Transit Supply Index scores on the days of the 2016 and 2021 censuses: using Statistical Area Level 1 (SA1) 2016 boundaries

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2023-08-22

Introduction

Previous research by **?** developed a transit Supply Index (SI), based on calculating the number of transit arrivals at stops within an area of interest, adjusted to account for the typical walk-access catchment for each stop. This document reports the development of R code to calculate the Supply Index of **?** directly from GTFS data. The code is used to output SI scores for the day of the 2016 census and the day of the 2021 census for each of the Australian Bureau of Statistics (ABS) 2016 Statistical Area Level 1 (SA1) zones in Victoria. These scores have been requested by Maryam Jafari as an input to her PhD project.

This rest of this document is structured as follows: the next section discusses the research context of transit metrics and the the Supply Index. In the third section the methodology for the code development is outlined, including discussion of the case study GTFS for Victoria, Australia, that was used to test and verify the code output. In the fourth section results are presented, starting with verification of the code output through hand-calculation of SI scores for Statistical Area 1 (SA1) areas in the Victorian Alps and Talbot. SI scores for SA1s across Greater Melbourne and Victoria are also presented. Mode-by-mode SI scores are also explored, followed by an examination of needs-gaps across the ABS Index for Relative Socio-Economic Advantage/Disadvantage (IRSAD) scores, ranks and population levels. The document then closes with a brief discussion and conclusion section.

Research context

The Suppy Index

Equation **??**[1] shows the Supply Index[2]. An advantage of the Supply Index is that it is a relatively simple number to calculate, understand and explain. It describes the number of transit arrivals at stops within an area of interest and time frame, multiplied by a factor accounting for the proportion of the area of interest that is within typical walking distance of each stop. Hence, more services, more stops and higher frequencies would all result in an increase in Supply Index score. The Supply Index does not incorporate further aspects, such as service span, off-peak share of service or service speed, which are a feature of the TQCSM. However, including such metrics may increase the complexity of calculating and describing the index to non-transit specialists. Such simplicity is also helped by the way that the Index is additive, in that $SI_{area,time}$ scores can be aggregated to calculate an overall score across multiple time periods or for a region encompassing multiple areas of interest.

$$SI_{area,time} = \sum \frac{Area_{Bn}}{Area_{area}} * SL_{n,time} \quad (1)$$

[1] In Equation **??** $SI_{area,time}$ is the Supply Index for the area of interest and a given period of time. $Area_{Bn}$ is the buffer area for each stop (n) within the area of interest. In **?** this was based on a radius of 400 metres for bus and tram stops, and 800 metres for railway stations. $Area_area$ is the area of the area of interest, and $SL_{n,time}$ is the number of transit arrivals for each stop for a given time period.

[2] Minor adjustments have been made to generalise the equation, as **?** focused on the context of Melbourne's Census Collection Districts (CCD) and calculations based on a week of transit service.

? calculated the $SI_{area,time}$ for various Census Collection Districts (CCDs)[3] in Melbourne using a timetable database provided by the Victorian Public Transport Authority (PTA). This predated the widespread availability of GTFS data. A question, therefore, is how to calculate the SI using GTFS data so that $SI_{area,time}$ scores can be calculated and compared for any area of interest where transit service information is available in that format.

[3] CCDs predate the introduction of Statistical Areas 1, 2, 3, and 4 (SA1, SA2, SA3, SA4), and other geographical divisions currently used by the Australian Bureau of Statistics (ABS), which may be more familiar to readers.

Transport Needs Index(es)

? also developed a Transport Needs Index based around population, transport and employment data. This was combined with the ABS' Index for Relative Socio-Economic Advantage/Disadvantage (IRSAD) to produce a combine index addressing social and transport needs Later in this document a similar needs-gap analysis is presented for Victorian SA1s. However, in the needs-gap analysis here only the IRSAD scores and population data are reported. Calculating the