Mendel University in Brno

MENDELU Working Papers in Business and Economics

114/2026

Evaluating the Impact of Infrastructure Investment on Regional Labor Markets

Štěpán Kučera

MENDELU Working Papers in Business and Economics
Research Centre
Faculty of Business and Economics
Mendel University in Brno
Zemědělská 1, 613 00 Brno
Czech Republic
http://vyzc.pef.mendelu.cz/en
+420 545 132 605

Citation

Kučera, Š. (2026). Evaluating the Impact of Infrastructure Investment on regional Labor Markets. *MENDELU Working Papers in Business and Economics* 114/2026. Mendel University in Brno. Cited from: http://ideas.repec.org/s/men/wpaper.html

Abstract

Štěpán Kučera: **Evaluating the Impact of Infrastructure Investment on Regional Labor Markets**

This paper examines the effect of improvements in road transport infrastructure on the intensity of inter-municipal work commuting in the Czech Republic over the period 2011–2021. The study uses linked census data on commuting flows between more than 79,000 origin-destination municipality pairs, together with network-based estimates of travel times derived from OpenStreetMap. Using the Open-Source Routing Machine (OSRM), we estimate first-difference OLS models that relate changes in normalised commuting intensity to absolute changes in road travel time, while controlling for pre-existing commuting linkages between municipalities and a set of controls variables. We find that a one-minute reduction in travel time raises car-based commuting intensity by approximately 0.12 to 0.17 car commuters per 1,000 economically active residents. This positive effect remains consistent across both intra-regional and intra-district spatial specifications. The analysis of heterogenous effects reveals a pronounced gender asymmetry. The travel time effect is negative, sizeable, and statistically significant for female commuters in all specifications, while it is statistically indistinguishable from zero for male commuters. For women, shorter travel time thus acts as a catalyst for work commuting across all model specifications. By contrast, for male commuters, the estimated effect is statistically indistinguishable from zero in the pooled national sample, while in alternative specifications the effect remains very weak. Education-stratified results indicate that the aggregate effect is driven primarily by workers with secondary education, whereas workers with either basic or tertiary education do not appear to respond to infrastructure improvements, or more specifically to reductions in commuting time. Stratification by sector of employment shows statistically significant results particularly in the primary and secondary sectors. While shorter commuting times in agriculture and manufacturing are associated with an increased intensity of work commuting, the results for the services sector are less clear-cut and vary across model specifications. Overall, the findings suggest that the labour market returns to road infrastructure investment are highly specific. Reductions in travel time increase car-based commuting, but the magnitude of the effect is modest. Both the strength and direction of the effect depend on the population group considered and on the broader economic-geographical context. Road infrastructure may therefore operate as a potential mechanism for improving labour market access among selected sociodemographic groups, while primarily reinforcing existing commuting corridors rather than generating entirely new ones.

Key words: transport infrastructure; commuting; labour mobility; spatial mismatch; gender; Czech Republic

JEL: R41, R12, J61, H54

Contacts

Štěpán Kučera, Department of Finance and Accounting, Faculty of Business and Economics, Mendel university in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, e-mail: xkucer31@mendelu.cz.

Acknowledgements

This research was supported by the Internal Grant Agency PEF Mendelu. The author expresses their gratitude for the financial support, which made this study possible. The funding enabled the collection of data and facilitated the analysis presented in this article.

1 Introduction

By facilitating the movement of people, goods and services, improvements in transport networks can strengthen economic integration and reshape the spatial organisation of economic activity (Eisler et al. 2011; Persyn et al. 2023; Rodrigue 2024; Taylor 2021; Zhang a Cheng 2023). One important channel operates through regional labour markets, as better connectivity can make employment opportunities beyond the municipality of residence easier to reach (Ottaviano 2008; Vickerman et al. 1999). Changes in accessibility may therefore influence regional economic outcomes not only through firm location and market access, but also by improving the spatial matching of labour supply and demand(Evers a Oosterhaven 2005; Evers et al. 1987). In particular, shorter road travel times can lower commuting costs and widen the range of jobs that can be reached without relocation. This may be especially relevant for municipalities with limited local employment, where improved connections can strengthen links to larger labour markets and support greater inter-municipal mobility.

The consequences of improved connectivity are nevertheless unlikely to be spatially uniform. Transport improvements can strengthen integration between local economies, but they can also redistribute economic activity towards stronger centres, meaning that improved accessibility does not necessarily generate comparable benefits across territories (Banister a Berechman 2001; Adler et al. 2020). The so-called "straw effect", whereby improved transport connections may contribute to the outflow of economic activity from peripheral and economically weaker areas towards stronger economic centres, represents the dual nature of transport infrastructure investment. What increases interregional connectivity may simultaneously deepen spatial inequality and reinforce economic disparities(Ottaviano 2008; Kim a Han 2016b; Ciani et al. 2022). Existing evidence therefore emphasises that the effects of infrastructure depend on the characteristics of connected places and on the capacity of local labour and housing markets to respond to improved accessibility (Habrman a Žúdel 2017; Kučera et al. 2025).

A critical and still insufficiently explored area of this debate concerns the mechanisms through which improved transport accessibility affects labour mobility and labour market participation. Although changes in travel times between municipalities may influence the attractiveness of commuting, expand the effective reach of labour markets, and alter the spatial distribution of job seekers and job vacancies, the effects of travel-time changes on labour market participants are not necessarily homogenous across all socio-demographic groups. Responses in commuting behaviour to changes in infrastructure may be constrained to a considerable extent by housing-market rigidities, pre-existing spatial patterns of commuting and economic activity, as well as by a range of socio-demographic factors, including gender, occupational skill level, family responsibilities, and socioeconomic status

(Gobillon a Selod 2007; Minkus et al. 2022; Martín-Barroso et al. 2022). The extent to which these factors mitigate or reinforce the labour market effects of improved accessibility remains an open empirical question, particularly in settings where transport network development has been relatively rapid but territorially uneven.

This paper examines how changes in road travel time are associated with changes in inter-municipal commuting intensity in the Czech Republic between 2011 and 2021. The country provides a useful setting because its highly fragmented municipal structure allows commuting and accessibility to be observed at a fine spatial scale. Census data on inter-municipal commuting are combined with road-network data from OpenStreetMap and calculate municipality-to-municipality travel times using the Open Source Routing Machine (OSRM). This approach captures changes in road accessibility between municipalities and provides a direct basis for examining how improved connectivity relates to commuting behaviour.

