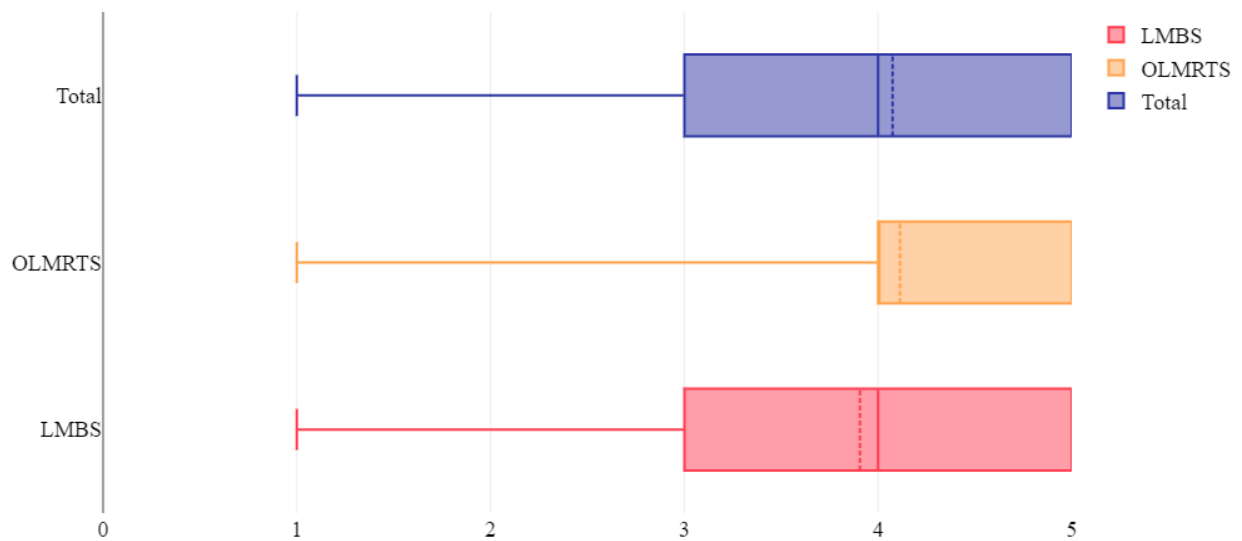


*Mean Efficiency: OLMRTS= 4.08, LMBS: 3.44, Total= 3.76

4.5.3: Motivation

The respondents were also asked to measure the level of happiness and drive they felt while doing their current job as compared to their next best alternative job. Once again, 100% of the respondents felt more motivated at their current job, the extent of which is displayed in Figure 6.

Fig 6: Motivation Scale



*Mean Motivation: OLMRTS= 4.06, LMBS: 3.91, Total= 3.99

4.6 People whose jobs were not contingent (Group B)

For the commuters who did not attribute keeping their job to an increase in geographical mobility due to public transport facilities, they were surveyed on the economic and socio economic benefits that they enjoyed, specifically time saving, cost saving, and comfort. The results are summarized below.

4.6.1: Cost and Time Saving

Table 4

Costs of traveling privately compared to traveling through public transport, answered by group B

