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Commuting and the Widening Regional Gap: Evidence from Innovation-Driven Growth

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Abstract

Context and Objectives: This longitudinal study examined the shifting dynamics of innovation concentration, regional inequality, and internal migration in Israel from 2000 to 2020, analyzing how centralized technological growth correlates with peripheral labor mobility. Methods: Utilizing a purely observational and correlational approach, the empirical framework tracks Central Bureau of Statistics time series data regarding commuting patterns, net internal migration, and composite socioeconomic living standard indices. Main Findings: The analysis revealed a significantly increasing tendency for peripheral residents to commute to central hubs, alongside stagnant permanent internal migration and a relative decline in peripheral living standards, underscoring an increasing structural dependence on the core. Limitations: Key limitations include the reliance on aggregated national-level data up to 2020 and the absence of occupational disaggregation, which prevents isolating specific labor segments or establishing direct causal mechanisms. Policy Implications: The study suggests that market-driven integration alone is insufficient to bridge spatial gaps. Carefully tailored interventions fostering local innovation capacity and alleviating the commuter burden are required to promote sustainable and balanced regional development.

Keywords: Israel; commuting; net internal migration; living standards; longitudinal study; time trend regression; innovation-led growth; regional inequality

1. Introduction

The relationship between innovation, regional inequality, and sustainable economic growth has attracted increasing scholarly attention. Although innovation, which is operationalized in this study as the spatial concentration of employment in high-tech sectors, is widely recognized as a catalyst for economic prosperity, its advantages are often concentrated in metropolitan areas, a trend frequently associated with widening the gap between core and peripheral regions [1,2]. This study focuses on "spatial sustainability", which refers to the long-term ability of peripheral regions to maintain economic viability and quality of life despite the increasing concentration of high-tech activity in core regions.

Human capital and knowledge spillovers are acknowledged as key drivers of regional productivity [3]. However, in regions with less flexible labor markets, such as those in Israel, the concentration of high-tech industries in the core often intensifies the income gaps with the periphery [4,5]. The concentration of innovation in core areas is closely associated with structural shifts within peripheral regions, particularly through labor mobility and broader economic dynamics, impacting long-term regional sustainability. When skilled labor migrates from the periphery to core regions, it can weaken the capacity for productivity growth in the periphery, potentially leading to stagnation [6]. Alternatively, labor

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mobility through commuting, defined as the daily movement of workers across district boundaries to their place of employment, can serve as a crucial channel for knowledge transfer [7,8]. However, this dynamic can also lead to the persistence of regional disparities if the periphery becomes primarily a "dormitory" for the central innovation hubs, as well as cyclical migration patterns and the persistence of regional disparities if not managed effectively [9].

Israel offers a compelling case for examining regional inequality, with the disparities between municipalities ranking among the highest of the member states of the Organization for Economic Co-operation and Development [10]. A key factor associated with this inequality is the high concentration of the high-tech sector, which serves as a primary proxy for innovation-driven development [6]. More than 60% of all high-tech jobs are located in Tel Aviv and the central subdistrict, and approximately 80% of high-tech companies operate in this area [10]. According to Israel's Central Bureau of Statistics (CBS) data, the average commute in Israel is characterized by short distances, with approximately 59% of employees traveling up to 10 km in each direction and 75% not exceeding a 20 km threshold. In contrast, long-distance commuting occurs from peripheral areas, where the average commuting distance from the periphery to major employment centers (Jewish localities) reaches 35 km among college-educated women from the North and up to 43 km among college-educated women from the Triangle region [11].

This concentration of economic opportunities in the core imposes substantial challenges on peripheral regions, alongside pronounced productivity gaps and salaries approximately 35% lower than those in central Israel [12]. While some peripheral areas have developed local technological niches [13], the overall trend remains one of structural dependence. This study builds on the work of Bar-El et al. [6] by shifting the focus from structural gaps to a nuanced examination of how the concentration of high-tech employment relates to the daily lives and mobility patterns of citizens. A key contribution of this research lies in its integrated analysis of three dimensions: commuting patterns, internal migration, and living standards. It is important to emphasize that this study is observational and correlational in nature; while we document longitudinal trends from 2000 to 2020 using time trend regression, our aim is to provide a descriptive foundation for regional policy rather than to establish definitive causal mechanisms.

The remainder of this paper is structured as follows. Section 2 presents the research hypotheses. Section 3 details the methodology, including the spatial definitions of our key variables, the proxy used for innovation, and the longitudinal analytical models used. Section 4 presents the results of our empirical analysis, and Section 5 discusses our findings, evaluates their implications for regional sustainability, outlines key policy recommendations, and presents the study's limitations.