Against this background, the main research question addressed in this paper is whether the commuting response to improvements in road accessibility differs across labour-market groups. First, the relationship between reductions in road travel time and changes in inter-municipal commuting is examined, together with the role of pre-existing commuting links between municipalities. The analysis is then extended to differences by gender, education and sector of employment. Such differences may arise because the same reduction in travel time does not necessarily reduce commuting constraints to the same extent for all workers. Greater effects may be observed among groups whose employment choices are more strongly limited by travel time, local job availability or other constraints on mobility. Particular attention is therefore given to the question of which labour-market groups show the strongest commuting response to reductions in travel time.

The paper contributes to the literature in three ways. First, it links changes in commuting flows to changes in network-based travel time observed for individual municipality pairs. Second, it examines whether the response to improved accessibility differs by gender, education and sector of employment. Third, combining comprehensive municipality-level commuting-flow data with OSRM-based travel-time estimates provides a more detailed measure of accessibility than approaches based on self-reported or aggregated indicators.

The remainder of the paper is organised as follows. Section 2 reviews the theoretical and empirical literature on transport infrastructure, regional development and labour mobility, with particular attention to the spatial mismatch framework and to heterogeneity in commuting responses by gender, education and sector of employment. Section 3 describes the data sources, the construction of the analytical dataset, and the empirical methodology. Section 4 reports the baseline and stratified results and discusses their implications for labour-market policy. Section 5 concludes.

2 Literature review

2.1 Transport accessibility and spatial labour-market integration

Transport infrastructure can influence regional economies through several channels, including firm productivity, market access, agglomeration and labour mobility. This paper focuses on the latter mechanism. The extent to which reductions in travel time alter the spatial matching of workers and jobs. Lower travel times increase the number of employment opportunities that can be reached within a given amount of time and may therefore increase commuting between municipalities. However, the effects need not be evenly distributed across space or across workers. They depend both on the geography of economic activity and on individual constraints that determine the willingness and ability to commute. This distinction is particularly important when infrastructure improvements connect smaller municipalities with stronger employment centres (Ottaviano 2008; Redding a Turner 2015; Gibbons et al. 2019; Ciani et al. 2022).

Commuting provides the main behavioural channel through which changes in road accessibility can affect local labour markets. Workers compare the benefits of employment opportunities with the monetary and time costs required to reach them. Longer commuting times therefore reduce the set of jobs that are economically or practically feasible, whereas faster connections enlarge the effective labour market available from a given place of residence. Better job accessibility has consequently been associated with shorter unemployment spells and improved labour-market outcomes (Korsu a Wenglenski 2010; Habrman a Žúdel 2017). From this perspective, infrastructure improvements can increase inter-municipal commuting even without changing the residential location of workers or the location of firms. The adjustment of commuting flows is unlikely to be instantaneous or independent of existing spatial relationships. Commuting patterns show considerable persistence because residential relocation is costly, job search is partly localised, and workers acquire information about employment opportunities through established spatial and social networks (Martín-Barroso et al. 2022). Travel-time reductions may therefore have stronger effects along municipality pairs where commuting links already exist. Infrastructure may in this sense intensify established labour-market connections rather than create entirely new ones.

2.2 Heterogeneous commuting constraints

These aggregate patterns of persistence, however, need not apply uniformly across all workers. The spatial mismatch framework provides a useful explanation for why the effects of improved accessibility may differ across workers. Spatial separation from employment opportunities can restrict job access when commuting costs or other mobility constraints limit the range of jobs that workers can feasibly reach (Gobillon a Selod 2021; Gobillon et al. 2007; Bastiaanssen et al. 2020).

Gender is one of the most consistently documented dimensions of commuting behaviour. Women tend to commute shorter distances and for shorter periods than men, even after differences in labour-market characteristics are taken into account (Martín-Barroso et al. 2022; Casado-Díaz et al. 2023). Household and childcare responsibilities can impose tighter daily time constraints on women, while occupational segregation and the structure of local labour markets may further limit the set of suitable employment opportunities within feasible commuting distance (Hanson 2010; Wachter a Holz-Rau 2022; OECD 2025). These constraints imply that reductions in travel time may have different marginal effects for women and men. Le Barbanchon, Rathelot and Roulet (2021) show that women place a higher value on shorter commutes when making job-search decisions, while evidence on commuting well-being similarly suggests that long journeys are particularly costly for workers with stronger household responsibilities (Avram 2025). Consistent with this asymmetry, causal estimates from the United States show that a ten-minute increase in commuting time reduces married women's labour-force participation by over four percentage points, with no significant effect for men (Farré et al. 2023). Improved accessibility may therefore expand the feasible job-search radius more strongly for women when commuting time is a binding constraint. At the same time, the response need not be uniform among women. Family status, skills, local employment opportunities, and household time constraints together shape how much a given travel-time reduction actually widens the feasible job-search radius (Kwon a Akar 2022; Avram 2025; Chen et al. 2024). Infrastructure improvements may therefore increase women’s labour-market accessibility without producing the same behavioural response across all female workers.

Spatial mismatch constraints may be particularly relevant for lower-skilled and lower-paid workers, for whom commuting costs represent a larger share of potential earnings and limited information about opportunities outside the local labour market may further narrow the scope of job search (Andersson et al. 2017). However, shorter travel times are likely to increase mobility only when transport costs represent a key constraint, as low expected wages, limited access to private transport, or the spatial concentration of suitable jobs may continue to restrict commuting. Educational attainment may therefore moderate the response to accessibility improvements in different ways. Lower-skilled workers may benefit from improved transport accessibility when poor connections limit access to more distant employment opportunities, but the effect may remain limited when other barriers to mobility persist. By contrast, highly educated workers generally search across wider labour markets and accept longer commutes (Martín-Barroso et al. 2022), making an additional travel-time saving less likely to alter the feasibility of an existing origin-destination link. At the same time, evidence from Germany suggests a different pattern, indicating that improved transport accessibility may facilitate interregional commuting particularly among highly educated workers (Heuermann a Schmieder 2019). The relationship between improved accessibility and commuting may therefore be non-linear across educational groups rather than increasing systematically with education.

The effect of travel-time reductions may also vary by sector of employment because jobs differ in their spatial distribution and dependence on road accessibility. Manufacturing and related secondary-sector activities are frequently located outside the largest urban cores and rely on access from surrounding municipalities, making commuting by car an important component of labour-market integration. Direct evidence on commuting patterns supports this distinction. Manufacturing workers commute systematically longer distances than service-sector workers across all education levels (Yue a O'Kelly 2023). Service employment is more strongly concentrated in urban centres and includes a wider range of occupations with very different commuting patterns, while employment in the primary sector remains partly tied to the location of land and natural resources. Infrastructure improvements may therefore change commuting flows differently across sectors even when workers face the same reduction in travel time (Ghani et al. 2016; Gibbons et al. 2019; Redding a Turner 2015). The expected response is therefore likely to vary across sectors rather than follow a single monotonic pattern.