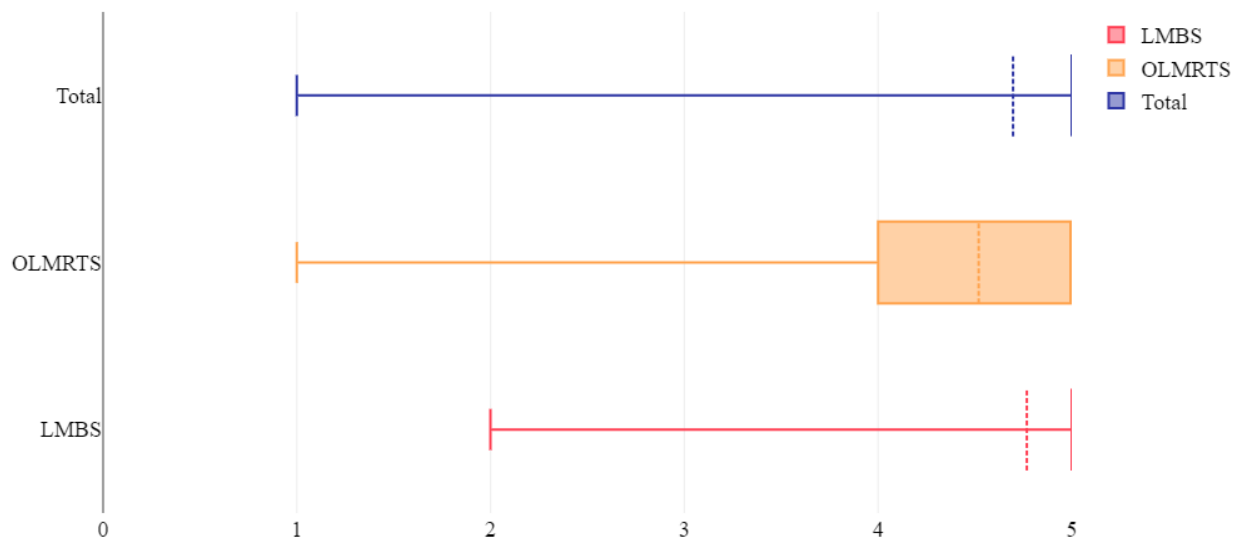
	Money saved transporting via Public Transport		Time Saved Transporting via Public Transport per trip (minutes)
	Savings (pkr)	% of private transport cost spent on public transport	
Metro Bus	3,670.53	33.17%	22.6
Orange Line Train	4,159.38	44.25 %	16.2
Total	3,915.0	38.7 %	19.4

The data demonstrates that any labor using public transport over private transport has to spend only 38.7% of what they would have to spend on private means. This translates into a monthly cost saving of 3,915 PKR (\$17.84) and also saving approximately 19 1/2 minutes per trip (39 minutes daily).

4.6.2: Comfort Rating

The respondents from group B were then asked to compare the comfort of traveling via public transport with the comfort derived while traveling via private transport. All respondents felt that public transport journeys were more comfortable compared to private means. The extent of this is displayed in Figure 7.

Fig 7: Comfort Scale



*Q1 & Q3 are on 5 for 'Total' & 'LMBS'

*Mean Comfort: OLMRTS= 4.52, LMBS: 4.77, Total= 4.64

4.7 Simple Regression Analysis

To analyze closely the relationship between the independent variable (increase in mobility) and the dependent variables, a simple regressive model that adopted the following formula was used:

$$y = \alpha + \beta x$$

The independent variable (increase in mobility) was calculated by using the distance between the station the passenger was getting on at and the station the passenger was getting off at. The distance between two stations was taken as the shortest distance between the two stations available on Google maps.

4.7.1: Group A

Fig 8: % Of Alternate income earned vs Increase in mobility

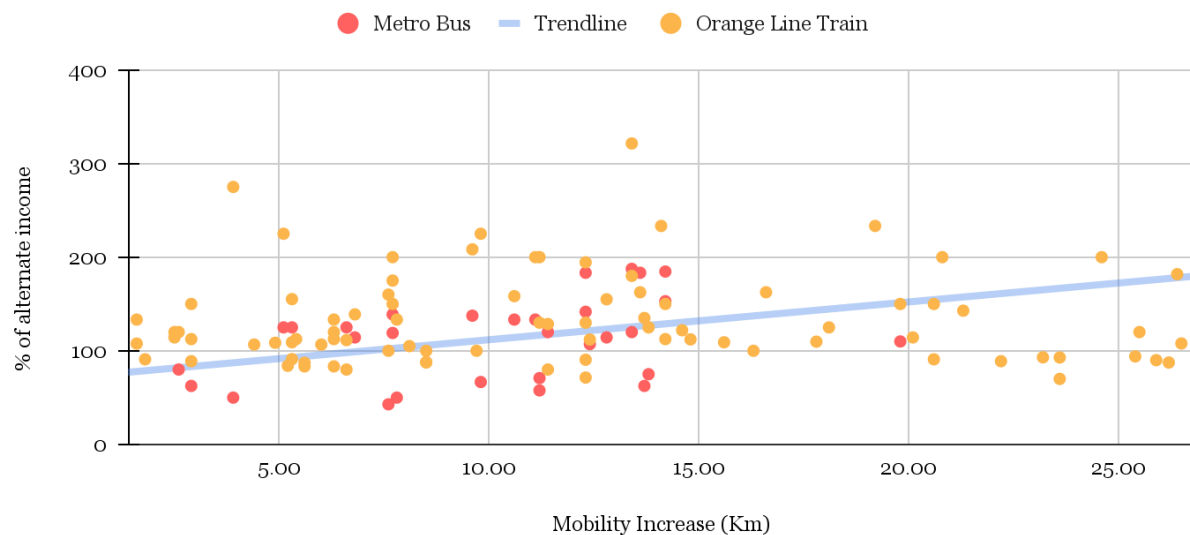


Figure 8 shows a positive correlation between the increase in geographical mobility and an increase in the percentage of alternate income (income earned from the next best alternative job). This explains that labor may be able to earn a higher percentage of their current income due to an increase in their geographical mobility.