2. Hypotheses

Based on the theoretical frameworks of the core–periphery model and the findings of Bar-El et al. [6] regarding the persistence of structural gaps, we propose that the concentration of high-tech employment in central Israel is associated with the following longitudinal trends in peripheral regions.

Specifically, we examine the following propositions.

H1. *Commuting and labor mobility show an increasing trend from the periphery to the center. The pull of high-paying high-tech jobs in the core, combined with the high costs of permanent relocation, is likely linked to a growing trend of residents in peripheral areas commuting to central regions for work.*

H2. *The standard of living in the periphery shows a relative decline compared with that in the center. Despite increased labor mobility, the spatial concentration of innovation-led growth may correspond with a widening socioeconomic gap. This potential divergence reflects the continued concentration of services and high-paying jobs in the central region, which could outweigh the localized improvements in the periphery.*

In the next section, we analyze three key parameters: commuting, net internal migration, and the Standard of Living Score. The selection of these parameters is directly motivated by the need to empirically document the "brain drain" phenomenon and the longitudinal trends of peripheral decline explored by Bar-El et al. [6]. We selected these variables to provide a comprehensive analysis of the observed outcomes of regional disparities. Commuting and net migration data allow us to differentiate between temporary labor movement and permanent relocation, whereas the Standard of Living Score provides a holistic measure to evaluate whether increased access to core employment is associated with an improved quality of life in the periphery. This multifaceted approach enables us to identify whether the socioeconomic gap persists even as labor mobility rises, providing an empirical basis for regional sustainability policy.

3. Materials and Methods

We employed a case-study approach focusing on the core and peripheral regions of Israel, categorized by administrative subdistricts (Nafot), as defined by the Israeli Central Bureau of Statistics (CBS). Following the methodology of Bar-El et al. [6], Israel is divided into four distinct areas based on the following administrative units:

1. Metropolitan area: The central and densely populated regions, including the Tel Aviv and Jerusalem districts and the Haifa subdistrict.
2. Suburban area: Subdistricts adjacent to metropolitan areas, characterized by lower housing density. This area includes the four subdistricts of the Central District, as well as Hadera, Yizre'el, Akko, and Ashkelon.
3. Northern periphery: The subdistricts of Zefat and Kinneret, located approximately 75–110 km from Haifa.
4. Southern periphery: The Be'er Sheva subdistrict, the largest area, lying 110–350 km from Tel Aviv.

To define the geographic scope of this study, we utilized the official peripherality index developed by the Central Bureau of Statistics, which classifies regions based on their level of accessibility to markets, employment opportunities, health services, and other essential urban amenities. The central region is defined as the metropolitan and suburban areas with the lowest index values, which also function as the primary innovation hubs for high-tech employment in Israel. Conversely, the peripheral region is defined as the areas with the highest index values, specifically focusing on the northern subdistricts of Zefat and Kinneret and the southern subdistrict of Beer Sheva. These peripheral areas are distinguished by their significant distance from major urban centers and concentrated economic activity, providing a clear spatial contrast to the innovation-driven core.

Longitudinal time series data from 2000 to 2020 were used, with the Israeli Central Bureau of Statistics as the primary internal data source. To document the observed spatial associations and identify long-term patterns, regression trendlines were estimated using a time trend approach to analyze three key parameters:

1. Commuting (C): This is defined as working outside the place of residence (short commute), outside the subdistrict (medium commute), or outside the district (long commute). Based on these definitions, we measure the share of workers in each region as follows:

$$C_{i,j,t} = \frac{\#\,Of\ workers\ employed\ outside\ region\ i\ at\ year\ t}{\#\,Of\ workers\ residing\ in\ region\ i\ at\ year\ t} \quad (1)$$

where i represents the region, with 1 for the center and 2 for the periphery; j represents the commuting distance, taking the values S for short, M for medium, and L for long commutes; and t represents the year, ranging from 2003 to 2020. In this study, these commuting patterns serve as an indicator of labor accessibility to innovation-driven employment in the core.

To identify empirical associations over time, we conducted regression analysis to examine the significance of observed trends over 18 years using the following time trend models:

$$C_{i,j,t} = \beta_{0C_{i,j}} + \beta_{C_{i,j}} * t + \varepsilon \quad (2)$$

where $\beta_{0C_{i,j}}$ is the intercept, $\beta_{C_{i,j}}$ represents the longitudinal trend over period t, and ε is the error term.