2.3 Spatial concentration of employment and regional integration

Improved accessibility can also change where economic activity takes place rather than simply increase its aggregate level. New economic geography predicts that lower transport costs strengthen interactions between core and peripheral areas and may reinforce agglomeration in larger economic centres (Krugman 1991; Ottaviano 2008). Empirical studies therefore report both local gains from improved road access and displacement effects. New infrastructure has been associated with higher employment, firm activity and market access in connected locations (Ghani et al. 2016; Gibbons et al. 2019), but benefits may also become concentrated in larger centres at the expense of smaller surrounding municipalities (Faber 2014; Kim a Han 2016a; Ciani et al. 2022; Kučera et al. 2025). For labour markets, this distinction is important because stronger access to an employment centre does not require jobs to relocate towards peripheral municipalities. Instead, part of the adjustment can occur through increased commuting from workers' places of residence to existing centres of employment.

The spatial redistribution perspective also highlights that infrastructure investment may function as a zero-sum game at the regional level. rather than creating new economic activity, it reallocates existing activity from disadvantaged peripheral municipalities to dominant (Ciani et al. 2022). Whether newly connected communities gain or lose relative to the urban cores to which they become linked depends on factors including their initial economic strength, the size of the local labour market, and the institutional and geographic conditions that shape firms' location decisions (Meersman a Nazemzadeh 2017).

2.4 Empirical implications and identification

Two gaps follow from this review. First, most evidence on accessibility and commuting relies on proximity to major infrastructure or aggregate accessibility indices, rather than on observed changes in network-based travel time between specific origin–destination pairs. Second, while commuting patterns are known to differ across gender, education and sector, it remains unclear whether these same groups differ in how strongly they respond to a given improvement in accessibility. This paper addresses both gaps by linking municipality-pair-level changes in road travel time to changes in commuting intensity, and by testing whether the estimated relationship differs systematically across sociodemographic groups and across spatial scales (intra-regional versus intra-district pairs). This spatial dimension matters because infrastructure effects need not be scale-invariant: evidence from other settings shows that road capital can raise economic activity within the same county while simultaneously reducing it in neighbouring counties, and that regional and local accessibility can move in different directions (Boarnet 1998; Silva a Altieri 2022)

Taken together, the literature suggests that reductions in travel time can increase commuting by enlarging the set of jobs that can be reached from a worker's place of residence. The magnitude of this response should not, however, be expected to be uniform. Workers differ in the time, financial and household constraints attached to commuting, while employment opportunities differ in their spatial distribution across skill groups and sectors. The empirical analysis therefore examines whether reductions in road travel time increase inter-municipal car commuting overall and then tests whether this relationship differs by gender, educational attainment and sector of employment. Particular attention is paid to groups for whom spatial or time constraints are more likely to restrict labour-market access.

3 Data and methodology

The empirical analysis draws on two primary data sources. The first is the Census, conducted by the Czech Statistical Office (ČSÚ) in 2001, 2011, and 2021, which provides detailed information on inter-municipal commuting flows at the level of individual origin and destination pairs, disaggregated by mode of transport and by key sociodemographic and occupational characteristics of commuters such as a gender, education, and sector of employment. A full list of variables, their definitions, and their sources is provided in table 1.

The second data source is the OpenStreetMap (OSM) road network, from which municipality-pair travel times and distances by private car were computed using the Open Source Routing Machine (OSRM). OSRM is a high-performance routing engine that calculates shortest-path travel times across the road network, taking into account road type, speed limits, and network topology (Huber a Rust 2016). Travel times were computed for each origin and destination municipality pair in both 2011 and 2021, using the OSM network snapshot corresponding to each respective year so as to capture the infrastructure changes, principally motorway openings that occurred between the two census years. This approach yields network-based travel time estimates that are free from real-time congestion noise and are fully replicable, as the underlying map data are publicly available. The two datasets were merged at the municipality-pair level.

Table 1 Variable definitions and data sources

Variable	Definition	Source
Dependent variable		
d_share	Change in car-based commuting intensity between municipality pair i, j, 2011–2021 (commuters per 1,000 economically active residents of the origin municipality)	Czech Statistical Office, Census, 2011/2021
Main explanatory variable		
d_duration	Absolute change in road travel time between municipality pair i, j, 2011–2021 (average of both directions, minutes)	OpenStreetMap / OSRM, 2011/2021
Path-dependence controls		
log_flow2001	Logarithm of the total commuting flow between i, j (pre-treatment proxy for latent commuting demand)	Czech Statistical Office, Census, 2001

distance	Road distance between municipality pair i, j	OpenStreetMap / OSRM, 2011
Push-pull controls		
Public transportation	Share of commuters using public transport	Czech Statistical Office, Census, 2011/2021
Unemployment rate	Unemployment rate	Czech Statistical Office / MPSV, Public Database, 2011/2021
Completed dwellings	Number of completed dwellings	Czech Statistical Office, Public Database (housing construction), 2011/2021
Accommodation establishments	Number of accommodation establishments	Czech Statistical Office, Public Database (tourism statistics), 2011/2021
Mean age	Mean age of residents	Czech Statistical Office, Census, 2011/2021
Share of children 0–14	Share of residents aged 0–14	Czech Statistical Office, Census, 2011/2021
Share of seniors 65+	Share of residents aged 65+	Czech Statistical Office, Census, 2011/2021
Mass	Gravitational mass of the municipality pair	Czech Statistical Office, Census, 2011/2021

Push-pull variables are constructed as the origin-minus-destination differential of the listed characteristic and enter the model as the change in this differential between 2011 and 2021: $d\_gap_{x,i,j} = (x_{i,2021} - x_{j,2021}) - (x_{i,2011} - x_{j,2011})$.

The 2021 census was conducted during the COVID-19 pandemic, when a segment of workers, particularly those in highly qualified professional occupations shifted temporarily to remote working. To assess whether this affected the commuting data, we examined the stability of commuting flows between 2011 and 2021. Only 12.2% of municipality pairs experienced a decline in commuting intensity, with the overall pattern moving towards increased commuting. This indicates that the 2021 census data remain broadly representative of underlying commuting relationships, though a modest downward pressure on commuting counts in certain occupational segments cannot be fully ruled out. We expect that the pandemic reduced how often people commute, that is, the frequency of trips per week, rather than the number of people commuting along a given route, which increased overall.