Fig 9: Pay difference vs Increase in Mobility

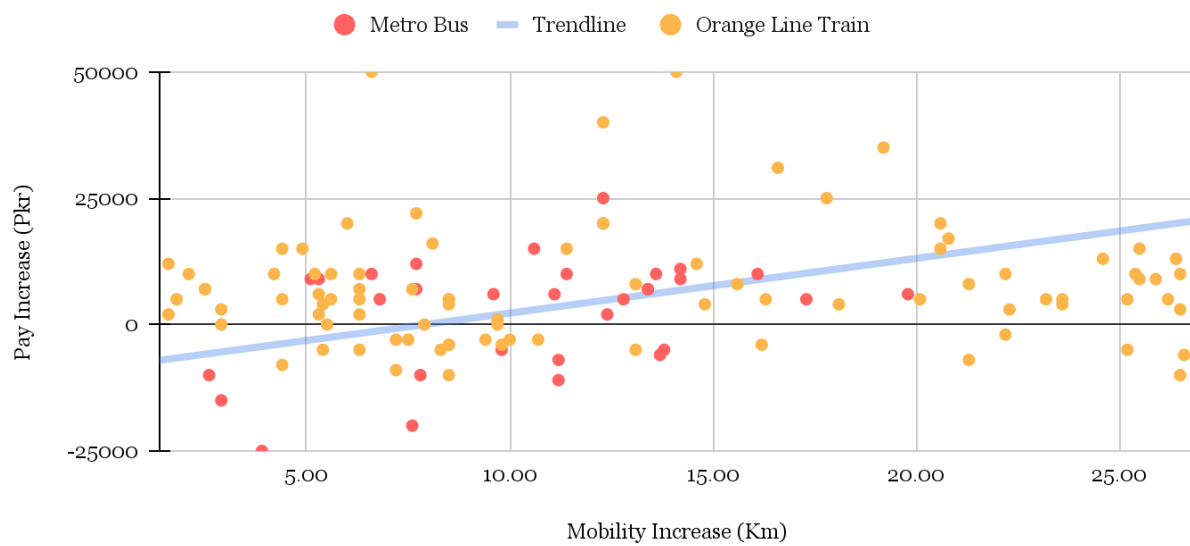


Figure 9 shows the impact on the pay difference between current and alternate jobs measured against the increase in geographical mobility.

While there was a clear correlation in figures 8 and 9, there seemed to be no correlation between an increase in mobility and the efficiency or motivation of labor, as indicated in the following-figures.

