Age and domestic migration effects on workers’ commuting distance

K. Bruce Newbold

Abstract

Do older workers, including those that work beyond age 65, have different commuting patterns than their younger counterparts? With a focus on older working adults, including those that continue to work beyond age 65, this paper examines the relationship between migration, residential location, and commute distance within Toronto’s commuter shed. The study utilizes data from the master file of the 2016 Canadian Census, allowing migrants to be disaggregated by duration of residence. Results indicate that living in rural areas and being a recent migrant are significantly associated with longer commutes. Furthermore, findings demonstrate that the commute distance of very recent migrants (those who migrated in the year immediately prior to the census) and individuals who moved to rural areas have the longest commute distances. As residential duration increases, commute distance decreases. Older workers have similar commuting behaviors as younger workers, although older workers who recently migrated have some of the longest commute distances as well.

Keywords Older workers · Travel behavior · Aging · Commuting

Introduction

Commuting distance is strongly associated with employment status and residential location decisions. Given the connection to residential location, migration decisions also impact commute distance, with the literature demonstrating that migrants typically have longer average commutes when compared to stayers living within the same area (Green 1999; Boyle et al. 2001; Findlay et al. 2001; Champion et al. 2008; Axisa et al. 2012a). Further, recent migrants (i.e., those that migrated in the past year as compared to either stayers or those who migrated in the previous five years) record the longest commute distances (Axisa et al. 2012b). These longer commute distances may reflect an outcome of relocation that
is dealt with after the move is complete (Breheny 1999). Similarly, residential moves are followed by job moves for many couples, but they are not done concurrently (Deding and Filges 2010; Zax 1994). Consequently, when either a residential or employment change occurs, changes to commuting patterns are also likely to occur.

Although most of the Canada’s population continues to retire at or near age 65, many older individuals continue to work past the typical retirement age. Estimates from Statistics Canada (2011) indicate that the employment rate of individuals 55 and over grew from 30.5% to 39.4% in 2010 for men and from 15.8 to 28.6% for women in the same period. Employment rates continued to increase through the decade (Statistics Canada 2021). By 2016 – the period that coincides with this study – employment rates among individuals aged 55 and over had increased to 40.5% and 30.4% for males and females, respectively. Males aged 65 to 69 saw their employment rate nearly double between 2000 and 2010, with this increased employment amongst older Canadians reflecting factors including the relaxation of mandated retirement ages across many occupations, personal financial needs, a preference to continue to work, tightening of the labor market, and other delays to retirement.

Consequently, the combination of aging, retirement or work continuance could impact commute distance. Despite that fact that a growing share of the labor force continues to work beyond the typical retirement age of 65, the commute distance and behaviors of these older workers have not been fully explored. While they may be similar to the commute behaviors of workers in their fifties and early sixties, there may also be differences. For instance, migration decisions of older workers may result in temporally longer commute distances as these older workers trade off a temporary increase in commute distance for a residential location that reflects lifestyle choices, amenities, and preferences for a particular location. Alternatively, commute distances of these older workers may be somewhat shorter given that multiple studies have observed a peak in commute distance among workers in their thirties or forties, followed by declining commute distances. Regardless of the reason, an increase in commuting distance has implications in terms of increased demand on road infrastructure and increased vehicular emissions. (Green 1999; Green et al. 1999).

While the relationship between migration and commute distance has been explored previously (i.e., Axisa 2012b; Champion et al. 2008), the question this paper addresses is how and whether commute behaviors change among older workers in the labor force, a question that is increasingly relevant. Set within Toronto’s commuter shed, an area that includes the Toronto Census Metropolitan area, Canada’s largest city, this paper focuses on the commuting behaviors of adults who migrated recently.

**Older workers, migration and commuting**

When considering commute distance, recent migration history and residential geography must be considered, a relationship highlighted by Horner et al. (2015). While Horner et al. (2015) found that there was little difference in commutes by age group, where commuters lived (region of residence) was important. For example, other research has revealed that commuters originating in rural areas generally have longer commutes as compared to their urban counterparts (Banister and Gallent 1998; Boyle et al. 2001; Champion 2009; Champion et al. 2008; Coombes and Raybould 2001; Green and Owen 2006). Migrants also tend to record longer commute distances than those who did not move. Further, individuals
migrating from urban to rural areas tend to experience longer average commutes (Axisa et al. 2012a). Regardless of the type of migration, commute distance tends to decrease as residential duration increases, suggesting that commuting over longer distances is a temporary solution to a recent migration. That is, long distance commuting becomes a strategic decision that accounts for lifestyle preferences, life course, and household composition, whereby dual earner households may balance commute distance and commute times relative to their preferred residential location (Sandow and Westin 2010). For older migrants, increased commute distance may be a temporary outcome of residential relocation that is dealt with at a later stage (Breheny 1999).

