THE ECONOMIC FACILITATING ROLE OF PASSENGER TRANSPORT IN SOUTH AFRICA

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ABSTRACT

Previous research that explored the economic facilitating role of passenger transport used one or two transport proxies to do so, and mostly reported their findings at country level, providing little insight into this relationship within a country. This paper addresses this knowledge gap as it discusses the facilitating role of public and private passenger transport for economic activity in metro, urban and rural areas in South Africa, with specific emphasis on the greater Cape Town region. Economic activity data was obtained from the StepSA 2018 dataset in the form of Gross Value Added index values per mesozone. Passenger transport data was obtained from the National Household Travel Survey 2020 dataset, with a sample size of nearly 150 000 South African respondents, to extract data of multiple passenger transport proxies including: (i) Travel time to five destinations (work, education, grocery and other shops and public transport); (ii) Travel cost to two destinations (work and education); and (iii) Access to private motorised transport. Spatial mapping, means analysis and correlation analysis were performed to demonstrate the relationship between economic activity and passenger transport travel behaviour. This required the disaggregation of the NHTS 2020 dataset to create detailed maps depicting passenger transport travel behaviour in South Africa, a first of its kind. Using the aforementioned analysis and data, this paper concludes the following: (i) The relationship between economic activity and travel time is moderately inverse but differs based on travel destinations; (ii) The relationship between economic activity and travel cost to work and education is direct and likely attributable to better paying jobs and education located in metros and urban areas; (iii) The relationship between economic activity and access to private motorised vehicles is direct and the strongest in metros. This paper proposes that South African authorities prioritise passenger transport investments in an effort to reduce travel cost in metros as this investment will yield greater economic activity returns compared to investments in an effort to improve travel cost in urban and rural areas or travel time or transport access to private motorised vehicles.

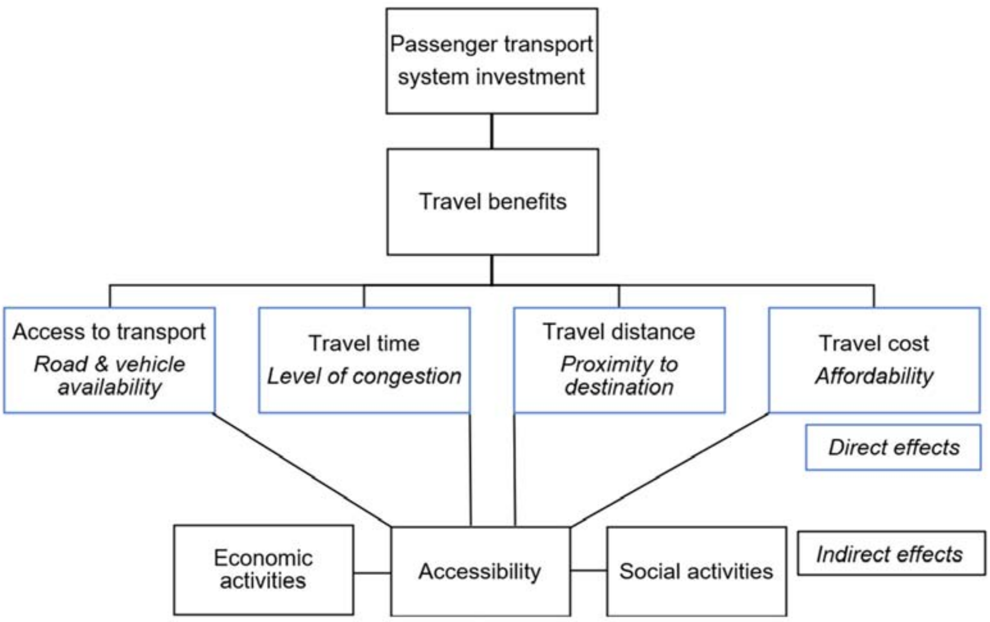
1. INTRODUCTION

The economic facilitating role of transport has been emphasised by politicians, academics, and commuters. The previous Minister of Transport for South Africa said: "Transport in South Africa is central to trade, the economy and social stability." (Mbalula, 2020). Accordingly, governments have invested substantially in (selected) public transport systems and an extensive road network. However, merely supplying roads and public transport services do not transpire into economic activity when this supply is not utilised. Transport has a derived demand. Therefore, if the demand for workers and the supply of job opportunities or skilled workers is low (as in South Africa), the demand to transport people to places of employment is low. Moreover, if the demand for consumer goods and the supply of stores which sells these goods is low, the demand to transport people to stores is low. Therefore, the economic facilitating role of transport should not be assumed without taking into consideration the extent to which the transport infrastructure (supply) is utilised (demand). Nevertheless, many have researched the economic facilitating role of transport by comparing economic growth with length of road network or length of public transport network (transport infrastructure supply). It is proposed that travel behaviour also be considered to better understand the economic facilitating role of transport.

This paper aims to understand the economic facilitating role of passenger transport per geographical area type (i.e., metro, urban, rural) in South Africa by incorporating travel behaviour. Its method includes maps detailing recent passenger travel behaviour data regarding travel time, travel cost and transport access in South Africa by disaggregating 2020 National Household Travel Survey data. Further to visual analysis, correlation analysis is conducted to identify the direction, strength and significance of the relationship between economic activity and multiple passenger transport proxies. The intention is to assist authorities to move towards effective passenger transport investment strategies to improve economic activity in their jurisdictions.

2. REVIEW OF RELEVANT RESEARCH

Passenger transport systems (infrastructure, operations and services) provide people with the *opportunity* to participate in economic activities for transactions between producers and consumers, employers and employees to take place (Tüzemen & Lögün, 2018; Kirkpatrick & Parker, 2004). Figure 1 illustrates the effects of passenger transport system investments on travel benefits and its corresponding economic benefits. Travel benefits such as improved access to transport, shorter travel times and distances, and lower travel costs are some of the direct effects of passenger transport system investments (Milewski & Zaloga, 2013). These direct effects indirectly improve accessibility to participate in economic and social activities.



Source: Adapted from Milewski and Zaloga (2013)

Figure 1: Effects of passenger transport system investment for economic acceleration

The following sub-sections provide a summary of relevant research that explored the impact of improved travel benefits on economic activity.

2.1 Access to Transport

Several studies have researched the relationship between economic activity (or economic growth) and access to transport (Korytarova et al., 2018; Deboosere et al., 2018; Jiang et al., 2017, among others). These studies used proxy variables of access to transport such as road or rail length, road density or road quality. A recurring finding from the observed fifteen studies is a direct relationship between economic activity and road or rail length, road density or road quality with a correlation coefficient ® ranging from .46 to .60 ($p<.05$) but with limited causality observed. Comparing the results of developed countries in Europe (Amairia, 2017; Kusideł & Górniak, 2012) with that of developing countries in Sub-Saharan Africa (Boopen, 2006; Njoh, 2000) indicates a stronger relationship between economic activity and access to transport in developed countries than in developing countries. The question is whether this finding applies to the context of urban (developed) versus rural (developing) areas within a country.