Fig 10: Motivation vs Increase in Mobility

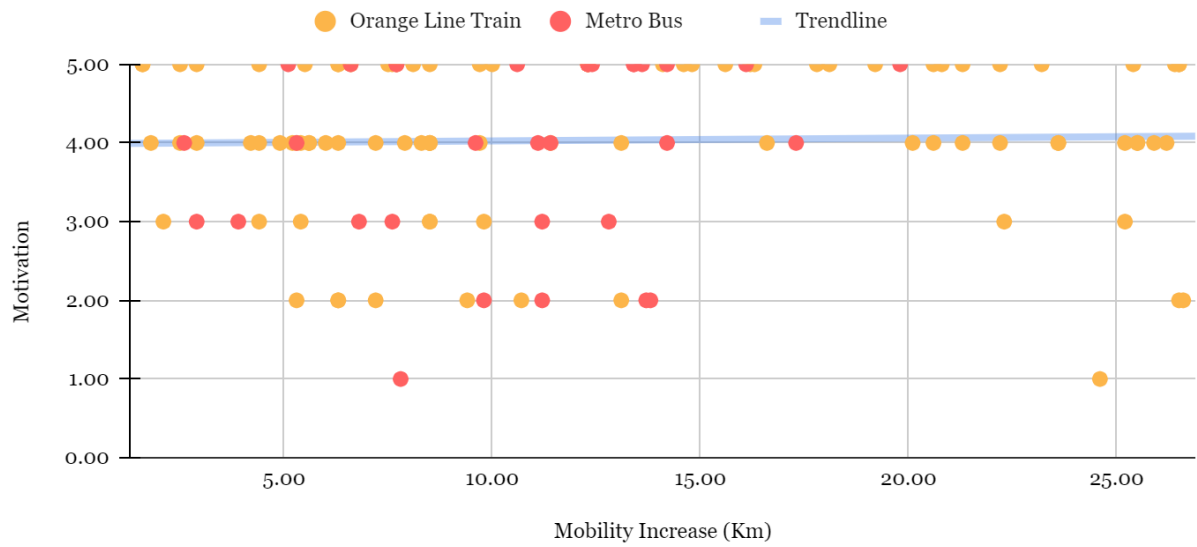
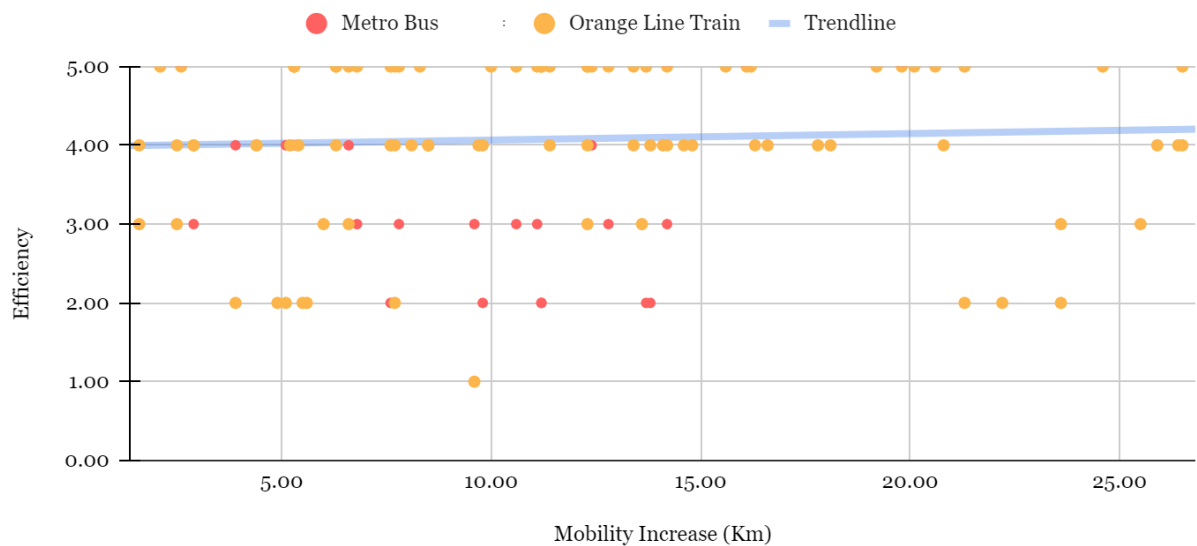


Fig 11: Efficiency vs Increase in Mobility



While respondents did attribute the increase in mobility as the driving force behind an increase in their job happiness and skill application, there did not seem to be much in common between the level of motivation/efficiency they felt with an increase in kilometers of travel distance.

4.7.2: Group B

Group B's fuel cost savings, time savings, and comfort ratings as compared to traveling on private transport were plotted against the independent variable; the graphical representations are presented below.