Second, the gender-disaggregated commuting data are subject to statistical disclosure limitations, as gender information is anonymised for commuting flows involving very small numbers of commuters, typically only a single individual. These unidentified observations tend to occur primarily over relatively long commuting distances. Nevertheless, gender remains identifiable for 93.4% of commuters by volume, providing broad coverage for the analysis of gender differences. The estimated gender effects should therefore be interpreted with this limitation in mind.

Third, travel times derived from OpenStreetMap reflect the road network configuration in each year and do not account for real-time traffic congestion. This approach ensures consistency and replicability of travel-time estimate across census years, while implying that the estimated effects primarily capture structural changes in transport infrastructure rather than variation in congestion levels. Given the focus of this study on long-term changes in transport accessibility, this represents an appropriate methodological simplification.

The dependent variable captures the change in car-based commuting intensity between a pair of municipalities over the decade 2011–2021, expressed as the number of car commuters per 1,000 economically active persons residing in the origin municipality:

$$d\_share_{i,j} = \frac{commuters_{i,j,2021}}{Economically\ active_{i,2021}} - \frac{commuters_{i,j,2011}}{Economically\ active_{i,2011}}\ x\ 1000$$

where *i* indexes the origin municipality and *j* the destination municipality, $commuters$ are commuted by car identified in the dataset and $Economically\ active$ is the number of economically active persons in the origin municipality. Pairs for which both the 2011 and 2021 commuting flows are zero are dropped from the sample, as they carry no information about the direction of change.

The main explanatory variable of interest is the change in road travel time between each origin-destination pair across the two census years. The absolute change in travel time (in minutes) is defined as:

$$d\_duration_{i,j} = \frac{duration_{i,j,2021} + duration_{j,i,2021}}{2} - \frac{duration_{i,j,2011} + duration_{j,i,2011}}{2}$$

we use an average of both commuting directions as it may differ (e.g. due to one-way routes). A negative value of $d\_duration$ indicates that the journey between a given pair of municipalities became faster between 2011 and 2021, most commonly due to the opening of a new motorway or expressway section along or near the relevant route.

Control variables are used to capture other sources of variability. The model includes the 2001 commuting flow as a pre-treatment proxy for the latent demand for commuting between each pair.

Pairs with a strong established commuting relationship in 2001 are likely to have been selected for infrastructure improvement precisely because of their high commuting potential, and controlling for this pre-existing demand reduces the risk of attributing to infrastructure what is in fact an extrapolation of a pre-existing trend. This concern reflects a broader empirical issue: infrastructure improvements are not randomly located, as new roads are more likely to be built where expected demand, economic potential, or strategic importance is already high (Crescenzi et al. 2016; Deng 2013; Redding a Turner 2015). Conditioning on pre-existing commuting flows therefore helps distinguish the effect of changes in accessibility from pre-existing spatial economic structure, although it does not fully eliminate the possibility of residual endogeneity. The logarithm of the total commuting flow in 2001 is included as an additional predictor ($log\_flow2001_{ij}$).

The choice of control variables is guided by a push-pull framework, which posits that commuting flows between two municipalities reflect the relative economic and demographic attractiveness of the destination compared to the origin. Variables that make the destination relatively more attractive–better employment prospects, more housing availability, larger population mass–are expected to generate pull effects that increase commuting from the origin. Conversely, characteristics of the origin that reduce the availability of local employment generate push effects that stimulate outward commuting.

Push-pull differentials are constructed as the origin value minus the destination value for each characteristic and each census year:

$$d\_gap_{x,i,j} = \left(x_{i,2021} - x_{j,2021}\right) - \left(x_{i,2011} - x_{j,2011}\right)$$

Where x is one of the following indices: use of public transportation, unemployment rate, completed dwellings, accommodation establishments, mean age, share of children 0–14, share of seniors 65+ and a gravitational mass, which captures population size of the pair and, unlike others, is computed as the logarithm.

The baseline regression model takes the following form:

$$d\_share_{i,j} = \beta_0 + \beta_1 \cdot d\_duration_{i,j} + \beta_2 \cdot log\_flow2001_{ij} + \beta_3 \cdot distance_{\ ij} + d\_gap_{x,i,j}{}'\gamma + \varepsilon_{ij}$$

All models are estimated by ordinary least squares (OLS) with heteroskedasticity-robust standard errors. This adjustment is necessary because the variance of the error term is not constant across municipality pairs. Commuting flows between larger municipalities tend to fluctuate more than flows between smaller ones, violating the homoskedasticity assumption of standard OLS inference. Robust standard errors correct for this heteroskedasticity without altering the point estimates, ensuring that the reported significance levels are not overstated.

4 Results and discussion

Table 2 presents the results of the three baseline OLS models. The pooled sample covers 79,244 municipality-pairs (Model 1), which is reduced to 66,870 intra regional pairs (Model 2) and 47,056 intra-district pairs (Model 3) as the geographic restriction is tightened. Across all three specifications, the key coefficient of interest the effect of the absolute change in road travel time on the change in normalised car-based commuting intensity is negative and statistically significant. In the base model, a one-minute reduction in travel time is associated with an increase of approximately 0.12 car commuters per 1,000 economically active residents of the origin municipality. This effect becomes somewhat larger in absolute terms for intra regional pairs and attains its greatest magnitude for intra-district pairs, though the latter estimate is significant only at the ten percent level, reflecting the reduced sample size and greater homogeneity of closely proximate municipality pairs. The consistency of the negative sign across all three specifications provides robust evidence that infrastructure improvements operationalised as reductions in network-based travel time translate into measurable increases in car based commuting intensity.

The historical commuting flow is the strongest predictor in all three models and carries a large positive coefficient: each unit increase in the logarithm of the 2001 flow is associated with an increase of between 305 and 376 in the normalised commuting intensity change, reflecting the strong path-dependence of spatial labour market integration. Pairs with established commuting linkages at the start of the observation period thus experience the largest absolute growth in commuting flows over the following two decades, consistent with the theoretical argument that infrastructure improvements reinforce rather than create commuting relationships. The initial road distance enters with a negative and highly significant coefficient across all specifications, indicating that more distant municipality pairs tend to experience smaller increases in normalised commuting intensity a result that is consistent with declining marginal accessibility gains from infrastructure for pairs separated by greater absolute distances.