Age also impacts commute distance. Potentially reflecting residential preferences for urban areas and proximity between work and entertainment options, commute distance tends to be shortest among youth and young adults. With increasing age, marriage, and growth of the family, commute distances tend to increase, with middle-aged adults typically having the longest commutes, followed by a modest decline in commute distance (Axisa et al. 2012b). Among older adults, aging also means a transition to retirement and potential shifts in travel behaviors from commuting to non-commuting patterns. Some older workers will, for example, opt for longer commute distances, potentially in anticipation of a forthcoming retirement and temporarily demonstrating a tradeoff between added commute distance (time) and their preferred residential location. Further, older adults (aged 50 and over) who are very recent (<1-year) migrants have some of the longest commutes, but also experience the largest reduction in mean commute distance (Axisa et al. 2012a, b). In other words, individuals may not factor commute distance into their residential location choice given that the need to commute will be short-term leading up to retirement. Alternatively, older adults and empty nesters show preferences for downtown living, a trend helping to fuel the condominium markets in many Canadian cities (Filion 2007), likely resulting in differences in commute distances and mode choices.

Although the literature has considered the impact of migration on commute distance, this paper extends the existing work by considering the commuting distance of older, working adults (aged 65+) compared to younger adults while considering the impact of migration and other correlates. Is there, for example, evidence that older workers may be trading off longer commutes with residential location choices? It first investigates mean commute distance, duration and mode by age and migrant status. It then seeks to understand mean commute distance while controlling for several groups of independent variables including migration status, geographical context, labor market, and demographic and household characteristics.

**Data and methodology**

This study focuses on commuting distance in Toronto’s commuter shed\(^1\), an area which closely corresponds to the Greater Toronto Hamilton Area (GTHA) region of Ontario. With a 2016 population of 9.245 million, the GTHA is the most heavily populated and urbanized region in Canada. The GTHA is also one of the fastest growing regions in North America, projected to reach 14.5 million people by 2051 (Hemson and Consulting 2020). Commuting in this region, like most North American cities, is dominated by the automobile. Looking

---

\(^1\) Toronto’s commuter shed is defined as all census subdivisions (CSDs) surrounding the city where a minimum of 10% of the working population commutes into any of the eight employment-rich CSDs of the GTHA.
Transportation

specifically at Toronto’s commuter shed (study area), slightly fewer than 80% of commuters travel to work by automobile, while 78% of those who commute by automobile do so alone. Conversely, only a fraction of commuters (6.5%) travel using active modes of transportation (bike and walk), 5.5% use public transit, and 7.9% telecommute. Toronto commuters already face the longest commute times (33 min) within Canada, and more than one-quarter of all commuters had travel times of 45 min or more in 2010 (Statistics Canada 2011).

The data used for this study are drawn from the 2016 Census of Canada master file, representing the 20% of the population that completed the census long-form. The data were constrained to include only those aged 20 years and older at the time of the census that reported paid full or part-time employment in the week prior to Census Day and who lived within the study area on census day. The study area was inclusive of the Greater Toronto Hamilton Area (GTHA, see Fig. 1) except for CSDs that were home to indigenous reservations, most of which are small and do not accurately represent the population in the region. All data were accessed through the Statistics Canada Research Data Center at the author’s institution. Individuals had to reside within the study area as of census day in 2016 but could have migrated into the region at any point over the previous five years. Finally, commute distances were capped at 100 km to avoid weekly (long-distance) commuters.

Descriptive statistics are used to investigate the mean commute distance for individuals based on migrant status, geographical context, labor market, and demographic and household variables. Since this study is particularly interested in the role migration plays on commuting distance, we examine the geographical context of recent migrants’ residential locations and how commute distance changes over time, both with respect to recent

Fig. 1 Study area
Transportation

migrants in general, and specific to their demographic and household characteristics. Independent variables (Table 1) were selected based on the findings of previous commuting studies (e.g., Axisa 2012a, 2012b; Boyle et al. 2001; Findlay et al. 2001; Champion et al. 2008; Green and Owen 2006) and data availability.

The impact of location and migration on commute distance is evaluated through three different measures. First, commuting studies that consider migrant status note that recent migrants are expected to commute longer distances than stayers. That is, increased commuting distance is often an outcome of residential relocation that is dealt with after the move is complete (Breheny 1999). This is expected as recent migrants have had little time to adjust to their new residential location relative to their work destination. Consequently, migrants are defined as individuals who changed their CSD of residence either 1 year or 5 years prior to census day, with migrations inclusive of both those that migrated within the GTHA or those that migrated into the GTHA from elsewhere in Canada between 2011 and 2016. Individuals who moved within a single CSD are considered local movers and were therefore combined with stayers. Individuals who remained within the same CSD over the 5-year census period (2011–2016) are stayers. Second, the paper assesses the type of move, including urban-urban, urban-rural, rural-rural, and rural-urban migrations. Finally, degree of rurality is important, with urban and rural areas defined according to the Statistics Canada hierarchy of Census Metropolitan Areas (CMAs, or urban areas with populations greater than 100,000); Census Agglomerations (CAs, or urban areas with populations between 10,000 and 99,000), and ‘strong’ and ‘moderate’ Metropolitan Influenced Zones (MIZ), which identify the degree of interaction (commuting) between a rural area and an urban area. The current study area does not contain any of the most rural zones (weak MIZ and no MIZ). It is expected that as degree of rurality increases, so too will commute distance.