2.2 Travel Time and Distance

Many studies have used proximity to work as proxy to explore the relationship between economic activity and travel time or travel distance (Gibbons et al., 2019; Smart & Klein, 2015; Ozbay et al., 2006, among others). A recurring finding from the observed ten studies suggest an inverse relationship between travel time or travel distance to work, and employment participation. Of significance is a study conducted by Johnson et al. (2017) in urban and rural Britain. Johnson et al. found that a 10% reduction in public transport travel time of commuters can lead to an increase in employment of 0.13% in rural areas and 0.30% in urban areas. This implies that the inverse relationship between travel time to work and economic activity is stronger in urban areas compared to rural areas, at least in Britain.

In South Africa, van der Merwe and Krygsman (2020) used correlation analysis to investigate the influence of travel distance on employment duration. They found that employment duration, specifically for lower-income workers, is negatively affected by travel distance ($r=-.02$; $p<.05$). However, a positive relationship between travel distance and employment duration, specifically for high-income workers was found ($r=.03$; $p<.05$). This may be because of higher-income individuals, predominately private car users, monetary ability to access more, and a greater choice of employment opportunities by private motor vehicle (van der Merwe and Krygsman, 2020). This direct/inverse relationship difference observed between travel distance and employment duration among different South African income groups gives rise to the argument that the relationship between travel distance and economic activity may differ among geographic area types. This is because the average household income in South African metropolitan areas is typically greater than in urban areas followed by rural areas.

Absent from relevant South African research is insight into the relationship between economic activity and travel distance or time to destinations *other than work*, such as grocery stores and educational institutions. Travel time, particularly in metros, is of interest as it is arguably a better travel behaviour indicator compared to travel distance as it factors in congestion as well as the full journey time for public transport users (first and last mile travelling, waiting time and transfer time).

2.3 Travel Cost

The potential to achieve full economic and social benefits of transport is more attainable when passenger transport services are affordable (Rodrigue, 2020). South Africans spend 17% of household expenditure on travel costs, well in excess of the 10% national benchmark (Statistics South Africa, 2017). If South Africans were to spend only 10% on passenger transport, the question arises of what the remaining 7% would be spent on. In this regard, a niche study by Ferdous et al. (2010) provides insight into the aforementioned question, but in the context of the United States of America (USA). Using a multiple discrete continuous nested extreme value model, Ferdous et al. predicted the change in the expenditure patterns of USA households in response to doubling travel (fuel) cost. The model predicted that an increase in household fuel expenditure will result in a significant decrease in vehicle purchases, grocery, and education expenditure, combined with an increase in public transport expenditure, implying a modal shift. These results suggest an inverse relationship between travel cost and economic activity. Accordingly, cheaper travel cost in South Africa may result in more money available for other types of household expenditures than travel expenditure. These could potentially include increased education and grocery expenditure with consequent economic benefits resulting from increased supply of and demand for products and services, differentiated per income group.

The remainder of this paper explores the extent to which travel cost, time and access to transport affect economic activity in each type of geographical area in South Africa. Therefore, this paper contributes to the knowledge of the facilitating role of passenger transport for economic activity in South Africa.

3. METHODOLOGY

3.1 Data and Objectives

The data for this paper was sourced from the National Household Travel Survey (NHTS) of 2020, provided by Statistics South Africa (Stats SA), and the StepSA dataset of 2018, provided by the Council for Scientific and Industrial Research (CSIR). The prior contains travel behaviour data, covering all passenger transport modes, and socio-economic data of a large sample size (145 385) of South Africans with whom interviews were conducted pre-pandemic. The latter dataset contains economic activity data, expressed in Gross Value Added (GVA) index values, for South Africa. Usually, GVA is used as a basis for making estimates of *regional* economic activity (van Huyssteen et al. (2018). It is broadly similar to what is more generally known as Gross Geographic Product (GGP). In essence, GVA is equal to compensation of employees plus gross operating surplus.

The spatial unit of analysis of the two datasets differ. While the published NHTS 2020 dataset does not disclose the addresses where interviews were conducted, it does indicate the Transport Analysis Zone (TAZ) and the geographic area type (i.e. metro, urban and rural) within the TAZ where interviews were conducted. Similar but smaller than provincial and municipal boundaries, TAZs are small area subdivisions, as determined by Stats SA, totalling at 384 TAZs unequal in area size. The StepSA 2018 dataset presents economic data (GVA) at Mesozone level. Mesozones are smaller than TAZ area subdivisions, as determined by the CSIR, totalling at 25 041 Mesozones relatively equal in area size at 50 km^2. The multiple area unit problem is addressed in the proceeding sub-sections.

The objective of this paper is two-fold. First, to visually compare economic activity with multiple passenger transport proxies related to travel behaviour (i.e., travel time, cost, and transport access) in South Africa using spatial mapping. The purpose of this objective is to obtain an initial understanding of the relationship between economic activity and passenger transport using maps. The second objective is to report on the findings of correlation analysis that explores the aforementioned relationship statistically.

3.2 Data Disaggregation Process: Maps

Disaggregation of the NHTS 2020 dataset from TAZ level to Mesozone level was required for spatial mapping purposes (objective 1). This entailed a two-step process. Firstly, Mesozone and TAZ shapefiles were overlayed in ArcGIS. The Mesozone shapefile depicts the demarcation of South Africa into a grid of 25 041 spatial units called Mesozones. The TAZ shapefile depicts the demarcation of South Africa into a grid of 384 TAZs. An overlay of these two shapefiles (Figure 2) identified the multiple Mesozones that reside within each TAZ. For example, Figure 2 illustrates that Mesozone 2017_00001 resides within TAZ 9007.

Source: Author (adapted from van Huyssteen et al., 2018, and Statistics South Africa, 2021)

Figure 2: Grid overlay of Mesozones and Transport Analysis Zones

Next, NHTS 2020 data was assigned to Mesozones. This process is explained by means of Table 1 using a simplified hypothetical example. Firstly, the mean value of the observations of a passenger transport proxy was determined for each geographic area type TAZ pair. For example, the mean value of travel time to work reported by respondents in the geographic area type TAZ pair '9007 Metro' is 45 minutes. This mean value was proportionately allocated to all Mesozones that reside within the relevant geographic area type TAZ pair. For example, Mesozones 2017_00001 and 2017_00002 reside within 9007 Metro. Hence, the travel time to work in those two Mesozones is assumed to be 45 minutes, as shown in Table 1.