Turning to the push-pull controls, the change in the public transport commuting share enters with a large and highly significant negative coefficient, indicating that pairs in which public transport commuting grew relatively faster experienced weaker growth in car based commuting a mechanical substitution effect between modes. The gravitational mass variable is negative throughout, suggesting that pairs where the joint population product grew most rapidly did not necessarily exhibit the strongest gains in car commuting intensity. The unemployment rate differential is positively signed and significant, confirming that pairs in which the destination municipality experienced rising unemployment relative to the origin show smaller increases or larger decreases in commuting intensity, as weaker labour demand at the destination reduces the incentive to commute there. The mean age and the share of children are both positively associated with commuting growth, while the share of seniors is insignificant throughout.

Table 2. Baseline results

	(1) Base Model	(2) Intra-region	(3) Intra-district
d_duration	-0.120***	-0.135***	-0.170+
	(0.002)	(0.003)	(0.053)
log_flow2001	304.588***	327.158***	376.384***
	(0.000)	(0.000)	(0.000)
distance	-0.012***	-0.015***	-0.012***
	(0.000)	(0.000)	(0.000)
Public transportation	-304.852***	-428.479***	-602.189***
	(0.000)	(0.000)	(0.000)
Mass	-482.608***	-399.631***	-453.026***
	(0.000)	(0.000)	(0.000)
Unemployment rate	42.401***	39.651***	46.567***
	(0.000)	(0.000)	(0.000)
Completed dwellings	-0.180+	1.946***	3.548***
	(0.065)	(0.000)	(0.000)
Accommodation establishments	0.561	16.189***	35.433***
	(0.432)	(0.000)	(0.000)
Mean age	119.704***	120.861***	123.092***
	(0.000)	(0.000)	(0.000)
Share of children 0–14	30.137***	31.142***	31.810***
	(0.000)	(0.000)	(0.000)
Share of seniors 65+	-5.380	-7.399	-6.746
	(0.231)	(0.128)	(0.237)
Constant	330.752***	315.546***	172.132***
	(0.000)	(0.000)	(0.000)
N	79244.000	66870.000	47056.000
R2	0.089	0.110	0.118
F	456.020	432.807	338.497

p-values in parentheses, robust standard errors
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.005$

Table 3 reports results for gender disaggregated commuting flows. For female commuters, the travel time coefficient is negative and statistically significant in all three specifications. Women's commuting behaviour thus responds strongly and consistently to changes in road travel time. For male commuters, by contrast, the base model coefficient is negative but statistically indistinguishable from zero. The magnitude of the female coefficient substantially exceeds that of the male coefficient in the base model, and the two-point estimates are statistically distinguishable.

This finding is consistent with the spatial mismatch and household responsibility literatures reviewed in Section 2. Women's commuting decisions are more tightly constrained by the feasibility of the journey both in terms of absolute travel time and the predictability of arrival and departure because domestic responsibilities create harder time constraints around the working day. Infrastructure improvements that reduce travel time therefore have a proportionally larger impact on the set of feasible job worker matches available to women, raising the effective labour market radius accessible to female workers and facilitating employment relationships that were previously too time costly to sustain. For men, who on average face looser time constraints, the marginal effect of a travel time reduction is smaller. Men are already commuting longer distances and the addition of further connectivity provides incrementally less new employment access. The R-squared values are uniformly higher for women (0.074–0.101) than for men (0.058–0.073), suggesting that the model captures a larger share of the variance in female commuting intensity, consistent with female commuting behaviour being more systematically related to the structural determinants included in the model.

Table 3. Gender-disaggregated results

	(1) Base Model	**(2) Intra-region**	**(3) Intra-district**
d_duration – women only	-0.142***	-0.107***	-0.134*
	(0.000)	(0.002)	(0.036)
d_duration – men only	-0.028	-0.074*	-0.123+
	(0.385)	(0.042)	(0.065)

p-values in parentheses, robust standard errors
+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.005

The education stratified results in Table 4 reveal a pronounced nonlinearity in the relationship between travel time and commuting intensity across the educational distribution. For secondary educated workers the largest group in the Czech labour market the travel time coefficient mirrors the baseline result closely in all model specifications. Secondary workers' commuting behaviour seem to be primarily responsible for the aggregate effect documented in Table 2.

For workers with only basic education, the travel time coefficient is economically negligible and statistically insignificant in the base and intra-regional models, reaching marginal significance with a positive sign in the intra district model. This null result is consistent with two complementary explanations. First, low skilled workers are disproportionately employed in occupations that are geographically constrained agriculture, food processing, local retail and therefore less likely to respond to improved inter-municipal accessibility. Second, car ownership and regular commuting may be costly for low-skilled and lower income households, limiting the extent to which road infrastructure improvements translate into commuting flow changes for this group. For tertiary educated workers, the base model coefficient is positive, this estimate reverses to a small negative in the intra-regional subsample. However, all effects are far from being significant.

Table 4. Education-stratified results

	(1) Base Model	(2) Intra-region	(3) Intra-district
d_duration – Primary education	0.004	0.007	0.022+
	(0.359)	(0.238)	(0.059)
d_duration – Secondary education	-0.130***	-0.115***	-0.149*
	(0.000)	(0.002)	(0.038)
d_duration – Tertiary education	0.007	-0.010	-0.005
	(0.631)	(0.443)	(0.819)

p-values in parentheses, robust standard errors
+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.005

Table 5 summarises the travel time coefficient for commuters disaggregated by economic sector. For primary sector workers (predominantly agriculture), the coefficient is negative and significant across all three specifications, indicating that even workers in rural, land-tied occupations respond positively to improved accessibility, possibly by accessing processing and distribution employment at larger nearby municipalities. The magnitude of the effect is, however, small relative to the baseline and is accompanied by a very low R-squared (0.008), reflecting the limited explanatory power of the structural model for this heterogeneous group.

Secondary sector (manufacturing and construction) workers display a pattern analogous to the aggregate: the base model coefficient is negative and significant, while the intra district estimate is smaller and statistically imprecise. The tertiary sector result stands out in the base model, the coefficient is positive and large, but this is completely reversed in both geographic subsamples, indicating that the aggregate positive estimate is entirely driven by between region flows. The R-squared for the tertiary sector base model (0.209) is more than twice that of any other specification, suggesting that service sector commuting is more strongly structured by the gravitational and push-pull forces captured in the model. The possible interpretation is that tertiary sector flows predominantly follow economic geography patterns rather than being strongly reshuffled by road infrastructure improvements. Service workers are already commuting to destinations selected on the basis of economic opportunity, and marginal changes in travel time within already connected corridors do not substantially alter these flows.