Labor market, household, and demographic variables were selected to control for other attributes that impact commuting behavior. The two variables selected to describe labor markets are employment status and occupation type. It is expected that full-time employment (employment status) or occupying a management or science-related job (occupation type) will have a positive influence on commuting (i.e., longer commute distances). Unfortunately, the census does not include information on job change, meaning we cannot track the impact of a change in occupation or industry has on commuting distance. The six variables that describe household and demographics include age, sex, household income, household structure, marital status, and age of youngest child. Age is represented in five-year age groups from age 20, with an open-ended 70+ age group. Increasing age, being female (sex), having children, or being a single parent (household structure) are expected to have negative influences on commuting (i.e., shorter commute distances). On the other hand, increasing household income (household income), or being married (marital status) are expected to have positive influences on commuting (i.e., longer commute distances).

Table 1 summarizes the data used in the analysis. As previously noted in the literature (i.e., Axisa et al. 2012a, 2012b; Champion et al. 2008), recent migrants (within the past year) have the longest commute distances (19.3 km), and stayers commute shorter distances.

---

2 Census subdivisions (CSDs) within provinces that are outside CMAs and CAs are assigned to one of the four MIZ categories (strong, moderate, weak or no influence). Interaction is defined by the proportion of commuters. For example, the strong MIZ category includes CSDs with at least 30% of the resident employed labor force living in the CSD working in any CMA or CA. For a full description, see: https://www150.statcan.gc.ca/n1/pub/92-195-x/2016001/other-autre/miz-zim/miz-zim-eng.htm.
| Variable                      | Definition                                                                 | Weighted sample (%) | Mean commute distance (km) |
|-------------------------------|---------------------------------------------------------------------------|---------------------|---------------------------|
| **Migrant status**           |                                                                           |                     |                           |
| Stayer                        | Respondent has lived in the same CSD for the past 5 years                 | 82.6                | 14.1                      |
| One-year migrant              | Respondent has moved to a different CSD in the past 1 year                 | 4.1                 | 19.3                      |
| Five-year migrant             | Respondent has moved to a different CSD in the past 5 years                | 13.2                | 17.0                      |
| **Geographical context**     |                                                                           |                     |                           |
| Residential location          |                                                                           |                     |                           |
| CMA                           | Respondent lives in a Census Metropolitan Area                             | 94.3                | 14.3                      |
| CA                            | Respondent lives in a Census Agglomeration                                 | 2.3                 | 18.1                      |
| Strong MIZ                    | Respondent lives in a Strong MIZ                                          | 3.0                 | 24.8                      |
| Moderate MIZ                  | Respondent lives in a Moderate MIZ                                         | 0.4                 | 21.1                      |
| Move type                     |                                                                           |                     |                           |
| Urban to urban                | Respondent moved from an urban area to urban area                          | 15.9                | 17.2                      |
| Rural to urban                | Respondent moved from a rural area to urban area                           | 0.2                 | 17.8                      |
| Rural to rural                | Respondent moved from a rural area to a rural area                         | 0.6                 | 28.4                      |
| Urban to rural                | Respondent moved from an urban area to a rural area                         | 0.2                 | 34.2                      |
| Stayer                        | Respondent did not move in the five years prior to census                  | 82.6                | 14.1                      |
| **Labor Market**              |                                                                           |                     |                           |
| Employment Status             |                                                                           |                     |                           |
| Full time                     | Respondent is working full-time (≥30 h per week)                           | 83.4                | 15.5                      |
| Part Time                     | Respondent is working part-time (<30 h per week)                           | 16.6                | 10.7                      |
| Occupation                    |                                                                           |                     |                           |
| Management                    | Respondent has a management occupation                                     | 13.4                | 16.9                      |
| Science                       | Respondent has a natural or applied sciences occupation                    | 8.3                 | 18.4                      |
| Sales and Service             | Respondent has a sales or service occupation                               | 20.8                | 11.4                      |
| Health                        | Respondent has a health occupation                                        | 6.8                 | 13.5                      |
| Government                    | Respondent has a government occupation                                     | 12.1                | 13.7                      |
| Other employment              | Respondent has an occupation different from the above                      | 38.6                | 15.7                      |
| **Demographic & Household**   |                                                                           |                     |                           |
| Age 20–24                     | Respondent is 20–24 years old                                             | 5.1                 | 12.7                      |
| Age 25–29                     | Respondent is 25–29 years old                                             | 10.2                | 14.5                      |
| Age 30–34                     | Respondent is 30–30 years old                                             | 11.0                | 14.6                      |
| Age 35–39                     | Respondent is 35–39 years old                                             | 11.2                | 15.1                      |
| Age 40–44                     | Respondent is 40–44 years old                                             | 12.2                | 15.6                      |
| Age 45–49                     | Respondent is 45–49 years old                                             | 13.2                | 15.4                      |
| Age 50–54                     | Respondent is 50–54 years old                                             | 14.1                | 15.3                      |
| Age 55–59                     | Respondent is 55–59 years old                                             | 11.5                | 14.7                      |
| Age 60–64                     | Respondent is 60–64 years old                                             | 7.1                 | 13.8                      |
| Age 65–69                     | Respondent is 65–69 years old                                             | 2.9                 | 12.7                      |
| Age 70+                       | Respondent is 70 years of age or older                                     | 1.4                 | 11.1                      |
| Sex                           |                                                                           | 49.8                | 12.9                      |
Males also have longer commute distances than females, and increasing rurality is also associated with longer commute distances as compared to those who live in the Toronto CMA. Not surprisingly, individuals who moved from urban to rural areas had the longest mean commute distance (24.2 km), closely followed by those who moved between rural areas (28.4 km). Even those who moved to urban areas had longer commute distances (approximately 17 km) than stayers (14.1 km). As noted elsewhere in the literature (i.e., Axisa et al. 2012b; Horner et al. 2015), commute distance peaks among adults in their early forties, before declining with increasing age.