$C_{1,j}$ represents the proportion of workers at distance j in the central region, and $C_{2,j}$ represents the proportion in the peripheral region.

$$C_{\frac{2}{1},j,t} = C_{2,j,t}/C_{1,j,t} \quad (3)$$

where $C_{\frac{2}{1},j,t}$ indicates the relative balance of workers commuting across distance j between the periphery and the center in year t. For example, a decreasing value for $j = S$ over time indicates a relative decline in short-distance commuting in the periphery, even if the absolute proportion of workers commuting increases. This ratio allows for the observation of spatial convergence or divergence trends between the two types of regions.

2. Net internal migration (NM): This is calculated as the population leaving a region minus the population entering that region. This variable serves to identify permanent shifts in population distribution in relation to regional innovation concentration. We measure the share of the population in each region as follows:

$$NM_{i,t} = \frac{\#\,net\ population\ migrate\ in\ region\ i\ at\ year\ t}{\#\,Of\ total\ population\ in\ region\ i\ at\ year\ t} \quad (4)$$

where i represents the region (1 = center, 2 = periphery), and t represents the year, ranging from 2005 to 2020.

To identify longitudinal patterns, regression analysis is conducted to examine the observed trends:

$$NM_{i,t} = \beta_{0NM_i} + \beta_{NM_i} * t + \varepsilon \quad (5)$$

where β_{0NM_i} is the intercept, β_{NM_i} represents the longitudinal trend over time, and ε is the error term.

3. Standard of Living Score (SL): To empirically document spatial disparities in regional sustainability and well-being, this study utilizes the official Socioeconomic Index (SL) developed by the Israeli Central Bureau of Statistics. The SL is a weighted score (1–10) that compares the population of cities in the periphery to those in the center with over 10,000 residents. Unlike simple income metrics, the SL is a multidimensional and holistic construct calculated using factor analysis, a statistical method that determines the relative weight of each component based on its explanatory power regarding regional socioeconomic variance. While raw income metrics only capture immediate financial flows, the composite standard of living score reflects the accumulated structural impacts of spatial inequality on household welfare, including educational access and infrastructure quality, which are critical for capturing long-term regional polarization.

The Socioeconomic Index includes 14 variables categorized into four primary domains:

- Education: Years of education and the proportion of individuals with academic degrees (specifically among the 25–54 age group).
- Employment: Salary levels and the presence of income security measures, including the proportion of low-wage earners and recipients of unemployment or income support benefits.
- Well-being: Average income, vehicle ownership, and days spent abroad, alongside the average value of vehicles as a proxy for liquid asset accumulation.
- Demographics: Median age and average number of children per family, as well as the dependency ratio within the municipality.

By applying factor analysis, each of these variables is assigned a specific weight, ensuring that the final index represents a robust and standardized measure of a municipality's relative standing. Following the calculation of the continuous score, municipalities are classified into ten homogeneous clusters, where Cluster 1 represents the lowest socioeconomic level and Cluster 10 the highest. For a full breakdown of the 14 variables and their respective statistical weights, see Appendix A.

The share of each region is measured as

$$SL_{i,t} = \ weighted\ score\ of\ all\ localities\ in\ region\ i\ at\ year\ t \tag{6}$$

where i = 1 for the center and 2 for the periphery, and t ranges from 2000 to 2020.

To identify longitudinal patterns, regression analysis examined trends over 21 years:

$$SL_{i,t} = \beta_{0SL_i} + \beta_{SL_i} * t + \varepsilon \tag{7}$$

where β_{0SL_i} is the intercept, β_{SL_i} represents the longitudinal trend over time, and ε is the error term.

SL_1 represents the weighted SL score for all central localities, and SL_2 represents that for peripheral localities. The balance between regions is calculated as

$$SL_{\frac{2}{1},t} \ = \ SL_{2,t}/SL_{1,t} \tag{8}$$

where $SL_{\frac{2}{1},t}$ indicates the relative SL between the periphery and the center in year t. This ratio serves as an indicator of spatial convergence or divergence in living standards between the innovation-rich core and the periphery.