Table 5. Sector-stratified results

	(1) Base Model	(2) Intra-region	(3) Intra-district
d_duration – Primary sector	-0.052***	-0.045***	-0.071***
	(0.000)	(0.000)	(0.000)
d_duration – Secondary sector	-0.076***	-0.051*	-0.054
	(0.000)	(0.044)	(0.305)
d_duration – Tertiary sector	0.371***	-0.085*	-0.078
	(0.000)	(0.019)	(0.241)

p-values in parentheses, robust standard errors; + p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.005

The baseline results presented in Table 2 establish the average relationship underlying the subsequent heterogeneity analysis. A one-minute reduction in road travel time is associated with an increase in car-based commuting intensity of approximately 0.12 to 0.17 commuters per 1,000 economically active residents, with the estimated effect becoming stronger as the geographical scope narrows from the pooled sample to municipality pairs within the same district. Two features of these baseline results merit particular attention before turning to the stratified estimates. First, the pre-treatment commuting flow in 2001 is by far the largest and most precisely estimated coefficient across all three specifications. This finding supports the mechanism of path dependence in historical commuting patterns. Municipality pairs with an established commuting relationship tend to exhibit the strongest subsequent response to improvements in accessibility, consistent with the notion that infrastructure primarily reinforces existing commuting corridors rather than creating entirely new ones. Second, the negative coefficient on initial distance indicates that this reinforcing effect diminishes with geographical separation, as improvements in accessibility generate progressively smaller commuting responses between more distant municipalities. Taken together, these findings suggest that the aggregate effect reported in Table 2 does not represent a uniform response to improved accessibility but rather depends on the pre-existing spatial relationship between origins and destinations. The group-specific results presented below provide further insight into this heterogeneity.

The gender specific results provide the clearest evidence of heterogeneity. Female commuting responds strongly and significantly to reductions in travel time, whereas the corresponding effect for men is statistically indistinguishable from zero in the baseline model. This pattern is consistent with causal evidence from other settings. Farré, Jofre-Monseny and Torrecillas (2023) show that a ten-minute increase in commuting time reduces labour-force participation among married women by more than four percentage points, while having no statistically significant effect on men. The results presented here extend this reasoning to changes in transport accessibility. Shorter travel times appear to relax time constraints associated with commuting, particularly among women, which is consistent with the role of household and childcare responsibilities. Improved accessibility therefore appears to affect commuting differently across genders rather than generating a uniform response.

The results by educational attainment are more difficult to explain through a single mechanism, and the existing literature provides mixed evidence in this respect. The absence of a statistically significant response among workers with basic education is consistent with the possibility that car ownership costs and the predominantly local and non tradable nature of many low skilled jobs limit their ability to take advantage of improved accessibility. This interpretation is consistent with Andersson et al. (2017), who show that the labour-market benefits associated with improved accessibility tend to be concentrated among workers with greater capacity to search for employment across wider geographical areas. At the same time, the insignificant response among tertiary educated workers contrasts with evidence from Germany, where infrastructure induced reductions in travel time were associated with commuting responses among highly educated workers (Heuermann a Schmieder 2019). Against this background, the significant response observed among workers with secondary education may reflect the specific occupational composition of this group in the Czech labour market, where manufacturing and technical occupations are relatively prominent. These workers may have sufficient mobility to respond to improvements in accessibility while remaining sufficiently constrained by the spatial distribution of employment for reductions in travel time to affect their commuting behaviour.

The specific results support this interpretation. The strong and consistent response among workers in the primary and secondary sectors contrasts with the less stable and largely insignificant coefficient for the tertiary sector outside the baseline specification. This pattern is consistent with evidence that manufacturing employment is associated with systematically longer commuting distances than service-sector employment across educational groups (Yue a O'Kelly 2023). By contrast, commuting in the service sector appears to be more strongly influenced by the preexisting spatial distribution of economic activity and less responsive to marginal changes in road travel time.

The combined effects observed when moving from the pooled sample to the intra district specification are consistent with evidence that infrastructure effects are not invariant across spatial scales. Accessibility improvements observed at the regional level do not necessarily translate proportionally into effects at a more local level and may, in some cases, operate differently across geographical scales (Boarnet 1998; Silva a Altieri 2022). This variation highlights the importance of examining commuting responses across different spatial scales rather than relying on a single geographical specification.

Taken together, the results point to targeted rather than uniform implications for economic policy. Road infrastructure investment does not increase commuting evenly across the workforce. Instead, the strongest labour market responses are concentrated among specific groups, including women, workers with secondary education, and those employed in manufacturing and agriculture, for whom travel time appears to represent a greater constraint on mobility. From a regional policy perspective, this suggests that the labour market benefits of road investment may be particularly pronounced in areas where these groups constitute a substantial share of the workforce. Improvements in transport accessibility should therefore be assessed not only as a general determinant of regional commuting, but also as a factor with the potential to alleviate specific constraints on labour mobility.

5 Conclusion

This paper has examined the relationship between changes in road travel time and inter municipal commuting intensity in the Czech Republic over the decade 2011–2021, drawing on linked census data covering more than 79,000 municipality pairs and network-based travel time estimates derived from OpenStreetMap via the OSRM routing engine. Three main contributions emerge from the analysis.

First, reductions in road travel time consistently increase car based commuting intensity across all geographic subsamples, with a one-minute saving associated with a rise of approximately 0.12 to 0.17 car commuters per 1,000 economically active residents. The strong positive effect of the 2001 pre-treatment flow confirms that infrastructure reinforces established corridors more than it creates new ones. Second, the effect is substantially larger and more consistent for women than for men, consistent with female commuting being more tightly constrained by absolute journey feasibility and domestic time budgets. Transport improvements thus serve as a partial equaliser of labour market access, expanding the set of viable job worker matches disproportionately for female workers. Third, secondary educated workers drive the aggregate result. Basic educated workers show no significant response, while the apparent positive effect for tertiary workers in the base model reverses within geographically restricted subsamples, reflecting metropolitan suburbanisation rather than a genuine infrastructure effect.

The findings carry several policy implications. The strong response of female and secondary educated commuters to travel time reductions suggests that road infrastructure investment can contribute to reducing spatial mismatches in labour markets characterised by high shares of workers in these groups notably manufacturing regions in the Czech interior where a large secondary sector workforce resides in municipalities with limited local employment opportunities.

Second, the strong dependence of the estimated effect on pre-existing commuting flows and on proximity between municipalities implies that road investment delivers the largest labour market returns when it reinforces already established commuting corridors rather than when it opens entirely new connections. This has a direct implication for project prioritization. Municipality pairs that already had an established commuting relationship, and pairs located close to one another within the same district, are more likely to generate measurable labour mobility gains than investments aimed at more distant locations with little pre-existing connection.