Fig 12: Monthly Cost saving vs Increase in Mobility

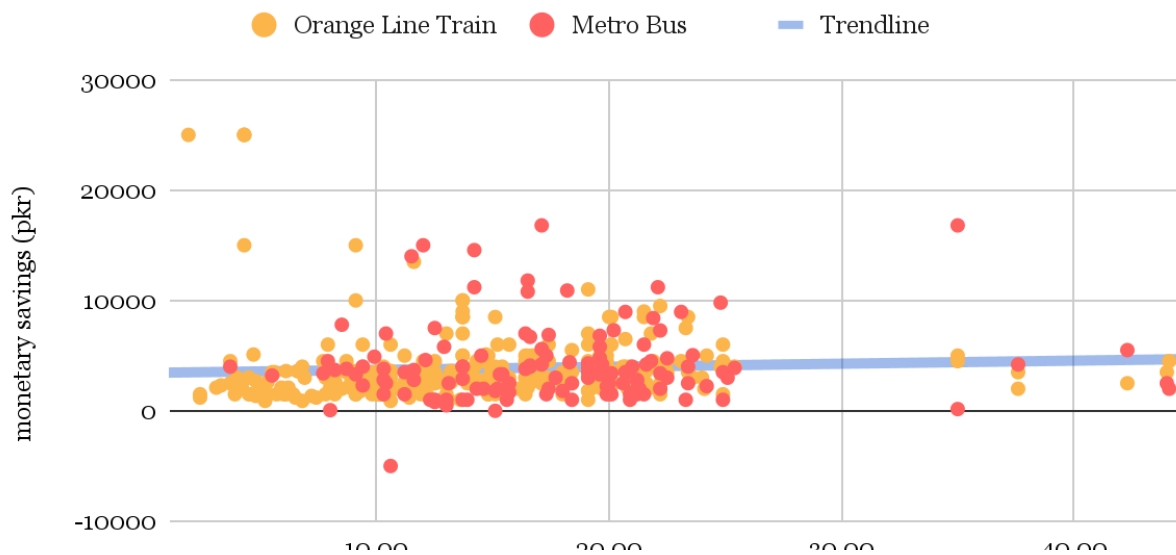
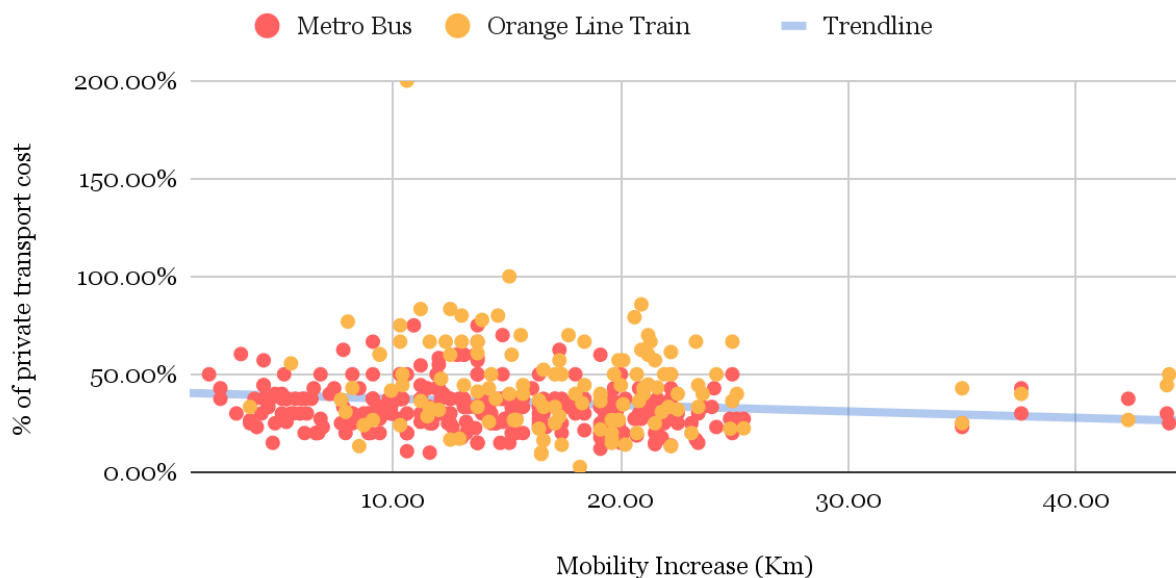
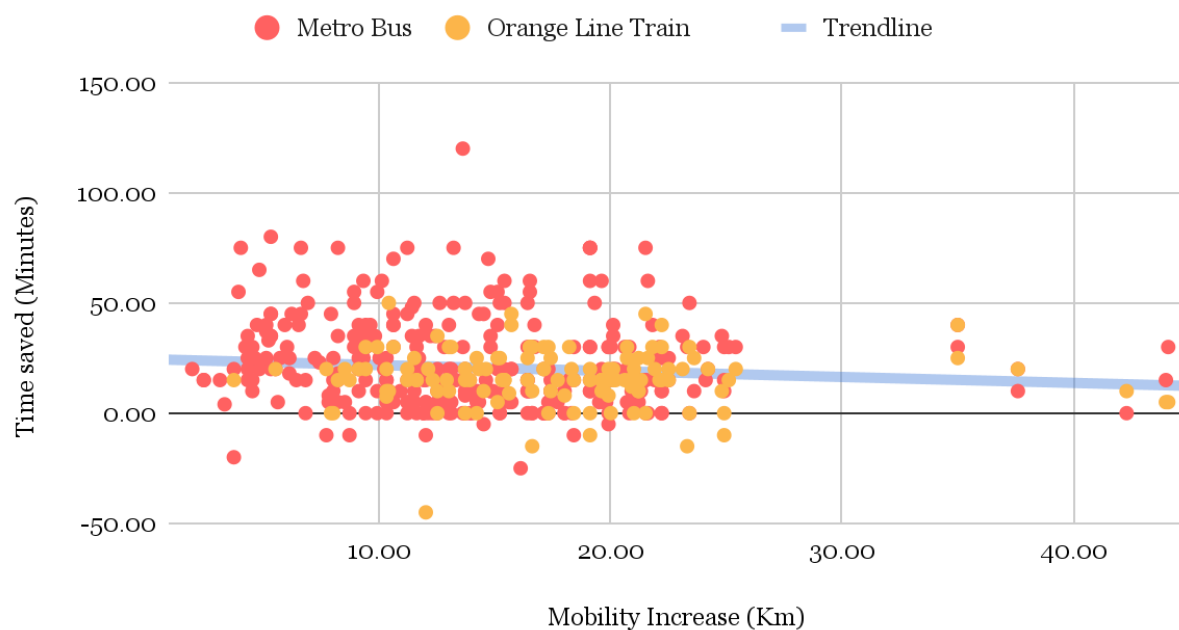