Multiple regression is used to quantify the relationship between migration status and residential location with commute distance while controlling for a variety of demographic, household, and employment variables, with the model specified as:

\[ T = X \beta + \varepsilon \]  

where \( T \) represents the natural logarithm of one-way commute distance (km) for individual \( i \) on a typical day. Statistics Canada measures commute distance as a one-way, Euclidean (straight-line) distance from an individual’s usual place of residence to their usual place of work. It is measured for all modes of transportation. For the purposes of this study, individuals with commute distances more than 100 km were excluded to avoid including weekly (long-distance) commuters. This cutoff point was deemed acceptable as it reduced the overall sample by less than 2%. Commute distance was log transformed to compress the variable’s long tail, which arises due to the well-known effect of distance decay on spatial interaction intensity.

On the right-hand side of the equation, \( X \) is a matrix of variables that reflect migrant status, geographical context, labor market, and demographic and household characteristics.
for individual $i$, and $\beta$ is a vector of parameters to be estimated by the model. Since the modeled dependent variable is based on a natural logarithmic transformation, interpretation of the parameters is as follows: when multiplied by 100, a parameter indicates the percentage change in commute distance associated with a unit change in an independent variable; and $\varepsilon$ represents the unobserved error in $i$. Consequently, the above model can be estimated using the Ordinary Least Squares (OLS) method. Finally, to avoid artificially inflating the $t$-values, the original weight variable (equal to Canada’s total population excluding institutional residents) was scaled so that the sum of the scaled weight variable was equal to the sample size.

## Results

Table 2 extends the descriptive analysis and considers commute distance (km), sex, age, and migration status. Overall, males had longer commute distances than females regardless of whether they migrated or stayed. With respect to migration status, individuals who migrated in the year before the census had the longest commute distances, exceeding distances recorded by those who migrated in the five years before the census or stayers. For instance, males who migrated in the past year had an average commute distance of 20.1 km, compared to 18.2 for five-year migrants and 15.9 km for stayers.

As expected, mean commute distance also varies by age, with younger adults generally reporting the shortest commute distances regardless of sex or migrant type. Commute distances generally peak in the 40 and 50s age groups before declining through the typical retirement years among stayers, who recorded a consistent decline in commute distances following the peak. Non-migrant older workers aged 70 and over had the shortest average commute distances, measuring just 11.8 and 8.8 km for males and females, respectively. Among older adults who migrated, however, commute distances are longer and typically remain longer compared to like aged individuals who did not migrate, with commute distances of older workers who migrated exceeding those recorded in the youngest age groups. For instance, females aged 70 and over who migrated in the past year recorded an

| Age | Males |  | 5-year | 1-year | Females | 5-year | 1-year |
|-----|-------|---|--------|--------|---------|--------|--------|
| 20–24 | 13.4 | | 13.0 | 14.2 | 11.9 | 11.3 | 13.6 |
| 25–29 | 14.3 | | 14.7 | 17.5 | 12.9 | 12.9 | 16.5 |
| 30–34 | 14.6 | | 18.1 | 20.3 | 11.9 | 15.7 | 18.4 |
| 35–39 | 15.9 | | 19.0 | 20.4 | 12.6 | 16.2 | 18.8 |
| 40–44 | 17.1 | | 20.5 | 22.8 | 12.9 | 16.6 | 18.9 |
| 45–49 | 17.1 | | 21.2 | 23.1 | 12.8 | 16.7 | 19.7 |
| 50–54 | 17.2 | | 21.0 | 23.5 | 12.7 | 17.2 | 21.8 |
| 55–59 | 16.5 | | 21.3 | 22.3 | 12.0 | 17.4 | 20.9 |
| 60–64 | 15.2 | | 21.4 | 24.8 | 11.2 | 17.0 | 20.7 |
| 65–69 | 13.9 | | 19.1 | 22.5 | 10.1 | 15.1 | 21.1 |
| 70+  | 11.8 | | 17.0 | 21.9 | 8.8 | 13.3 | 21.3 |
| AVG  | 15.9 | | 18.2 | 20.1 | 12.3 | 15.3 | 18.0 |
| Weighted N | 1,217,510 | 205,735 | 66,510 | 1,231,705 | 187,415 | 58,080 |
average commute distance of 21.3 km, nearly 8 km longer than the commute distance of 20–24-year-olds and only slightly less than the maximum average distance of 21.8 km for 50–54-year-old females. Males aged 70 and over who migrated in the past year recorded a mean commute distance of 21.9 km, which again exceeded the commute distances of younger males and was only slightly less than the peak commute distance. Consequently, despite increased age, these older workers tended to have some of the longest commute distances following migration.