Third, the pronounced gender asymmetry suggests that road infrastructure alone is unlikely to close existing gaps in labour market accessibility. The gender asymmetry documented above suggests that travel time is only part of what constrains women's commuting. Household and childcare responsibilities appear to constrain it as well, meaning that a shorter commute does not, by itself, remove every barrier to a longer or more distant job search. Road infrastructure is therefore likely to be more effective at improving women's labour market access when paired with complementary measures such as childcare availability or flexible working arrangements than when treated as a stand-alone policy tool.

Several limitations of this analysis should be acknowledged. The identification strategy relies on conditioning on pretreatment commuting intensity rather than on a fully exogenous instrument for changes in travel time, and residual endogeneity arising from the non-random placement of infrastructure investments cannot be entirely ruled out. The 2021 Census was conducted during the COVID-19 pandemic, when some workers temporarily shifted to working from home. However, as discussed in the paper, the stability of commuting flows between 2011 and 2021 suggests that this shift did not systematically bias the estimated relationship, although a modest downward effect on commuting volumes in certain occupational segments cannot be entirely excluded. Finally, the analysis is restricted to car based commuting flows and does not capture potential substitution effects between improvements in road and rail transport. In areas that experienced substantial investment in rail infrastructure alongside motorway expansion, the estimated effect of road travel time may therefore partly reflect omitted improvements in rail accessibility.

References

Adler, Martin W., Ilias Pasidis, Or Levkovich, Alexander C. Lembcke, a Rudiger Ahrend. 2020. „Roads, Market Access and Regional Economic Development “. *OECD Regional Development Papers*, dostupné online před tiskem, prosinec 3. https://doi.org/10.1787/8b9eca17-en.

Andersson, Fredrik, Mark J. Kutzbach, John C. Haltiwanger, a Henry Pollakowski. 2017. *Job Displacement and the Duration of Joblessness: The Role of Spatial Mismatch*. 203–18. https://doi.org/10.1162/REST_a_00707.

Avram, Silvia. 2025. „Commuting and Gender Differences in Job Opportunities“. *Sociological Science* 12 (březen): 158–79. https://doi.org/10.15195/v12.a8.

Banister, David, a Yossi Berechman. 2001. „Transport investment and the promotion of economic growth“. *Journal of Transport Geography*, Mobility and Spatial Dynamics, roč. 9 (3): 209–18. https://doi.org/10.1016/S0966-6923(01)00013-8.

Bastiaanssen, Jeroen, Daniel Johnson, a Karen Lucas. 2020. „Does Transport Help People to Gain Employment? A Systematic Review and Meta-Analysis of the Empirical Evidence“. *Transport Reviews* 40 (5): 607–28.

Boarnet, Marlon G. 1998. „Spillovers and the Locational Effects of Public Infrastructure“. *Journal of Regional Science* 38 (3): 381–400. https://doi.org/10.1111/0022-4146.00099.

Casado-Díaz, José M., Raquel Simón-Albert, a Hipólito Simón. 2023. „Gender Differences in Commuting: New Evidence from Spain“. *Social Indicators Research: An International and Interdisciplinary Journal for Quality-of-Life Measurement* 169 (3): 907–41.

Ciani, Emanuele, Guido de Blasio, a Samuele Poy. 2022. „A freeway to prosperity? Evidence from Calabria, South of Italy“. *Economics of Transportation* 29 (březen): 100250. https://doi.org/10.1016/j.ecotra.2022.100250.

Crescenzi, Riccardo, Marco Di Cataldo, a Andrés Rodríguez-Pose. 2016. „Government Quality and the Economic Returns of Transport Infrastructure Investment in European Regions“. *Journal of Regional Science* 56 (4): 555–82. https://doi.org/10.1111/jors.12264.

Deng, Taotao. 2013. „Impacts of Transport Infrastructure on Productivity and Economic Growth: Recent Advances and Research Challenges“. *Transport Reviews* 33 (6): 686–99. https://doi.org/10.1080/01441647.2013.851745.

Eisler, Jan, Jaromír Kuns, a František Orava. 2011. *Ekonomika dopravního systému.* 1. Vysoká škola ekonomická v Praze: Oeconomica.

Evers, G. H. M., a Jan Oosterhaven. 2005. *TRANSPORTATION, FRONTIER EFFECTS AND REGIONAL DEVELOPMENT IN THE COMMON MARKET*. https://doi.org/10.1111/j.1435-5597.1988.tb01113.x.

Evers, G. H. M., P. H. Van Der Meer, J. Oosterhaven, a J. B. Polak. 1987. „Regional Impacts of New Transport Infrastructure: A Multisectoral Potentials Approach“. *Transportation* 14 (2): 113–26. https://doi.org/10.1007/BF00837588.

Faber, Benjamin. 2014. „Trade Integration, Market Size, and Industrialization: Evidence from China’s National Trunk Highway System“. *The Review of Economic Studies* 81 (3 (288)): 1046–70.

Farré, Lídia, Jordi Jofre-Monseny, a Juan Torrecillas. 2023. „Commuting time and the gender gap in labor market participation“. *Journal of Economic Geography* 23 (4): 847–70. https://doi.org/10.1093/jeg/lbac037.

Ghani, Ejaz, Arti Grover Goswami, a William R. Kerr. 2016. „Highway to Success: The Impact of the Golden Quadrilateral Project for the Location and Performance of Indian Manufacturing“. *The Economic Journal* 126 (591): 317–57. https://doi.org/10.1111/ecoj.12207.

Gibbons, Stephen, Teemu Lyytikäinen, Henry G. Overman, a Rosa Sanchis-Guarner. 2019. „New road infrastructure: The effects on firms“. *Journal of Urban Economics* 110 (březen): 35–50. https://doi.org/10.1016/j.jue.2019.01.002.

Gobillon, Laurent, a Harris Selod. 2007. „The Effect of Segregation and Spatial Mismatch on Unemployment: Evidence from France“. SSRN Scholarly Paper No. 1134239. Social Science Research Network, březen 1. https://papers.ssrn.com/abstract=1134239.

Gobillon, Laurent, a Harris Selod. 2021. „Spatial Mismatch, Poverty, and Vulnerable Populations“. *Post-Print*, Post-Print, halshs-03247492. https://ideas.repec.org//p/hal/journl/halshs-03247492.html.

Gobillon, Laurent, Harris Selod, a Yves Zenou. 2007. „The Mechanisms of Spatial Mismatch“. *Urban Studies* 44 (12): 2401–27.

Habrman, Michal, a Branislav Žúdel. 2017. *Od Tatier k Dunaju, diaľnice stavajú*. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.mfsr.sk/files/archiv/priloha-stranky/4947/40/2017_10_Dialnice.pdf.