Table 1: Disaggregation of 2020 NHTS dataset from TAZ to mesozone

NHTS 2020 Dataset Extract (simplified)				Disaggregated Dataset	
Person unique identifier	Transport Analysis Zone (TAZ)	Geographic area type within TAZ	Travel time to work	Travel time to work: geotype TAZ mean	Mesozone
16010001	9007	Metro	50	45	2017_00001 2017_00002
16010002	9007	Metro	40		

Source: Author developed

3.3 Data Aggregation Process: Correlation

Aggregation of the StepSA 2018 dataset was required for correlation analysis (objective 2). As mentioned, the StepSA 2018 dataset contains economic activity data, measured by GVA index values, and presented at Mesozone level. However, with the NHTS 2020 (transport) data aggregated to the spatial level of geographic area type TAZ pairs (through process 3.2), the next step was to aggregate the economic activity data from Mesozone level to geographic area type TAZ pairs as well. To do this, the proportionate sum of GVA was calculated per geographic area type TAZ pair (Table 2). For example, the proportionate sum of GVA in the geographic area type TAZ pair ‘9007 Metro’ is 2600, as shown in Table 2.

Table 2: Aggregation of 2018 StepSA dataset from Mesozone to TAZ

2018 StepSA Dataset Extract (simplified)				Aggregated Dataset	
Mesozone	Transport Analysis Zone (TAZ)	Geographic area type of mesozone	Gross Value Added (GVA)	Travel time to work: geotype TAZ mean	GVA: geotype TAZ sum
2017_00001	9007	Metro	1400	45	2600
2017_00002	9007	Metro	1200		

Source: Author developed

4. RESULTS AND INTERPRETATION

4.1 Visual Analysis

Maps in this section depict economic activity and travel behaviour, including travel time and travel cost by private and public transport, and access to private motorised vehicles, in South Africa for all income groups. The purpose of this section is not to establish the strength of the relationship between economic activity and travel behaviour in South Africa. Instead, the purpose of visually analysing the maps presented in this section is to provide an initial understanding of the direction of the relationship (direct or indirect) between economic activity and travel behaviour in South Africa.

Economic activity is expressed as GVA index values per Mesozone as provided by the StepSA 2018 dataset. Figure 3 shows the spatial variation in economic activity across South Africa while Figure 7 illustrates economic activity for the greater Cape Town region. These figures show that metros are the largest generators of economic activity. This is illustrated by the green areas on Figure 3, including metro areas such as Cape Town, Gqeberha, East London, Durban, Johannesburg, and the Cape Town city core in Figure 7. Despite covering less than 2% of national land area, these and other metros account for 58% of economic activity as measured by the share of national GVA. Urban areas account for a substantial but smaller percentage of economic activity (25%) as highlighted by mostly blue areas in Figures 3 and 7 including urban areas such as Stellenbosch, Mthatha and Welkom. In contrast and despite covering 95% of national land area, rural areas account for only 17% of economic activity. This is illustrated by mostly orange and red areas in the two economic activity maps presented in this section.

Travel behaviour is expressed using various maps that depict travel time, travel cost and access to private motorised vehicles per Mesozone based on the disaggregated NTHS 2020 dataset (refer to section 3.2 for disaggregation methodology). Figures 4 to 6 show the spatial variation in travel time, travel cost and access to private motorised vehicles across South Africa while that of the greater Cape Town region is shown in Figures 8 to 10. Noticeable on these maps is the exclusion of some South African areas which is due to limited area participation in the NHTS 2020.

A visual analysis of the transport-related and economic-related maps reveal a seemingly inverse relationship between economic activity and travel time, a direct relationship between economic activity and access to transport, while the direction of the relationship between economic activity and travel cost seems unclear. Metro and urban areas perform better economically and perform better in terms of the ability to reach various destinations each within 20 minutes and access to private motorised vehicles, when compared to rural areas. Some exceptions apply as can be seen in the rural areas of south of Vryburg and north of Gqeberha. In these areas, relatively low economic activity is observed despite relatively low travel time and high levels of access to private motorised vehicles. A possible explanation for these exceptions is linked to unemployment. For example, 71% of the surveyed NHTS 2020 respondents who reside north of Gqeberha (blue area in Figure 4) are unemployed of which 61% want to remain unemployed. As such, while economic activities and transport to access economic activities may be nearby (within 20 minutes of travel time), factors such as willingness to work and skilled labour is required for economic development to transpire.

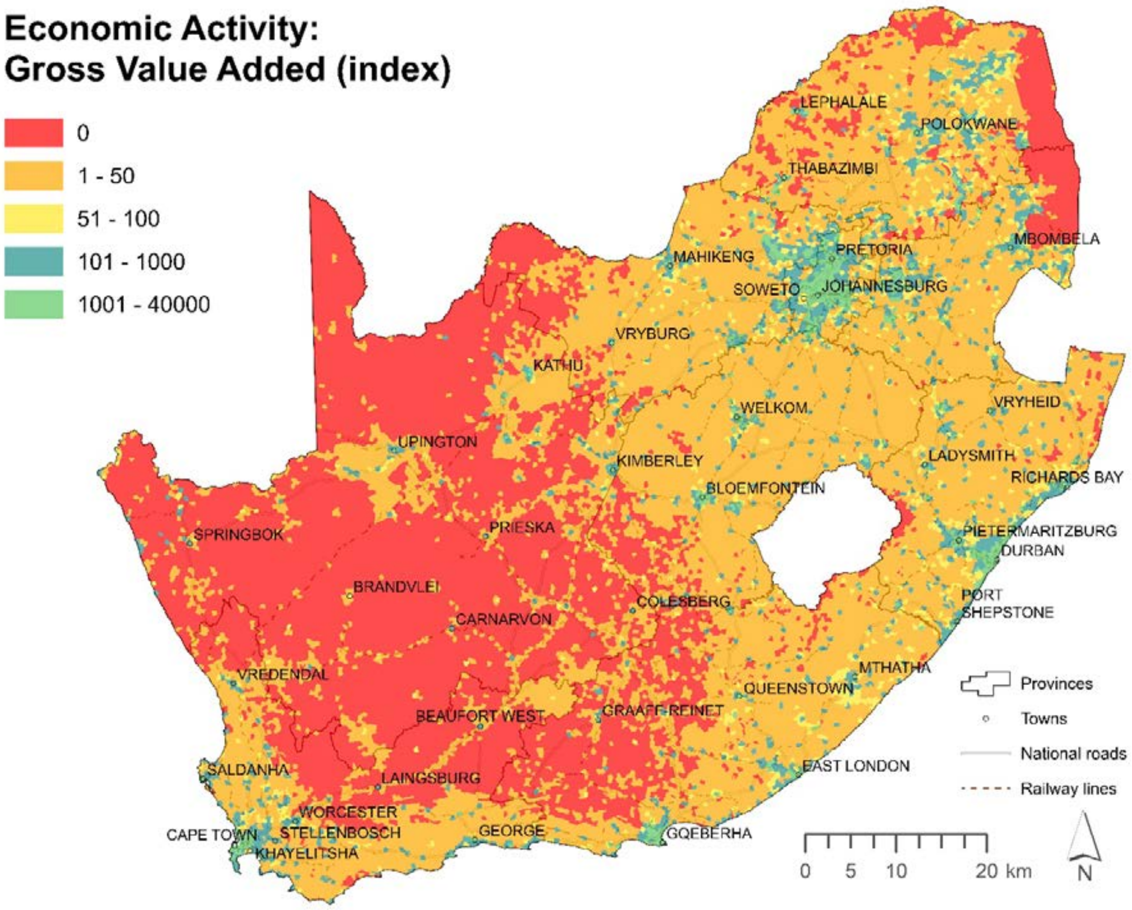
Based on visual analysis, the direction of the relationship between economic activity and travel cost to work and education in South Africa is unclear. Intuitively, low travel cost to work and educational institutions promote high levels of economic activity. Therefore, an inverse relationship between economic activity and travel cost to work and education is expected. High travel cost to work discourage the unemployed to seek employment and learners to seek education. Analysis of the NHTS 2020, found that 2.62% of those surveyed did not work in the past week before being surveyed due to high travel cost. Examples of the intuitive inverse relationship between economic activity and travel cost to work and education is observed in the metro area of Gqeberha, the urban areas of Upington and Worcester, and the rural area south of Laingsburg.