Fig 13: %Of Private Transport cost spent on Public Transport vs Increase in Mobility



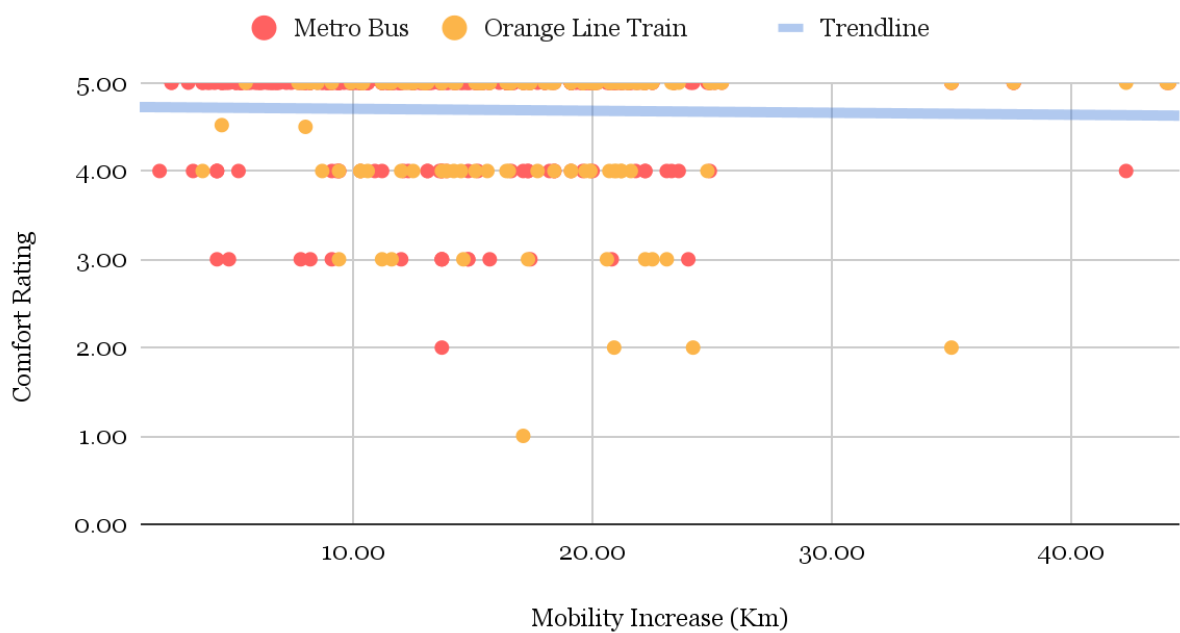
There was a positive correlation between an increase in mobility and an increase in transport cost savings, and there was also a negative correlation between an increase in mobility and the percentage amount of alternate private transport costs being spent on public transport travel. Both these figures (12 and 13) point towards a higher rate of cost savings with increases in labor mobility.