4. Results

4.1. Commuting Trends

As shown in Table 1 and Figure 1, the analysis documents a notable longitudinal trend of increased commuting in the center and periphery. The proportion of residents commuting outside their city for work is consistently higher in the central region compared with the periphery. However, the slope of the trendline for this increase is steeper in the periphery than in the center across all commuting distances. For instance, the percentage of residents commuting to the central innovation-driven core for short distances rose from 45.7% in 2003 to 53.6% in 2020, whereas in the periphery, it increased from 31.7% to 43.8% over the same period. The steeper slope in the periphery corresponds with a significantly larger proportion of peripheral residents seeking to integrate into the core's labor market, suggesting a growing trend of peripheral residents seeking employment outside their immediate communities as an adaptive response to the spatial concentration of innovation. The ratio of peripheral to central commuting (P/C ratio), shown in the right panel of Figure 1 and Column 3 of Table 1, has increased over the years for all commuting distances. This ratio is especially high for commuting beyond the subdistrict, documenting

a larger propensity for medium-distance commuting from the periphery toward central employment hubs. Peripheral commuting notably increased relative to the center, even for long commutes.

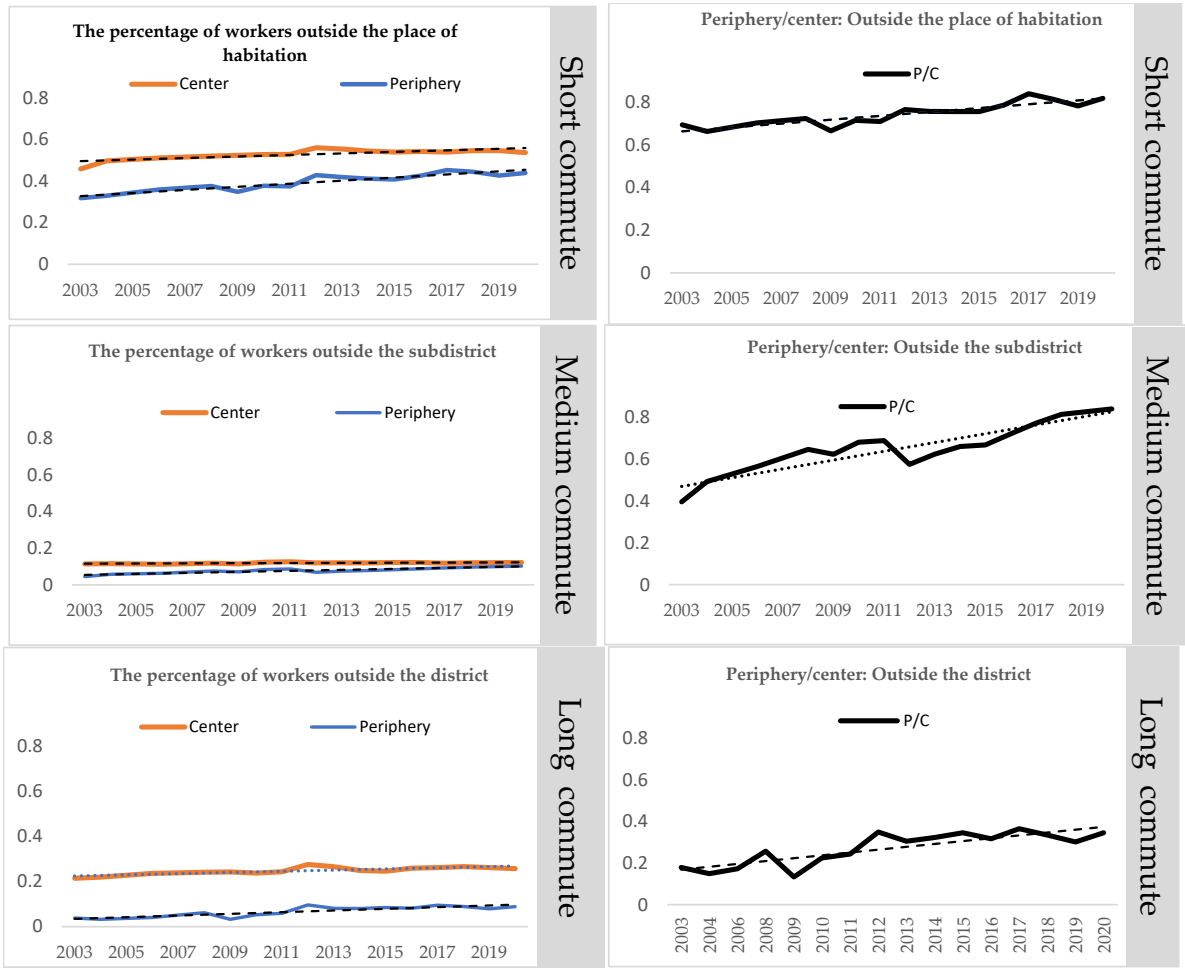

Figure 1. The three types of commuting distances from the place of residence (**left**: $C_{i,j,t}$ and the ratio of the proportion of the periphery to the proportion of the center (**right**: $C_{\frac{2}{1},j,t}$), 2003–2020. Note: The dashed lines in the figure indicate a linear trend.