Conversely, a direct relationship between economic activity and travel cost is observed in the metro area of Johannesburg, the urban areas adjacent to the Cape Town city core and the rural areas adjacent to Springbok and Vredendal. Contributing to high travel costs in the Johannesburg metro, is population density. For the urban areas outside of the Cape Town city core (Bellville, Durbanville and Brackenfell), travel distance between these areas and the city core contribute to high travel cost. Often, residents in the urban areas outside of the Cape Town city core travel 30 to 50 kilometres by private motorised vehicle to attend better paying jobs and educational institutions in the city core. In some rural areas, such as those adjacent to Springbok and Vredendal, low travel cost to work and education may coexist with low economic activity where agriculture is the key economic sector of the rural area. In these areas, work, residence and sometimes education are all located on the same farm. Therefore, low travel cost to work and education may occur in some rural areas. The direct/inverse relationship difference observed between travel cost and economic activity among geographic area types highlight the need for further statistical analysis.

The visual analysis presented in this section suggests some relationship between economic activity and travel behaviour including travel time, travel cost and access to private motorised transport.

The following hypotheses are derived:

i) The relationship between economic activity, measured by GVA, and trip travel time, measured in minutes to various destinations, is indirect.
ii) The relationship between economic activity and transport access, measured by access to private motorised vehicles, is direct. These hypotheses, together with the unclear relationship between economic activity and travel cost to work and education, are further explored through correlation analysis.