Fig 14: Time saved vs Increase in Mobility



The trendline for time saving was also always positive but at a negative slope, meaning while travelers were saving time using public transport- they were eventually losing time with increments in kilometers of travel.

Fig 15: Comfort rating vs Increase in Mobility



Much like efficiency and motivation scales, the comfort scale also did not have any clear correlation with increments in mobility of labor.

4.8 A Qualitative Outlook

This chapter explains and analyzes the difference in responses using a more qualitative approach, furthermore this chapter also delves into the philosophy and ramifications of public transport and why more people don't use it if it is so beneficial.

4.8.1 Rationality

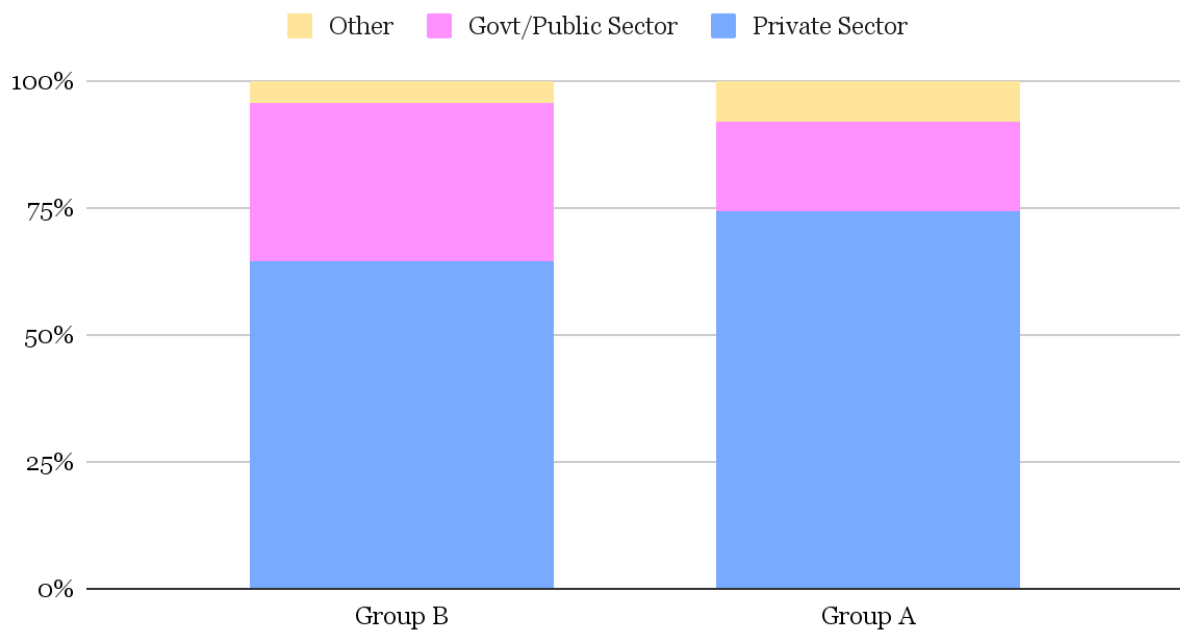
At the start of the research paper we assumed that any rational respondent would only work at a job that is more beneficial to them in terms of monetary, skill, or motivational means. Living in times of uncertainty and total economic distress in Pakistan, many respondents were reluctant to give up their current jobs and even entertain the possibility of an alternate job solely for the sake of job security and procurement. When respondents were reminded that their costs for private transport may exceed the salary that they earn, many respondents were adamant on working for a short-term loss just for the sake of keeping a job. This seemingly irrational behavior does start to become rational once we consider the economic distress and downturn the general populace of travelers have to face in order to get by a day. Many respondents were earning on a daily wage basis and could not afford to even entertain the possibility of not having secure work to do.

Moreover, as Abraham Maslow stated in his research about human motivation and the hierarchy of human needs, *"the most prepotent goal will monopolize consciousness and will tend of itself to organize the recruitment of the various capacities of the organism. The less prepotent needs are minimized, even forgotten or denied. But when a need is fairly well satisfied, the next prepotent ("higher") need emerges, in turn to dominate the conscious life and to serve as the center of organization of behavior, since gratified needs are not active motivators. Thus man is a perpetually wanting animal"* (Maslow, 1958, pp 26-47). Once a worker has satisfied their basic physical needs, the desire for a higher pay may diminish, and the worker is more motivated towards other needs in life such as self actualization. This may describe why certain people were willing to take on lower-paying jobs or were willing to spend some time with a negative net income.