Table 3 extends the analysis to consider the direction of migration, distinguishing between stayers and rural-rural, urban-urban, rural-urban, and urban-rural migrations. Not unexpectedly, individuals who migrated from urban to rural areas (U-R) had the longest average commute distance (34.2 km), with males commuting longer distances (37.2 km) than females (31.2 km). With an overall average distance of just 14.1 km, stayers had the shortest overall commutes. Moreover, these differences are largely consistent across age groups. That is, individuals who have moved from urban to rural areas have consistently longer commutes as compared to all other migrant types, while stayers (those that have not moved within the 5-year window) consistently have the shortest commute distances. Migrants who moved from a rural location to another rural location typically had the second

| Age  | Sex  | U-R  | R-U  | R-R  | U-U  | Stayer |
|------|------|------|------|------|------|--------|
| 20–24| female | 26.5 | 14.0 | 21.9 | 11.9 | 11.9   |
|      | male  | 29.4 | 13.4 | 23.4 | 13.2 | 13.4   |
| 25–29| female | 31.9 | 15.0 | 23.2 | 13.7 | 12.9   |
|      | male  | 32.0 | 17.6 | 27.5 | 15.4 | 14.3   |
| 30–34| female | 29.7 | 16.4 | 24.7 | 16.2 | 11.9   |
|      | male  | 39.4 | 21.5 | 30.6 | 18.6 | 14.6   |
| 35–39| female | 32.1 | 18.1 | 25.7 | 16.5 | 12.6   |
|      | male  | 34.7 | 19.5 | 30.0 | 19.3 | 15.9   |
| 40–44| female | 34.9 | 14.4 | 25.9 | 16.6 | 12.9   |
|      | male  | 41.1 | 24.4 | 33.1 | 20.8 | 17.1   |
| 45–49| female | 29.8 | 20.4 | 25.7 | 16.9 | 12.8   |
|      | male  | 37.7 | 22.6 | 36.2 | 21.2 | 17.1   |
| 50–54| female | 35.1 | 22.8 | 25.9 | 17.5 | 12.7   |
|      | male  | 43.1 | 22.1 | 35.5 | 20.8 | 17.1   |
| 55–59| female | 30.6 | 14.7 | 26.7 | 17.5 | 12.0   |
|      | male  | 44.6 | 21.6 | 35.7 | 20.6 | 16.5   |
| 60–64| female | 27.9 | 10.3 | 23.7 | 17.4 | 11.2   |
|      | male  | 38.5 | 21.9 | 36.3 | 21.2 | 15.2   |
| 65–69| female | 24.6 | 16.4 | 26.3 | 15.8 | 10.1   |
|      | male  | 32.8 | 10.5 | 27.2 | 19.5 | 13.9   |
| 70+  | female | ---  | ---  | 8.3  | 15.6 | 8.8    |
|      | male  | ---  | ---  | 24.0 | 17.3 | 11.8   |
| AVG  | female | 31.2 | 16.2 | 24.9 | 15.7 | 12.3   |
|      | male  | 37.2 | 19.3 | 31.9 | 18.7 | 15.9   |
| AVG  | (both) | 34.2 | 17.8 | 28.4 | 17.2 | 14.1   |

Note: Mean distance suppressed for 70+ U-R and R-R migrants due to small sample size.
Table 4. Mean trip duration (minutes) by age and migration status

| Age    | Males |     |     | Females |     |     |
|--------|-------|-----|-----|---------|-----|-----|
|        | Stayers | 5-year | 1-year | Stayers | 5-year | 1-year |
| 20–24  | 29.3 | 31.0 | 29.5 | 29.5 | 30.6 | 29.9 |
| 25–29  | 31.3 | 31.6 | 33.2 | 31.9 | 30.9 | 33.6 |
| 30–34  | 31.4 | 34.6 | 37.3 | 30.0 | 33.3 | 35.7 |
| 35–39  | 32.1 | 35.8 | 37.9 | 29.7 | 33.9 | 35.1 |
| 40–44  | 32.8 | 37.6 | 38.3 | 29.4 | 33.1 | 33.7 |
| 45–49  | 32.5 | 37.3 | 37.1 | 29.4 | 33.1 | 34.5 |
| 50–54  | 32.0 | 35.1 | 37.2 | 29.1 | 32.6 | 34.1 |
| 55–59  | 31.3 | 34.9 | 34.6 | 28.9 | 31.9 | 33.1 |
| 60–64  | 30.3 | 34.4 | 35.9 | 28.3 | 31.3 | 33.9 |
| 65–69  | 28.5 | 31.9 | 32.8 | 26.5 | 28.9 | 31.4 |
| 70+    | 25.0 | 28.8 | 31.8 | 23.8 | 26.4 | 32.2 |
| AVG    | 31.4 | 34.7 | 35.7 | 29.3 | 32.4 | 33.8 |
| Weighted N | 1,217,510 | 205,735 | 66,510 | 1,231,705 | 187,415 | 58,080 |
longest commute distances, while those who moved from rural to urban locations or urban to urban locations had more similar commute distances.

We turn next to the average commute duration, measured in minutes (Table 4). Similar to commute distance, commute duration was generally longer for males than females, with the longest average commute durations recorded for recent (1-year) migrants: 35.7 min for males and 33.8 min for females. Commute durations were only slightly shorter for individuals who migrated in the five years prior to the census (34.7 and 32.4 min for males and females, respectively), with stayers having the shortest commute times. In much the same way, commute duration peaked among male workers in the 40–44-year-old group, although trip duration among females tended to peak slightly earlier (i.e., in the 25–29 group for stayers, 30–34 for one-year migrants and 35–39 for 5-year migrants), especially among those who migrated, suggesting that females may adjust their commute times downward faster following migration and potentially for family reasons. Finally, among one-year migrants, commute times for the oldest age group were longer than their counterparts in their twenties.