Table 1. Coefficients of the variables in the center and periphery. Commuting: outside the place of habitation (short commute), outside the subdistrict (medium commute), and outside the district (long commute).

	Commuting Trend		
	Center (1)	**Periphery (2)**	**$\frac{\text{Periphery}}{\text{Center}}$ (3)**
Short Commute	3.7 *** (0.79)	7.435 *** (0.8)	9.0 *** (1.25)
Medium Commute	0.43 ** (0.15)	2.73 *** (0.32)	20.9 *** (2.5)
Long Commute	2.6 *** (0.5)	3.69 *** (0.6)	12.5 *** (2.16)

Note: ** and *** represent significance at the 5% and 1% levels, respectively. Standard deviations are shown in parentheses. For better visualization, all numbers are multiplied by 1000.

To ensure the structural reliability and validity of our longitudinal models, we performed systematic stationarity diagnostics utilizing standard Augmented Dickey–Fuller testing procedures on all primary variables. The empirical results confirmed that the core commuting and economic series are integrated of order one, or I(1), displaying non-stationarity in levels but achieving strong stationarity in first differences. This underlying data structure directly justifies our decision to employ HAC standard errors, also known as Newey–West standard errors, to robustly control for residual autocorrelation and heteroscedasticity. The consistency of these model estimations, combined with favorable Durbin–Watson statistics and high R squared values, indicates that the observed spatial polarization trends are statistically robust and not driven by model specification errors.

In summary, although the central region of Israel consistently has a higher percentage of residents commuting for work, the periphery has seen a higher rate of increase across all distances, as evidenced by the steeper slope of the trendline and the rising P/C ratio over the period. These empirical findings document an increasing trend for peripheral residents to seek employment outside their immediate subdistricts, often commuting to central innovation-rich areas, which may present notable implications for long-term regional social sustainability.

4.2. Net Internal Migration (NM)

As shown in Table 2 and Figure 2, the descriptive analysis documents no significant overall longitudinal trend in inter-regional migration between the periphery and the central innovation hubs. Specifically, the net percentage of residents migrating from the periphery shifted from −0.68% in 2005 to approximately +0.048% in 2020. In contrast, for the center, the net percentage of resident migration was 0.07% in 2005, decreasing to 0.00137% by 2020. The trendline for the periphery over this period exhibits a slightly positive slope, suggesting a potential reduction in net outward migration or a shift toward near-equilibrium population movement. For the center, the trendline shows a stable, albeit slightly negative, slope, reflecting a minor decrease in net outward migration.

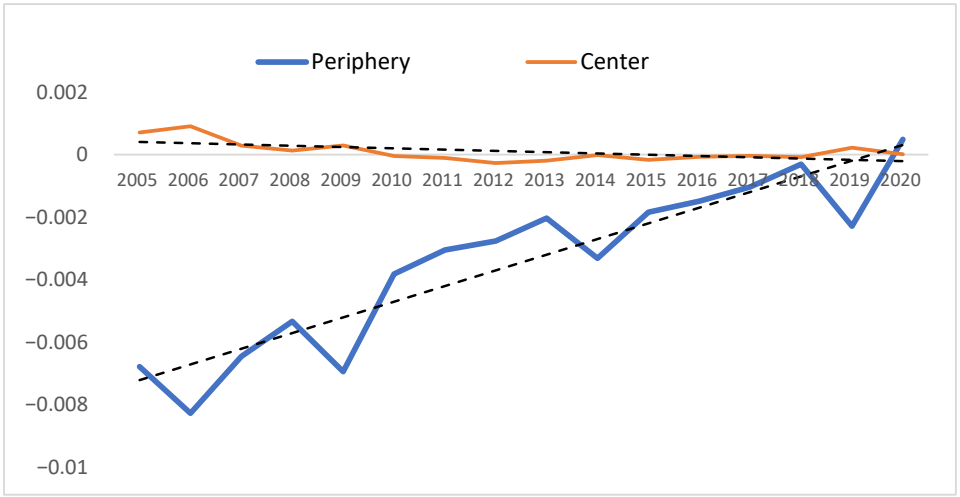

Figure 2. NM balance per thousand inhabitants 2005–2020 ($NM_{i,t}$). Note: The dashed lines in the figure indicate a linear trend.