Hanson, Susan. 2010. „Gender and mobility: new approaches for informing sustainability“. *Gender, Place & Culture* 17 (1): 5–23. https://doi.org/10.1080/09663690903498225.

Heuermann, Daniel F., a Johannes F. Schmieder. 2019. „The Effect of Infrastructure on Worker Mobility: Evidence from High-Speed Rail Expansion in Germany“. *Journal of Economic Geography* 19 (2): 335–72.

Huber, Stephan, a Christoph Rust. 2016. „Calculate Travel Time and Distance with Openstreetmap Data Using the Open Source Routing Machine (OSRM)“. *The Stata Journal* 16 (2): 416–23. https://doi.org/10.1177/1536867X1601600209.

Chen, Yutong, Kerem Coşar, Devaki Ghose, Shirish Mahendru, a Sheetal Sekhri. 2024. „Gender-Specific Transportation Costs and Female Time Use: Evidence from India’s Pink Slip Program“. SSRN Scholarly Paper No. 4851782. Social Science Research Network, květen 1. https://papers.ssrn.com/abstract=4851782.

Kim, Jin Yoo, a Jung Hoon Han. 2016a. „Straw Effects of New Highway Construction on Local Population and Employment Growth“. *Habitat International* 53 (duben): 123–32. https://doi.org/10.1016/j.habitatint.2015.11.009.

Kim, Jin Yoo, a Jung Hoon Han. 2016b. „Straw effects of new highway construction on local population and employment growth“. *Habitat International* 53 (duben): 123–32. https://doi.org/10.1016/j.habitatint.2015.11.009.

Korsu, Emre, a Sandrine Wenglenski. 2010. „Job Accessibility, Residential Segregation and Risk of Long-term Unemployment in the Paris Region“. *Urban Studies* 47 (11): 2279–324.

Krugman, Paul. 1991. „Increasing Returns and Economic Geography“. *Journal of Political Economy* 99 (3): 483–99.

Kučera, Štěpán, Soňa Kukučková, a Marek Litzman. 2025. „Impacts and Dynamics of Transport Infrastructure Development on Regional Socioeconomic Growth“. *Sociologia - Slovak Sociological Review* 57 (4): 271–90. https://doi.org/10.31577/sociologia.2025.57.4.10.

Kwon, Kihyun, a Gulsah Akar. 2022. „Have the gender differences in commuting been shrinking or persistent? Evidence from two-earner households in the U.S.“ *International Journal of Sustainable Transportation* 16 (12): 1121–30. https://doi.org/10.1080/15568318.2021.1971345.

Le Barbanchon, Thomas, Roland Rathelot, a Alexandra Roulet. 2021. „Gender Differences in Job Search: Trading off Commute against Wage“. *The Quarterly Journal of Economics* 136 (1): 381–426. https://doi.org/10.1093/qje/qjaa033.

Martín-Barroso, David, Juan A. Núñez-Serrano, Jaime Turrión, a Francisco J. Velázquez. 2022. „Are workers’ commutes sensitive to changes in the labour market situation?“ *Journal of Transport Geography* 101 (květen): 103352. https://doi.org/10.1016/j.jtrangeo.2022.103352.

Meersman, Hilde, a Marzieh Nazemzadeh. 2017. *The contribution of transport infrastructure to economic activity: The case of Belgium*. https://doi.org/10.1016/j.cstp.2017.03.009.

Minkus, Lara, Nicolai Groepler, a Sonja Drobnič. 2022. „The significance of occupations, family responsibilities, and gender for working from home: Lessons from COVID-19“. *PLoS ONE* 17 (6): e0266393. https://doi.org/10.1371/journal.pone.0266393.

OECD (OECD). 2025. „Full Report: Gender Gaps in Paid and Unpaid Work Persist“. září 14. https://www.oecd.org/en/publications/gender-gaps-in-paid-and-unpaid-work-persist_25a6c5dc-en/full-report.html.

Ottaviano, Gianmarco I. P. 2008. „Infrastructure and Economic Geography: An Overview of Theory and Evidence“. *EIB Papers*, EIB Papers, červenec 18, 6/2008. https://ideas.repec.org//p/ris/eibpap/2008_006.html.

Persyn, Damiaan, Javier Barbero, Jorge Díaz-Lanchas, Patrizio Lecca, Giovanni Mandras, a Simone Salotti. 2023. „The Ripple Effects of Large-Scale Transport Infrastructure Investment“. *Journal of Regional Science* 63 (4): 755–92. https://doi.org/10.1111/jors.12639.

Redding, Stephen J., a Matthew A. Turner. 2015. „Chapter 20 - Transportation Costs and the Spatial Organization of Economic Activity“. In *Handbook of Regional and Urban Economics*, editoval Gilles Duranton, J. Vernon Henderson, a William C. Strange, roč. 5. Handbook of Regional and Urban Economics. Elsevier. https://doi.org/10.1016/B978-0-444-59531-7.00020-X.

Rodrigue, Jean-Paul. 2024. *The Geography of Transport Systems*. 6. Routledge. https://doi.org/10.4324/9781003343196.

Silva, Cecília, a Marcelo Altieri. 2022. „Is regional accessibility undermining local accessibility?“ *Journal of Transport Geography* 101 (květen): 103336. https://doi.org/10.1016/j.jtrangeo.2022.103336.

Taylor, Michael A. P. 2021. „Chapter 3 - Transportation infrastructure“. In *Climate Change Adaptation for Transportation Systems*. Elsevier. https://doi.org/10.1016/B978-0-12-816638-3.00003-9.

Vickerman, Roger, Klaus Spiekermann, a Michael Wegener. 1999. „Accessibility and Economic Development in Europe“. *Regional Studies* 33 (1): 1–15. https://doi.org/10.1080/00343409950118878.

Wachter, Isabelle, a Christian Holz-Rau. 2022. „Gender Differences in Work-Related High Mobility Differentiated by Partnership and Parenthood Status“. *Transportation* 49 (6): 1737–64. https://doi.org/10.1007/s11116-021-10226-z.

Yue, Liying, a Morton O’Kelly. 2023. „Commuting performance in Shanghai: Efficiency and orderliness“. *Travel Behaviour and Society* 31 (duben): 223–31. https://doi.org/10.1016/j.tbs.2022.12.008.

Zhang, Yijia, a Lu Cheng. 2023. „The role of transport infrastructure in economic growth: Empirical evidence in the UK“. *Transport Policy* 133 (březen): 223–33. https://doi.org/10.1016/j.tranpol.2023.01.017.