Turning next to the regression models that further explore the relationship between commute distance and migration status (one and five-year migration) while controlling for sociodemographic, socioeconomic and employment variables, Table 5 presents 3 different models. Model 1 incorporates migration status and other socioeconomic and sociodemographic variables that have been previously observed to reflect commuting distance. Using model 1 as a base, Model 2 also incorporates the type of move (i.e., rural to urban, urban to rural, rural to rural and urban to urban versus stayers), and Model 3 continues to grow the model by incorporating a series of interaction effects with migration status. Only statistically significant interactions were retained.

The results of model 1 fit the literature and expectations well. For example, being a migrant significantly increases commute distance, with commute distances longer for recent (within the past year) migrants than those who had migrated in the previous 5 years. In addition, workers who live in CMAs and CAs have shorter commute distances that those in rural areas, while commute distances are 26.7% longer for those who live in strong MIZ areas, reflecting the greater rurality of these locations. Turning to age effects, the model also indicates that as age increases, so too does commute distance, with increased duration up to age 40–44. Between ages 45–49 and 50–54, commute distance remains longer than those aged 20–24 (the reference group), but the difference has decreased from the peak age of 40–44. Beyond age 55–59, commute distances were shorter than the youngest age cohort.

With respect to other effects, males, full time workers, commuters who use either a car or public transit and families with children have longer commute distances than their counterparts (active transit or no children). In the latter case, this is most likely capturing middle-aged adults, while the shorter commute distances of singles and married individuals may capture younger adults. Occupation also influenced commuted distance, with individuals engaged in science-based occupations having longer commutes, while other groups (inclusive of individuals in health, government, management and sales and service) had shorter commute distances.

Model 2 introduces the type of migration, distinguishing between the broad direction of the move. Overall, most relationships remain consistent with those observed in model 1, with the notable exception being that the effect of migration in the year prior to the census on commute distance became insignificant. In terms of migration type, individuals who
moved from urban to rural areas had the longest commute, with migrants between rural areas having the second longest commutes. However, even those who moved within urban areas or from rural to urban had longer commute distances than stayers.

Model 3 introduces a number of interaction effects between migration status and selected variables. In this model, stepwise regression was used to select only the significant interaction effects, while forcing all other previous variables from models 1 and 2 into the model. Once again, the results are largely consistent with the earlier models, with one-year migration status once again being statistically significant. Both males and individuals who were single experienced slightly shorter commute distances if they had migrated in the past one or five years. Conversely, married individuals who had recently migrated had longer commute distances. Finally, age had several significant interaction effects, particularly among older (55+) migrants. In each case, recent migrations tended to increase the commute distance of older adults.

Conclusion

Using the Toronto commuter shed as an example, this paper has explored the relationship between commute distance and migration, with a focus on how commute distance differs between older working adults and their younger counterparts. Broadly speaking, increasing age, marriage, and the presence of children are associated with increased commute distances. Commute distance tends to increase and peak in the fifties before modest declines through the typical retirement age of 65 and onward.

Echoing earlier results (i.e., Axisa et al. 2012b), migration status and residential location is an important determinant of commute distance. In general, individuals who have migrated recently (one year prior to the census and between one and five years prior to the census) have longer commute distances than those who did not migrate in the previous five years. In other words, increasing residential duration appears to reduce commute distance. Recent migrations further impact the commute distance, particularly among older adults as revealed by the interaction effects. For instance, while older workers tend to have shorter commute distances than the youngest workers, recent migration increases the distance that they commute. As such, the longer commute distances among older workers may be seen as short-term, with the longer distance a temporary result of the migration and possibly reflecting an anticipated retirement while not factoring into the overall utility of the individual. In short, the results suggest that long-distance commuting is a strategic decision that accounts for lifestyle preferences and age. Consequently, there are subtle differences in commuting behavior of older workers as compared to their younger counterparts, particularly among those who recently migrated.

The relationship between commute distance and migration is interesting and raises the question of how commuting is considered in the migration decision. Given that duration of residence is related to commute distance, with individuals adjusting their commute distance downward over time following migration, the results suggest that the commuting implications of the move were not fully considered prior to the move or were considered under ‘ideal’ conditions, such as estimating the commute time on weekends or off-peak hours when vehicle traffic is lighter. As such, the increase in commute distance may be a temporary outcome of migration that is dealt with at a later stage (Breheny 1999).
Table 5  Estimation results for Commute distance