Source: Author developed

Figure 3: Economic activity

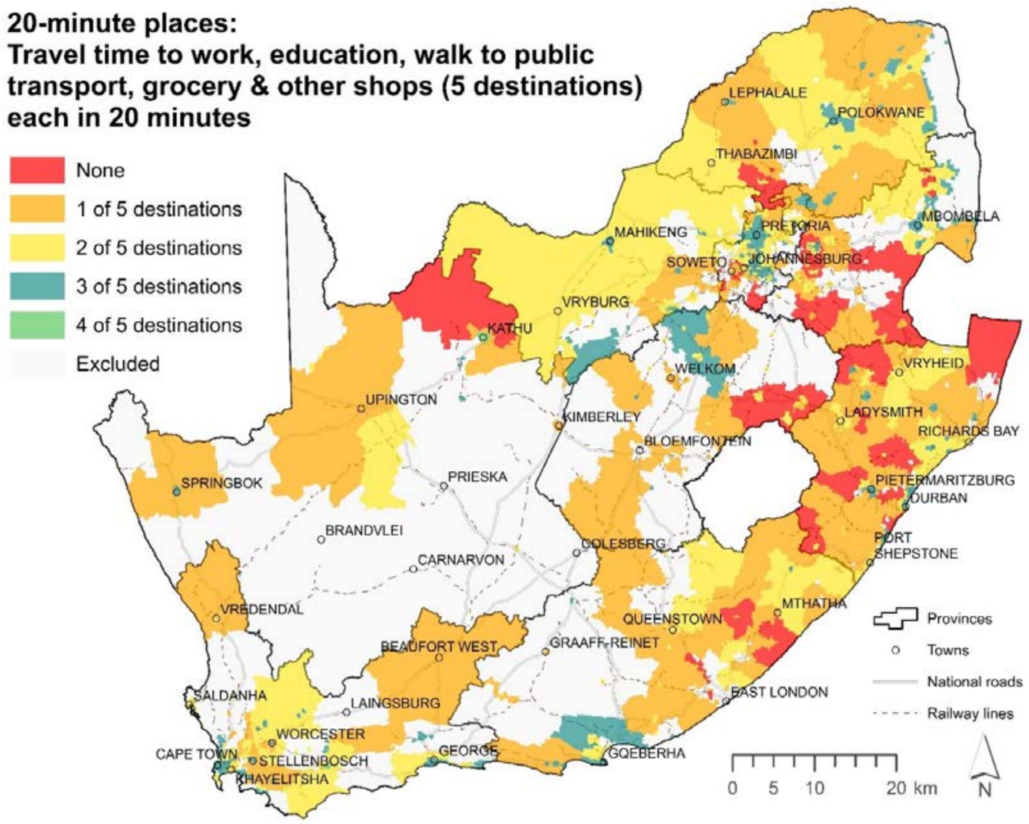


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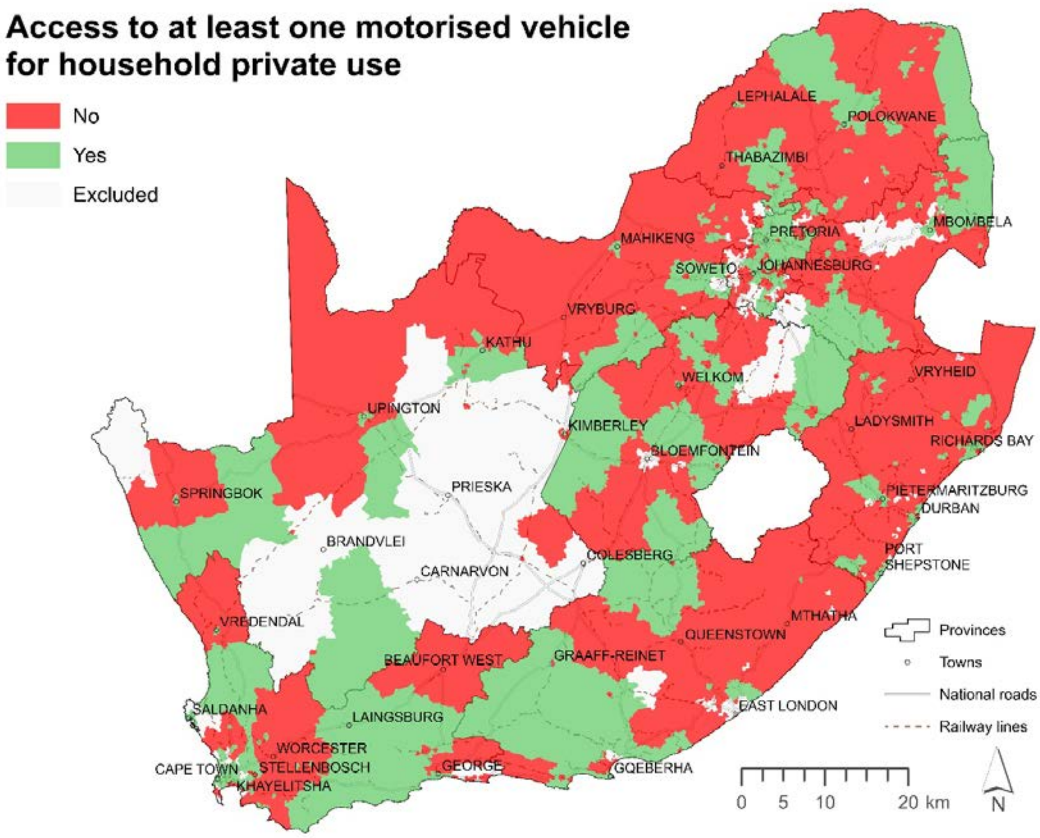
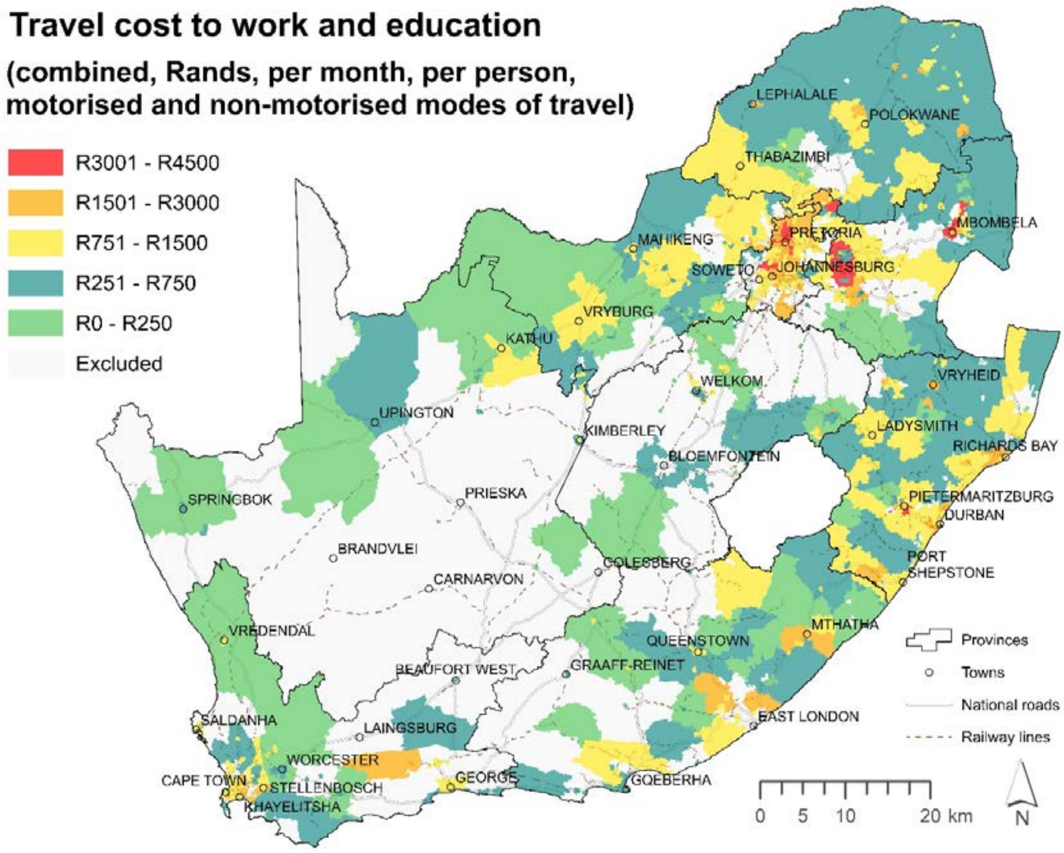
Figure 4: Travel time