4.8.2 Nature of Job

A commonly identified factor about why many people were not willing to give up their jobs was that a majority of them were working government jobs. Most of these were workers in the public health sector or lawyers who did not have many alternatives for themselves and therefore were bound to their jobs. Moreover, there is/are a certain level of respect, prestige, and perks associated with having a government job, which makes them more reluctant to leave their job and be associated with an alternate private job. This disparity is evident in the figure below.

Fig 16: Employment sector of Group A & Group B



Group B had a higher percentage of government employees which made them reluctant towards quitting their jobs.

5.0 Conclusion

The research showed a clear linkage between spatial mismatching and low wages, skill application and motivation of workers. Moreover the regression analysis showed that the effects worsened as the distance between housing location and work location increased.

We found that 21.16% of regular commuters for work are only able to keep their current jobs due to the availability of higher geographical mobility. Furthermore, we found that these people were, on average, on a scale of 0-5, 3.76 more efficient and 3.99 more motivated in their current jobs as compared to their next best alternative job. More significantly, we found that an individual in this group is able to earn an average of 106,325.76 PKR extra on their annual income, an increase of 37.82%. This provides compelling evidence on how public transport systems in Lahore have diminished the detriments of spatial mismatching.

The research also provided evidence as to how public transport was able to diminish the costs incurred due to spatial mismatching for the people who did not necessarily attribute retention of their current job to public transport. These people saw themselves spending an average of 38.7% of what they would be spending otherwise in order to commute, translating to an annual saving of 46,980PKR. These people also saw themselves saving 155.2 hours annually and enjoying a mean ride comfort of 4.64 (on a scale of 0 to 5) as compared to traveling on private transport.

5.1 Policy Takeaways

With the LMBS and OLMRTS being relatively new projects they have already started showing promise in amending the detriments of spatial mismatch by providing rapid transit to workers in and outside of Lahore. While this paper is no cost benefit analysis it provides a key takeaway in showing how public transport systems are a viable solution to extend opportunities to lesser developed areas in providing them with more fruitful job opportunities. Extending beyond the boundaries of this research it is also very key to observe the access that is enabled to not only job opportunities but advanced technology and better education, key factors in the long term development of a country.

The government should consider implementing such projects in other areas of Pakistan, especially in Balochistan to connect lesser developed areas to cities like Quetta and Gwadar (which are relatively more economically stimulating). As noted in Pillar VII of the 'Pakistan 2025' document presented by the Ministry of Planning and Development, greater regional connectivity is cardinal in stimulating such economic growth.

6.0 Limitations of the study

Firstly, with a team of over 8 field researchers, it is hard to completely exterminate researcher bias. The team was not very experienced or qualified, as all interns were highschool students. It is important to take into account the misunderstandings that could arise with the questions and their interpretations. Even though the team was thoroughly briefed on the survey, there is still a possibility of false interpretation and researcher bias seeping in.

Moreover, the study was conducted during only one month of the calendar year, and to improve the reliability of responses, it could be conducted over at least a span of a year. The research was also not conducted during the full hours of public transport service (6AM-10PM) and to produce more accurate responses, data should have been collected at all times.

Furthermore, on the questions where respondents were asked to give an answer on a scale of 0 to 5 (efficiency, motivation, and comfort), the respondents may have felt a subconscious obligation to not choose 0, and they may have chosen the lower range of numbers instead to represent their disapproval when this was not the case and was communicated to them. However, we still understand that this may be a possible limitation that undermines the results.

Lastly, the opportunity cost of fuel and salaries were estimates made by people as there was no possible way to calculate them otherwise. So these calculations in the paper are by no means exact figures, but rather may be the closest representation of what the real figures would look like.

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Acknowledgements

- **Project Coordinators:** Nawal Waseem & Muhammad Abdul Rehman
- **Research Interns:** Dua Anwaar, Khadija Riyad, Maryam Habib, Raiena Saqib, Saria Nadeem, Rayan Umer, & Zeeniya Mehdi
- **Staticians:** Abdullah Muzaffar, Yahya Liaqat, Ahmed Aziz

Appendix

- [Survey Responses and Questionnaire](#)
 - [PMA ridership accounts](#)
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