|                      | Model 1       |          | Model 2       |          | Model 3       |          |
|----------------------|---------------|----------|---------------|----------|---------------|----------|
|                      | \( B \)       | \( p \)  | \( B \)       | \( p \)  | \( B \)       | \( p \)  |
| Intercept            | -1.989        | <0.0001  | -1.923        | <0.0001  | -1.943        | <0.0001  |
| Migration Status     |               |          |               |          |               |          |
| Ref=stayer           |               |          |               |          |               |          |
| One Year Migrant     | 0.346         | <0.0001  | 0.031         | 0.0560   | 0.860         | <0.0001  |
| Five Year Migrant    | 0.188         | <0.0001  | -0.186        | <0.0001  | -0.683        | <0.0001  |
| Sex                  |               |          |               |          |               |          |
| Male                 | 0.163         | <0.0001  | 0.164         | <0.0001  | 0.175         | <0.0001  |
| Marital Status       |               |          |               |          |               |          |
| Ref=Divorced,        |               |          |               |          |               |          |
| Married              |               |          |               |          |               |          |
| Single               | -0.053        | <0.0001  | -0.052        | <0.0001  | -0.029        | <0.0001  |
| Married              | -0.032        | <0.0001  | -0.029        | <0.0001  | -0.044        | <0.0001  |
| Household Structure  |               |          |               |          |               |          |
| Ref=No children      |               |          |               |          |               |          |
| Children             | 0.041         | <0.0001  | 0.043         | <0.0001  | 0.042         | <0.0001  |
| Work Status          |               |          |               |          |               |          |
| Full Time            | 0.244         | <0.0001  | 0.244         | <0.0001  | 0.245         | <0.0001  |
| Geographic Context   |               |          |               |          |               |          |
| Ref=Moderate MIZ     |               |          |               |          |               |          |
| CMA                  | -0.306        | <0.0001  | -0.294        | <0.0001  | -0.300        | <0.0001  |
| CA                   | -0.321        | <0.0001  | -0.310        | <0.0001  | -0.317        | <0.0001  |
| Strong MIZ           | 0.267         | <0.0001  | 0.266         | <0.0001  | 0.263         | <0.0001  |
| Age (Ref=20–24)      |               |          |               |          |               |          |
| Age 25–29            | 0.043         | <0.0001  | 0.042         | <0.0001  | 0.043         | <0.0001  |
| Age 30–34            | 0.050         | <0.0001  | 0.050         | <0.0001  | 0.047         | <0.0001  |
| Age 35–39            | 0.059         | <0.0001  | 0.059         | <0.0001  | 0.058         | <0.0001  |
| Age 40–44            | 0.072         | <0.0001  | 0.700         | <0.0001  | 0.071         | <0.0001  |
| Age 45–49            | 0.053         | <0.0001  | 0.052         | <0.0001  | 0.054         | <0.0001  |
| Age 50–54            | 0.038         | <0.0001  | 0.037         | <0.0001  | 0.039         | <0.0001  |
| Age 55–59            | -0.007        | 0.3286   | -0.009        | 0.2469   | -0.011        | 0.1498   |
| Age 60–64            | -0.047        | <0.0001  | -0.048        | <0.0001  | -0.055        | <0.0001  |
| Age 65–69            | -0.137        | <0.0001  | -0.139        | <0.0001  | -0.143        | <0.0001  |
| Age 70+              | -0.298        | <0.0001  | -0.299        | <0.0001  | -0.305        | <0.0001  |
| Occupation           |               |          |               |          |               |          |
| Management           | -0.013        | 0.0016   | -0.012        | <0.0001  | -0.013        | <0.0001  |
| Science              | 0.143         | <0.0001  | 0.145         | <0.0001  | 0.146         | <0.0001  |
| Sales & Service      | -0.213        | <0.0001  | -0.214        | <0.0001  | -0.214        | <0.0001  |
| Health               | -0.079        | <0.0001  | -0.079        | <0.0001  | -0.079        | <0.0001  |
| Government           | -0.140        | <0.0001  | -0.139        | <0.0001  | -0.139        | <0.0001  |
| Household Income     |               |          |               |          |               |          |
| Household Income     | -0.002        | <0.0001  | -0.002        | <0.0001  | -2.000        | <0.0001  |
| ln Income            | 0.192         | <0.0001  | 0.185         | <0.0001  | 0.187         | <0.0001  |
| Transportation Mode  |               |          |               |          |               |          |
| Ref=Active Travel    |               |          |               |          |               |          |
| Car                  | 2.049         | <0.0001  | 2.047         | <0.0001  | 2.043         | <0.0001  |
| Transit              | 2.090         | <0.0001  | 2.092         | <0.0001  | 2.088         | <0.0001  |
| Migration Type       |               |          |               |          |               |          |
| Ref=Stayer           |               |          |               |          |               |          |
| Urban to Rural       | 0.452         | <0.0001  | 0.520         | <0.0001  |            |          |
| Rural to Urban       | 0.237         | <0.0001  | 0.332         | <0.0001  |            |          |
| Rural to Rural       | 0.408         | <0.0001  | 0.474         | <0.0001  |            |          |
| Urban to Urban       | 0.371         | <0.0001  | 0.463         | <0.0001  |            |          |
While the current analysis is limited by using the 2016 census, the results are largely consistent with expectations. It should be noted, however, that the findings may partially reflect the study location. Legislative pieces including the province’s Places to Grow (Government of Ontario 2006) and the Greenbelt Plan (Government of Ontario 2005) guide development and population growth within the GTHA. However, an unintended consequence may be increased commuting distance as workers may take advantage of relatively lower cost housing outside of the Greenbelt but who commute across the Greenbelt into the employment dense areas inside the Greenbelt, including Toronto. Within this context, further work could explore the impact of employment or occupation change concurrent with residential change and its impact on commute distance. For example, if individuals (whether migrants or stayers) change jobs, what are the implications for commute distance? Do commute distances decrease? Even for those that do not relocate, commute distance may increase. Further exploration is warranted.