Table 2. Coefficients of the variables in the center and periphery: $NM\ (NM_{i,t})$ and $SL\ (SL_{i,t})$

	Migration and Standard of Living		
	Center (1)	**Periphery (2)**	$\frac{\textbf{Periphery}}{\textbf{Center}}$ **(3)**
NM	−0.04 *** (0.014)	0.5 *** (0.056)	----
SL Score	−12.83 *** (3.17)	−23.2 *** (2.28)	−2.56 *** (0.69)

Note: *** represent significance at the 1% level. Standard deviations are shown in parentheses. For better visualization, all numbers are multiplied by 1000.

In summary, the population movement from the periphery to the center documents no significant trend at the inter-regional level. These empirical findings suggest that, despite the potential pull of employment in central regions, permanent migration from the periphery remains limited, likely due to the high costs and financial challenges associated with relocating to urban centers. This persistence in population distribution, despite economic disparities, underscores a key challenge for long-term regional social sustainability.

4.3. Standard of Living Score (SL)

The longitudinal analysis of the SLs from 2000 to 2020 (ranging from 1 to 10) reveals a decreasing trend in both regions. As shown in Figure 3, the score in the periphery declined from 4.08 in 2000 to 3.72 in 2020, whereas in the center, the score decreased from 5.44 in 2000 to 5.40 in 2020. Although both regions exhibit a downward trajectory, the slope of the decline in the periphery is notably steeper than that in the center, corresponding with a more pronounced reduction in living standards within peripheral areas. Furthermore, as shown in Table 2 and Figure 4, the SL P/C ratio consistently decreased over this period. These results point toward a notable relative decline in the quality of life in the periphery relative to central regions.

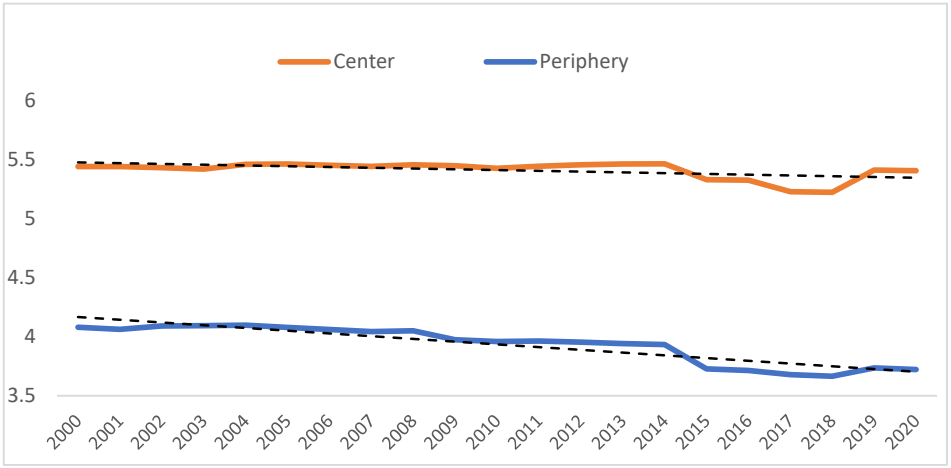

Figure 3. SL 2000–2020 $(SL_{i,t})$. Note: The dashed lines in the figure indicate a linear trend.

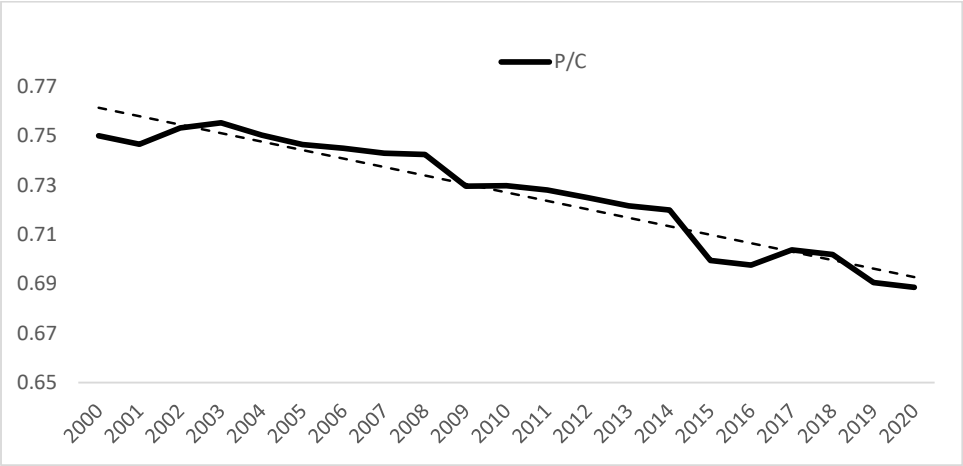

Figure 4. Periphery–center ratio of SL 2000–2020 $\left(SL_{\frac{2}{1},t}\right)$. Note: The dashed lines in the figure indicate a linear trend.