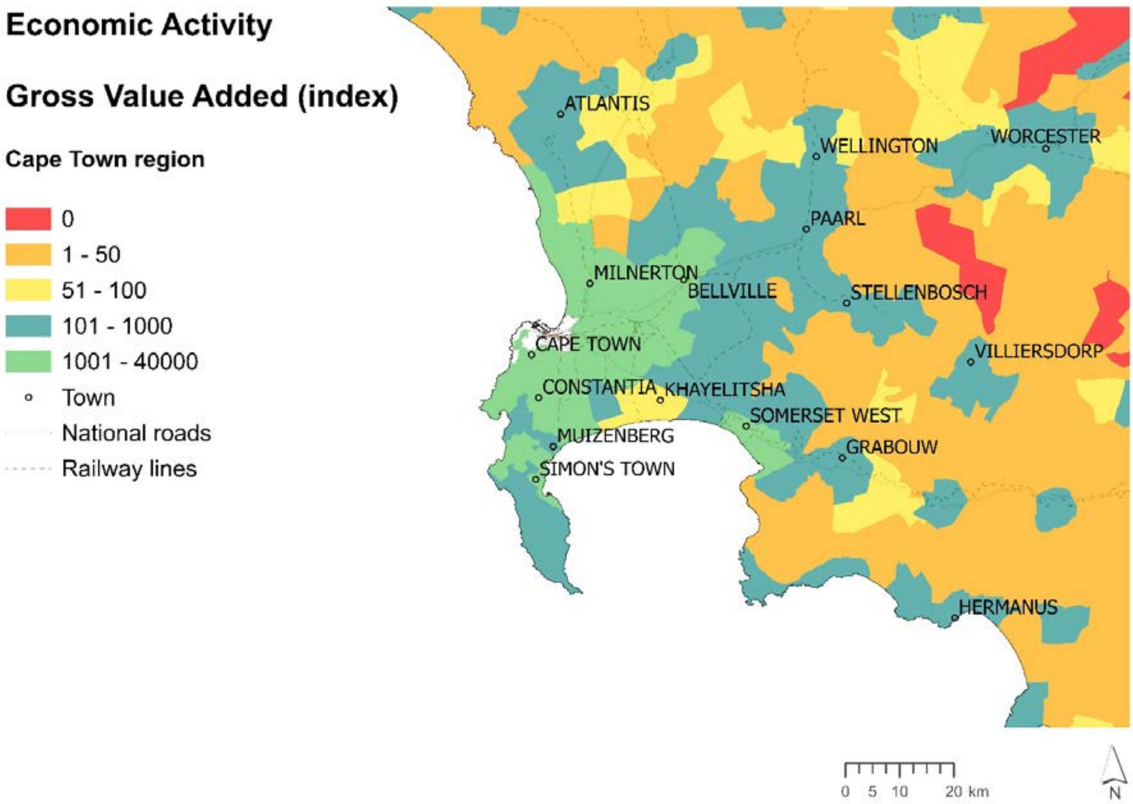
Source: Author developed

Figure 5: Transport access



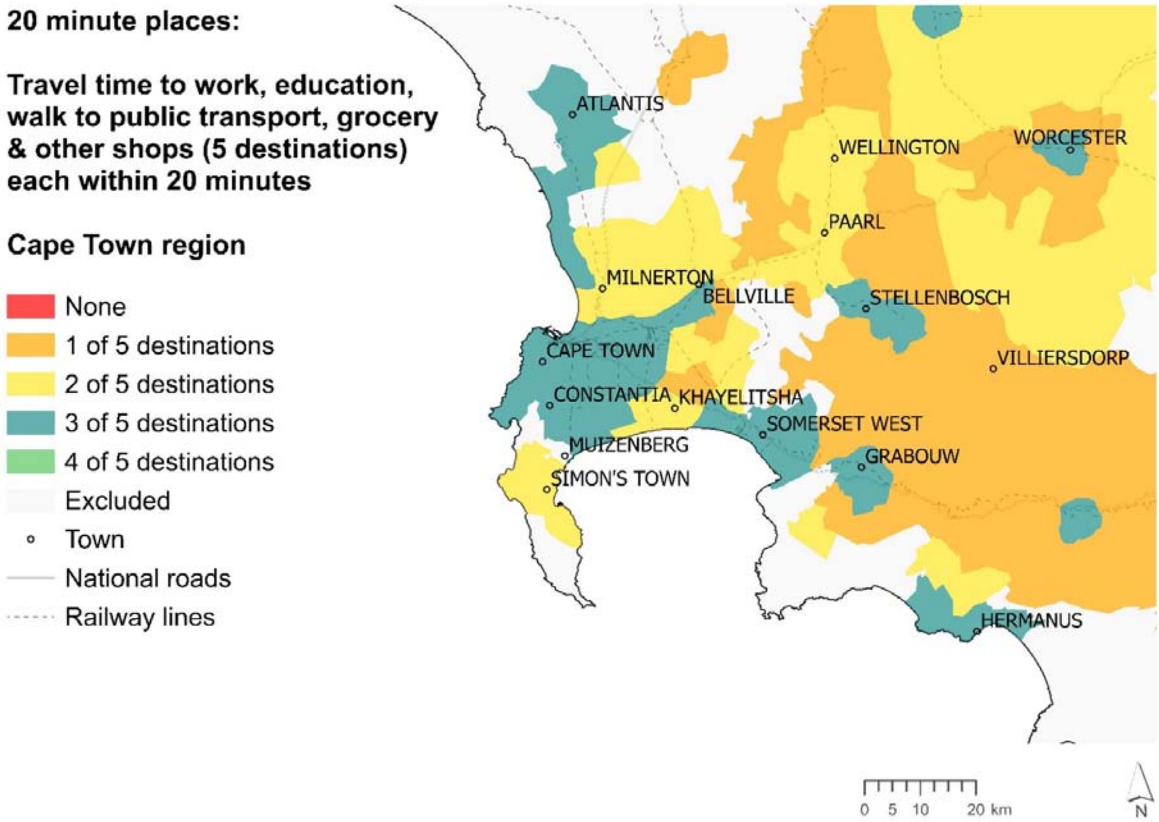
Source: Author developed

Figure 6: Travel cost



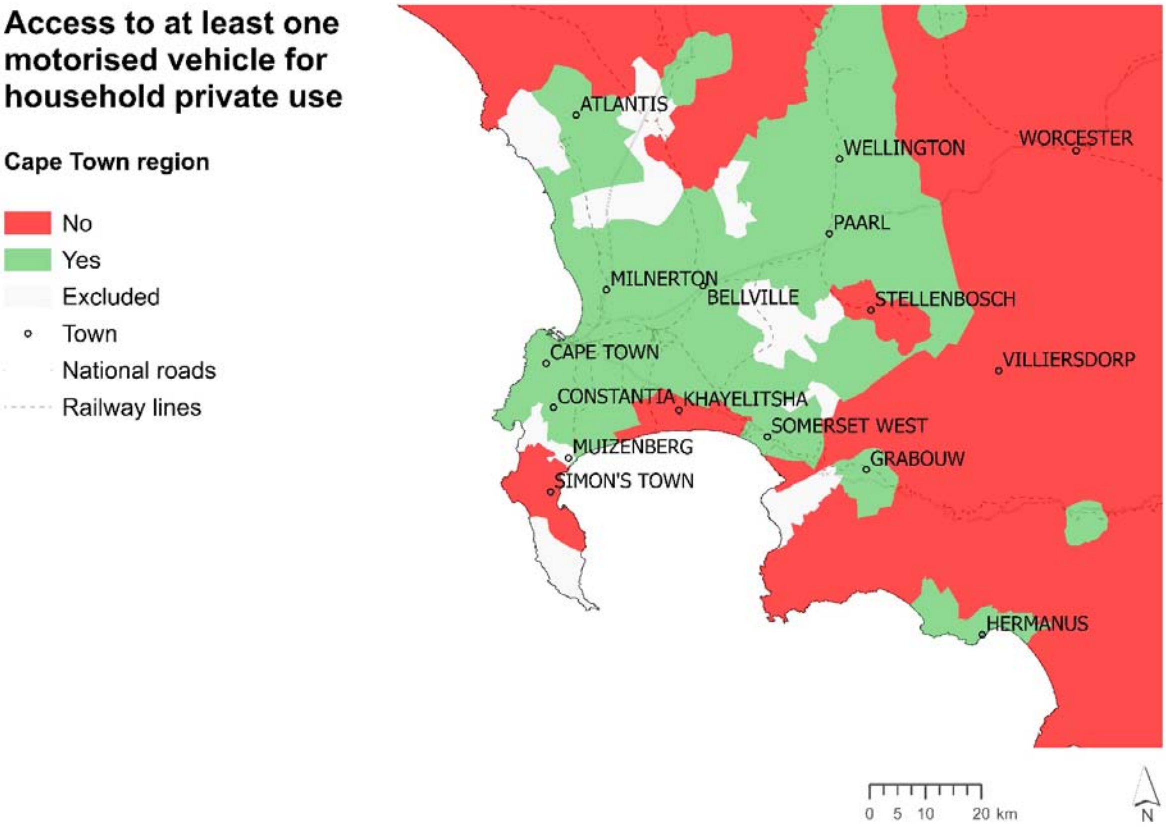
Source: Author developed

Figure 7: Economic activity – Cape Town region



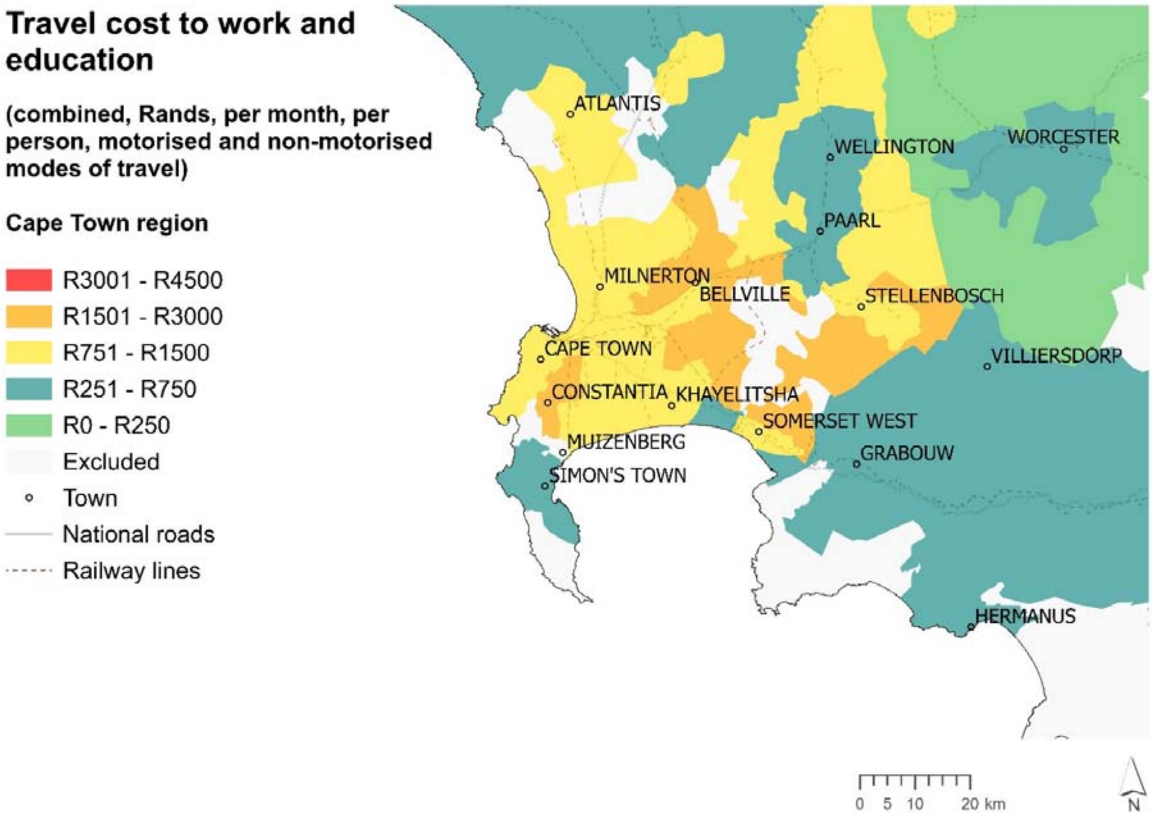
Source: Author developed

Figure 8: Travel time – Cape Town region



Source: Author developed

Figure 9: Transport access – Cape Town region



Source: Author developed

Figure 10: Travel cost – Cape Town region

4.2 Means Analysis

Table 3 presents the mean values of economic and travel behaviour proxies in South Africa per geographic area type and is based on the data analysis of the StepSA 2018 and NHTS 2020 datasets. The (mean) values of GVA, household income, travel time to work, stores as well as travel cost and transport access differ significantly among the three geographic area types. On average, those who reside in metros have quicker access to stores and better access to private motorised vehicles which may contribute to the much larger share of national GVA and higher mean household income found in metros compared to urban and rural areas. This, despite the longer travel time and higher travel cost to work and education in metros. The aforementioned is likely explained by the concept of labour market efficiency in which commuters travel for longer to reach higher paying jobs (in metros) that more closely match their skills.

The high mean travel time to work (57 minutes), educational institutions (38 minutes) and walk time to public transport (17 minutes) in metros is partly attributable to congestion. Modal choice and travel distance likely contribute to the high monthly travel cost to work (R1 205) and educational institutions (R551) in metros as access to private motorised vehicles is the greatest in metro areas (36%). Also contributing to high travel costs and travel time to work in metros is the relatively higher share of workers whose place of employment is located in a different district municipality compared to their place of residence (7,87% versus 4,73% national mean). Travel