Finally, the COVID-19 pandemic has potentially re-written commuting behaviors across the GTHA and elsewhere. On one hand, average commute distances could increase given multiple families moved out of the core of Toronto for more distant locations elsewhere in the GTHA or even beyond the GTHA as they sought less expensive housing and an escape from the virus (see Newbold et al. 2022). At the same time, if these families engaged in remote work and telecommuting, commute distances could decrease. Differences in commuting length by age group may also emerge, with distances potentially increasing among younger workers as they moved out of denser core areas, while remaining relatively stable among older workers who already resided in less dense areas. Further work, and particularly with longitudinal data that can track both residency and commute distance, is needed to untangle the impacts of the pandemic on commuting patterns, along with the longevity of these changes.

**Supplementary Information**  The online version contains supplementary material available at https://doi.org/10.1007/s11116-022-10341-5.
Authors’ contributions (KB Newbold): Literature Search and Review, data analysis, manuscript preparation. This research was supported financially by a grant from the Social Sciences and Humanities Research Council of Canada (SSHRC), #410-2009–1402.

Declarations

Conflict of interest The corresponding author states that there is no conflict of interest.

References

Axisa, J., Scott, D.M., Newbold, K.B.: Factors influencing commute distance: a case study of Toronto’s commuter shed. J. Transp. Geogr. 24, 123–129 (2012a)
Axisa, J., Newbold, K.B., Scott, D.M., Migration: Urban Growth, and Commuting Distance in Toronto’s Commute Shed. Area. 44(3), 344–355 (2012b)
Banister, C., Gallent, N.: Trends in commuting in England and Wales – becoming less sustainable? Area. 30,331–341(1998)
Boyle, P., Cassidy, S., Duke-Williams, O., Rees, P., Stokes, G., Turner, A.: Commuting Patterns in Rural Areas Countryside Agency, London (2001)
Brehey, M.: The people – where will they work? Town and Country. Planning. 68, 354–355 (1999)
Champion, T.: Urban-rural differences in commuting in England: a challenge to the rural sustainability agenda? Planning. Pract. Res. 24, 161–183 (2009)
Champion, T., Coombes, M., Brown, D.: Migration and longer distance commuting in Rural England. Reg. Stud. 42, 1–15 (2008)
Coombes, M., Raybould, S.: Commuting in England and Wales: ‘people’ and ‘place’ factors in Pitfield D ed Transportation Planning, Logistics and Spatial Mismatch: A Regional Perspective. Pion, London (2001)
Deding, M., Filges, T.: Geographical mobility of Danish dual-earner couples – the relationship between change of job and change of residence. J. Reg. Sci. 50, 615–634 (2010)
Filion, P.: The urban growth centres strategy in the Greater Golden Horseshoe: Lessons from downtowns, nodes and corridors. Neptis Foundation, Toronto, ON (2007)
Findlay, A.M., Stockdale, A., Findlay, A., Short, D.: Mobility as a driver of change in rural Britain: an analysis of the links between migration, commuting and travel to shop patterns. Int. J. Popul. Geogr. 7, 1–16 (2001)
Government of Ontario; Greenbelt plan Ministry of Municipal Affairs and Housing.; (2005)
Government of Ontario; Places to grow: growth plan for the Greater Golden Horseshoe Ministry of Public Infrastructure Renewal.; (2006)
Green, A.: Employment opportunities and constraints facing in-migrants to rural areas in England. Geography. 84, 34–44 (1999)
Green, A., Hogarth, T., Shackleton, R.E.: Longer distance commuting as a substitute for migration in Britain: a review of trends, issues and implications. Int. J. Popul. Geogr. 5, 49–67 (1999)
Green, A., Owen, D.: The Geography of Poor Skills and Access to Work. Policy Press, Bristol (2006)
Hemson, Consulting, Greater Golden Horseshoe: Growth forecasts to 2051. Available online at: (2020).
Horner, M.W., Schleith, D.K., Widener, M.J.: An Analysis of the Commuting and Jobs–Housing Patterns of Older Adult Workers. Prof. Geogr. 67(4), 575–585 (2015). DOI: https://doi.org/10.1080/00330124.2015.1054018
Newbold, K.B., Towle, C., Vrabic, K.: Exploring Human Mobilities in the COVID-19 Era. In: Brun, S., Gilbreath, D. (eds.) COVID-19 and A World of Ad Hoc Geographies. Springer (2022)
Sandow, E., Westin, K.: The preserving commuter – duration of long-distance commuting. Transp. Res. Part A. 44, 433–445 (2010)
Statistics Canada.; Commuting to Work. The Daily, Aug 24.: Available online at (2011). https://www150.statcan.gc.ca/n1/daily-quotidien/110824/dq110824b-eng.htm, accessed October 2021
Statistics Canada; Labour force characteristics by age group, monthly, seasonally adjusted: Available online at (2021). https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410028702, accessed October 2021
Zax, J.: When is a move a migration? Reg. Sci. Urban Econ. 24, 341–360 (1994)
Publisher’s Note  Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.