To further validate our findings, we conducted a subsample analysis focusing on the final decade of the study period. The results indicate that the negative trajectory of the periphery center living standards ratio persists throughout this interval. Moreover, the diagnostic measures for this subsample show increased stability and structural consistency, which reinforces the reliability of the overall trend observed in the full model.

5. Discussion and Conclusions

The longitudinal documentation provided in this study offers insight into the evolving dynamics of innovation, regional inequality, and migration in Israel during the studied period. Our analysis indicates a consistent longitudinal association between the concentration of innovation in the central region and the increasing pull for skilled workers from the periphery, a classic manifestation of the core–periphery model within the context of a modern innovation-driven economy. Going beyond traditional theoretical models, these long-term trends reveal a structural friction within the spatial economy: while peripheral labor increasingly integrates into the core through daily commuting, this mobility operates alongside permanent migration stagnation and a relative erosion of peripheral socioeconomic standing. This implies that commuter-based integration, within the current institutional framework, remains insufficient to facilitate regional economic convergence, as the localized benefits of technological growth fail to translate into broader living standard improvements within the peripheral communities.

These results illuminate a central dilemma of regional sustainability. On the one hand, the residents' ability to access the core through increased commuting can be interpreted as a potential economic adaptation to the spatial concentration of high-tech sectors. On the other hand, the increasing reliance on long commutes, combined with the documented stagnancy in permanent relocation, suggests a structural barrier that could potentially weaken these communities and prevent them from fully benefiting from distributed growth. To provide greater analytical depth, these observed longitudinal trends must be interpreted through the theoretical mechanisms established in the spatial economics literature. The persistent expansion of labor commuting from the periphery, coupled with a relative decline in local living standards, strongly substantiates the operation of structural backwash effects within small and highly concentrated innovation economies. Rather than facilitating spatial equilibrium through decentralized spread effects, the intense agglomeration economies of the core function as a spatial vacuum. This mechanism continuously siphons regional labor capacity and human capital toward the center on a daily basis. Consequently, the

periphery is systematically restricted to a residential tracking role, serving as a labor supply zone for centralized technological growth while remaining structurally isolated from the high-value-added economic multipliers, ultimately widening the spatial welfare gap and highlighting that the current spatial model may pose notable challenges to long-term regional sustainability.

Furthermore, the study highlights how spatial dependency operates as a long-term structural phenomenon. While these longitudinal associations do not establish direct causality and primarily reflect structural trends up to the year 2020, their persistent nature across multiple robustness and subsample checks suggests that to foster more balanced regional development, there is a need for targeted policies that prioritize local innovation, improve transportation efficiency to reduce the commuter's burden, and address the structural factors inhibiting regional convergence. By shifting from managing dependency to fostering local resilience, policymakers could more effectively mitigate the documented spatial disparities emerging from innovation-led growth. Beyond the local context, these findings offer broader theoretical implications for the international literature on spatial economics. By demonstrating that high-density technological growth can simultaneously accelerate labor commuting while eroding peripheral living standards, this study challenges traditional trickle-down assumptions, positioning small and highly concentrated innovation economies as critical environments for studying structural regional polarization. These dynamics directly mirror international spatial equilibrium models and agglomeration diseconomies observed in major global technology hubs, where extreme geographic clustering increasingly generates severe regional imbalances and spatial friction.

5.1. Recommended Policy Measures

To address the documented spatial divergence and promote regional sustainability, several policy measures are recommended, strategically grounded in the empirical associations identified in our analysis, specifically the surge in commuting, stagnant internal migration, and the widening socioeconomic gap documented by the Central Bureau of Statistics indices:

- Mitigating the "commuter's burden": Given the documented steep increase in commuting from the periphery to innovation hubs, significant improvements in public transport are crucial. Our findings suggest that while peripheral residents integrate into the center's labor market, they bear the socioeconomic costs of long-distance mobility. Policy should focus on high-speed rail and dedicated public transit lanes to reduce the time and welfare "tax" on peripheral households. To address the risk that improved transport may further strengthen centralization, these investments must be paired with congestion charges in the core to fund regional transit, ensuring that commuting remains a sustainable link rather than a driver of regional dependency.
- Targeted investment in peripheral education: To counteract the relative decline in the peripheral Standard of Living Scores (SLs) documented by the Central Bureau of Statistics, financial incentives and attractive working conditions should be used to attract high-quality educators to peripheral regions. Since our results associate innovation concentration with a widening living-standard gap, enhancing local human capital serves as a foundational element toward regional resilience. This policy aims to build a long-term foundation for local growth, potentially reducing the current structural dependence on core labor markets for high-skill employment.
- Fostering non-technological innovation to address stagnant migration: Considering the identified stagnation in permanent internal migration despite growing economic disparities, policymakers must support innovations in non-technological sectors that align with peripheral strengths. Since residents are not relocating to innovation hubs,

the "place-based" economy must be strengthened locally, which involves promoting regional clusters and shared industrial zones to enhance coordination, providing employment alternatives for those unable or unwilling to commute, and thereby stabilizing the local socioeconomic base.

- Enhancing service quality in lower-tier municipalities: To address the widening regional Standard of Living (SL) gap shown in our longitudinal data, efforts should focus on improving the quality of public services and infrastructure in peripheral municipalities. Raising the spatial attractiveness of these areas appears critical to mitigating further regional divergence. This could include strategic mergers or regional service collaborations to ensure efficient resource allocation, directly addressing the documented decline in relative quality of life within peripheral areas.

By implementing these targeted interventions, policymakers can move toward a more balanced regional development model, mitigating the documented negative externalities of innovation-led growth and fostering long-term spatial sustainability.

5.2. Potential Limitations and Criticisms

Despite the insights provided, this study has some limitations that should be considered when interpreting the results. First, a significant limitation is the absence of disaggregated commuting and migration data by occupation. This restricts our understanding of whether specific occupational groups exhibit a higher propensity for commuting or permanent relocation, thus limiting the identification of targeted policy interventions. Future research should examine these patterns by occupation to clarify the differential impacts of regional disparities on various segments of the labor force.

Second, while the longitudinal analysis documents significant spatial trends over two decades, the empirical approach relies on time trend regressions that identify associations rather than direct causal effects. Consequently, the findings should be interpreted with caution, as the study does not employ a quasi-experimental design to isolate innovation concentration as the sole causal driver of the observed shifts. Additionally, because the empirical analysis relies on data extending up to the year 2020, it captures the structural dynamics of the preceding two decades but cannot account for subsequent shifts, such as the widespread transition to remote work models after the pandemic or recent macroeconomic changes in the technology sector. To mitigate the econometric limitations inherent in such longitudinal time trends, particularly the risk of spurious correlations driven by temporal autocorrelation, this study implemented robust estimation techniques, including HAC standard errors and subsample stability checks, to ensure the statistical validity of the reported associations. Furthermore, the focus on national-level trends may limit the ability to capture localized variations or unique policy effects within specific peripheral or central communities. Future research could benefit from incorporating more granular econometric modeling, such as the inclusion of additional control variables, and qualitative methods to complement quantitative analysis, providing a deeper understanding of the socioeconomic complexities involved.

Finally, relying solely on a weighted composite Standard of Living (SL) score, although comprehensive, may obscure the specific factors contributing to the observed decline in the periphery. A disaggregated analysis of the individual parameters comprising this score (e.g., education, employment, income, and demographics) could offer a more nuanced understanding of quality of life dynamics and help identify which specific dimensions are most susceptible to regional divergence.

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Informed Consent Statement: Not applicable.

Data Availability Statement: The data that support the findings of this study are available from https://doi.org/10.5281/zenodo.17084176 (accessed on 20 May 2026).

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Conflicts of Interest: The author declares no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

SL	Standard of Living Score
C	Commuting
NM	Net internal migration
CBS	Central Bureau of Statistics

Appendix A

Table A1. Variables and weights of the socioeconomic index.

Variable Category	Indicator	Weight (%)
Living Standards	Average monthly income per capita	8.64
Employment	% earning below minimum wage	8.34
Living Standards	Motorization rate (car ownership)	8.00
Employment	% earning over twice the average wage	7.91
Education	Average years of schooling (ages 25–54)	7.69
Education	% with an academic degree (ages 25–54)	7.65
Living Standards	Average days spent abroad	7.52
Employment	% in the labor force (ages 15+)	7.43
Demographics	Median age	7.40
Employment	% of women (ages 25–54) without labor income	7.27
Demographics	% of families with 4+ children	6.89
Demographics	Dependency ratio	5.59
Employment	% receiving income support benefits	5.20
Living Standards	Average car license fee (car value)	4.48
Total		100.00

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