time to grocery stores and stores other than grocery stores (15 and 21 minutes respectively) in metros are significantly lower than the national means (20 and 35 minutes respectively) and nearly half compared to rural areas (28 and 47 minutes respectively). In summary, means analysis indicates that metros perform better economically to urban and rural areas. This is *partly* and arguably linked to shorter travel time to stores and greater access to transport in metros despite its higher travel cost and travel time to work.

Table 3: Means analysis of passenger transport and GVA per geographic area type

Variable	Indicator	Metro	Urban	Rural	All
GVA	Share of national GVA	58%	25%	17%	100%*
Household income (Rands, monthly)	Household income irrespective of employment status	R16 991	R12 030	R5 998	R9 642*
Travel time (minutes)	To work	57	38	46	45*
	To educational institution	38	30	37	35**
	To walk to public transport	17	15	17	16**
	To grocery store	15	13	28	20*
	To stores other than grocery stores	21	24	47	35*
	±Number of 5 destinations each travelled to within: 15 minutes	2	2	1	2
	±Number of 5 destinations each travelled to within: 20 minutes	2	2	1	2***
	±Number of 5 destinations each travelled to within: 30 minutes	3	3	2	3
Travel cost (Rands, monthly)	To work by private and public motorised vehicle	1 205	1 106	1 170	1 156****
	To education by private and public motorised vehicle	551	428	317	399*****
	To work and education by private and public motorised vehicle (weighted mean)	1960	1666	1583	1597*
	To work and education by motorised and non-motorised vehicle (weighted mean)	1491	997	482	525*
Transport access	Access to at least one motorised vehicle for household private use	36%	32%	20%	27%*

Source: Author developed

Key: Means differ significantly at p-value 0.05 based on one-way ANOVA testing for:
* Metro, urban and rural areas;
** Metro and urban areas, and for urban and rural areas;
*** Metro and rural areas, and for urban and rural areas;
**** Metro and urban areas; and
***** Metro and rural areas.
± Five destinations refer to: work, educational institution, public transport, grocery store and stores other than grocery stores.

4.3 Correlation Analysis

Table 4 presents correlation coefficients to illustrate the relationship between economic and travel behaviour proxies in South Africa per geographic area type and is based on the data analysis of the StepSA 2018 and NHTS 2020 datasets. The purpose of this section is to determine the direction and strength of the relationship between GVA and travel time, cost and access to private motorised transport. Whether trip travel time is directly or inversely correlated with economic activity depends on the destination that the surveyed NHTS 2020 respondent travelled to. The results in Table 4 show an overall weak direct relationship between travel time to work and economic activity (r=.228, p<.05). However, metros experience a weak inverse relationship between travel time to work and economic activity. This is likely due to the high opportunity cost of time of metro residents as metro residents typically earn and spend more money than their urban and rural counterparts. In addition thereto, the money that metro residents could have spent or earned if they were not travelling is likely to be more than the money spent on travel cost to work.

Table 4: Correlation analysis of passenger transport and GVA per geographic area type

Variable	Indicator		Metro n=93	Urban n=165	Rural n=245	South Africa n=503
Travel time	To work		-.201*	.186*	.030	.228*
	To educational institution		.063	.172*	.190*	.067
	To walk to public transport		.060	-.097	-.122	-.048
	To grocery store		-.096	-.151*	-.035	-.229*
	To stores other than grocery stores		-.178	-.205*	-.012	-.338*
	±Number of 5 destinations each travelled to within:	15 minutes	.265	.005	.017	.083
		20 minutes	.071	.073	.119	.086
		30 minutes	.079	-.067	.159	.033
Travel cost	To work by private and public motorised vehicle		.241*	.047	.124	.109*
	To education by private and public motorised vehicle		.335*	.011	.226*	.426*
	To work and education by private and public motorised vehicle		.358*	.050	.157*	.234*
	To work and education by motorised and non-motorised vehicle		.381*	.284*	.303*	.503*
Transport access	Access to at least one motorised vehicle for household private use		.336*	.225*	-.074	.328*

Key: *Significant at p-value 0.05 based on pairwise Pearson correlation analysis. Source: Author developed.

A weak to moderate inverse relationship between travel time to stores (grocery and otherwise) and economic activity was found (r= -.229 to -.338, p<.05). This suggests that travel time discourage consumers to make in-store purchases. This finding especially applies to urban areas (r= -.151 to -.205, p<.05) but less to rural areas (r = -.012 to -.035, p>.05) as rural residents have few other options. The correlation coefficients of the remaining two travel time destinations (educational institution and walk time to public transport) suggest no relationship with economic activity. Furthermore, the results of Table 4 show that the more destinations that can be travelled to within 15, 20 or 30 minutes, the greater the economic activity (r=.033 to .083, p>.05). However, this finding is not statistically significant. In summary, travel time has a negative utility attached to it as travel time takes time away from other activities that could have stimulated economic activity more.

The results show a moderate direct relationship between economic activity and access to private motorised vehicles in metro and urban areas (r= .336 and .225 respectively, p<.05), however a negligible relationship is observed in rural areas (r= -.074, p>.05). The latter finding is partly attributable to the negligible effect of having access to a private motorised vehicle in rural areas because of fewer economic activities located in rural areas. This is substantiated when considering the long travel times of rural residents who travel to stores (20 to 45 minutes - Table 3 refers). The results show that trip travel cost and economic activity are directly correlated. More specifically, travel cost to work and educational institutions is strongly correlated with economic activity (r= up to .503, p<.05). The strength of this overall statistically significant direct relationship is the strongest in metro areas. This is likely explained by the fact that economically active people can afford to, and have to, pay for travel in metros which by their nature (being larger) have longer travel distances which often cannot be undertaken by non-motorised transport. Additionally, it is argued that the longer distance travelled to access better paying employment in metros contributes to the direct relationship between travel cost and economic activity in metros.

5. SUMMARY OF RESULTS

This paper discussed the economic facilitating role of public and private passenger transport in metro, urban and rural areas in South Africa. Visual and means analysis provided an initial overview of the investigated relationship. Spatial mapping suggested an overall inverse relationship between economic activity, measured by GVA, and trip travel time, measured in minutes to five destinations, a direct relationship between economic activity and access to private motorised transport while the relationship between economic activity and travel cost to work and education was found to be unclear according to visual analysis. Means analysis showed that the economic activity of South Africa is concentrated in metros despite longer travel times and greater expenditure on travel cost in metros.

Correlation analysis explored the hypotheses derived from visual analysis. The results of the correlation analysis accepts the hypothesis that the relationship between economic activity and travel time is inverse when the travel destination is stores or public transport. However, when the destination is work and educational institution, the hypothesis is rejected. A direct but weak relationship between economic activity and the number of destinations that can be travelled to within a certain period of time was observed. As intuitively expected, travel time to stores is inversely correlated with economic activity. This relationship is stronger in metro and urban areas compared to rural areas. An inverse but negligible relationship was detected between economic activity and travel time to public transport, and a direct but negligible relationship between economic activity and travel time to educational institutions. A moderate inverse relationship between economic activity and travel time to work was observed in metros, but not in urban and rural areas, though the latter is not a statistically significant finding. With regards to travel cost, the results of the correlation analysis found a statistically significant moderate direct relationship between economic activity and travel cost across all geographic area types. This is likely attributable to costs incurred to travel to better paying jobs and education. This direct relationship is stronger in metros followed by rural and then urban areas. Lastly, the hypothesis of a direct relationship between economic activity and access to private motorised vehicles is accepted. This relationship is stronger in metros than in urban and rural areas.

6. CONCLUSION

The findings discussed in this paper confirm that there is a relationship between economic activity and passenger transport and that the direction, strength and significance of this relationship differs for travel time, travel cost and access to transport across the geographic area types in South Africa. The relationship between economic activity and travel cost is the strongest among the passenger transport proxy indicators analysed. Therefore, if South African authorities were to prioritise passenger transport investment in an effort to seek the greatest return on economic activity, then invest in efforts to reduce travel cost, especially in metros, would be proposed. Measures include continued investment in government-subsidised public transport (e.g., MyCiti bus service) or other measures that reduce travel cost for commuters. This prioritisation has the potential to increase economic activity, including employment participation, through more affordable passenger transport. However, while travel cost may become cheaper due to government investments, factors such as willingness to work and sufficient skilled labour are required for economic development to transpire.

The research can be taken forward by considering variations in the relationships between economic activity and passenger transport across income groups and over time. The latter can be achieved by including the NHTS of 2013 and a (new) post-pandemic NHTS. The results suffer from the multiple area unit problem (MAUP) and some areas have been excluded from spatial mapping. This can be improved by increasing the sample size of future NHTS and if the NHTS dataset is made available at a finer spatial grain for future research.

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