

The Relationship Between Innovation, Regional Inequality, and Migration: A Case Study of Israel

1. Introduction

The association between innovation, regional inequality, and economic growth has attracted increasing scholarly attention. Although innovation is widely associated with economic prosperity, its advantages are often concentrated in metropolitan areas, thereby widening the gap between core and peripheral regions (Bar-El and Maymoni 2023). Israel offers a compelling case for examining regional inequality, with disparities between municipalities ranking among the highest among member states of the Organization for Economic Co-operation and Development (OECD 2020). While traditional regional economic models typically highlight a strong association between innovation activity and growth, the shift toward isolating causal pathways has introduced a more complex understanding of this nexus (Fragkandreas, 2022). Current evidence suggests that the impact of innovation hubs is highly heterogeneous, often contingent upon regional institutional capacities and existing spatial inequalities (Peiró-Palomino et al., 2022).

Centralised innovation appears to increase regional standard of living (SL) inequality through complex pathways. In Israel, this connection is exemplified by the high concentration of the high-tech sector: more than 60% of all high-tech jobs are located in Tel Aviv and the central subdistrict, where approximately 80% of high-tech companies operate (OECD 2020). This structural divergence is a key correlate of productivity gaps and salaries approximately 35% lower than those in central Israel (Israel Innovation

Authority 2023). This study provides a nuanced examination of how the growing concentration of innovation is associated with changes in the daily lives and mobility patterns of citizens, exploring its tangible influence on labour mobility, migration, and living standards.

2. Literature Review and Theoretical Framework

2.1 Knowledge Spillovers vs. Unequal Access

Understanding regional divergence requires distinguishing between competing economic pathways. Knowledge spillovers are widely described as an important factor of spatial labour mobility in innovation-led economies. Causal evidence indicates that labour mobility is a critical mechanism for knowledge transfer, where high-skilled workers moving within innovation clusters receive significant wage premiums (Castillo et al., 2020). Conversely, the mechanism of unequal access can lead to regional economic polarisation. When innovation hubs concentrate spatially, they can generate ‘backwash effects’ associated with greater disparities. In Israel, this polarisation is reinforced by public transportation, which is often inadequate and inefficient (Bank of Israel 2017). Centralised innovation may be positively associated with regional inequality when knowledge diffusion is localised rather than dispersed.

2.2 Differential Impacts on Commuting, Migration, and Living Standards

The mechanisms described above correlate with spatial outcomes in distinct ways:

- **Commuting:** Long-distance commuting is increasingly recognized as a deliberate employment strategy utilized by workers to navigate labour market demands (Ravalet et al., 2017). In Israel, this strategy

faces a unique structural challenge where heavy dependence on private transport acts as a barrier to mobility.

- **Migration:** Internal migration patterns exhibit a bidirectional association with innovation hubs (Faggian et al., 2009). While earlier patterns trended toward population de-concentration (Lipshitz, 1991), recent evidence suggests a significant reversal. Contemporary research highlights a ‘strengthening of the national core’ (Tel Aviv metropolitan area) and a corresponding socio-economic weakening of peripheral regions (Hananel et al., 2021). This shift is heavily moderated by housing costs, which act as a formidable barrier to permanent migration into central innovation hubs, forcing a reliance on commuting as a primary labour market strategy (White et al., 2022).
- **Living Standards (SL):** Centralised innovation positively correlates with regional SL inequality by rewarding skill premiums (Fragkandreas et al., 2022). In Israel, these dynamics manifest as persistent regional income disparities (Israel Innovation Authority 2023).

2.3 Mediating Factors and Regional Divergence

Factors such as human capital, physical capital, and knowledge spillovers are key correlates of regional productivity (Felsenstein 2015). Human capital is especially important, as skilled individuals are vital for generating and transferring knowledge. While the probability of technological innovation in most peripheral regions surpasses that in core regions, it declines with increasing peripherality (Israel and Salinger 2025), suggesting an inverted U-shaped relation in which agglomeration is associated with

diminishing net positive outcomes beyond a particular point (Antonelli et al., 2011). When skilled labour migrates from the periphery to core regions, it can weaken the capacity for productivity growth in the periphery, potentially leading to stagnation (Rattsoe and Stokke 2010).

3. Hypotheses

Based on the theoretical frameworks of the core-periphery model and the findings of Bar-El et al. (2024) regarding the persistence of structural gaps, we propose that the concentration of innovation in central Israel disproportionately affects peripheral regions.

- **H1:** Commuting and labour mobility will increase from the periphery to the centre, reflecting a ‘pull’ mechanism of the core’s wage premium.
- **H1a (Distance-Decay Effect):** The intensity of the commuting trend will be significantly higher in the ‘near periphery’ compared to the ‘far periphery’, reflecting the impact of transport capacity.
- **H1b (Substitution Mechanism):** Commuting may function as a structural substitute for permanent migration, particularly when housing cost disparities inhibit household relocation.
- **H2:** The SL in the periphery will decline relative to that in the centre.
- **H2a (Skill Composition Sorting):** The relative decline in the SL is associated with the concentration of high-skill human capital in the core.
- **H2b (Asset Accumulation Gap):** Regional disparities in wealth accumulation are associated with residential location, where the

capacity to build relative asset values differs between core and peripheral populations despite shared access to central employment hubs.

4. Methodology

This study employs a multivariate ordinary least squares (OLS) regression framework with time-series data from 2000 to 2020.

4.1 Spatial Classification

Israel is divided into four distinct areas:

- **Metropolitan Area:** Tel Aviv, Jerusalem, and Haifa subdistrict.
- **Suburban Area:** Subdistricts adjacent to metropolitan areas, including the Central District, Hadera, Yizre'el, Akko, and Ashkelon.
- **Northern Periphery (Far Periphery):** Zefat and Kinneret subdistricts, characterized by geographic isolation and an absence of rail infrastructure.
- **Southern Periphery (Near Periphery):** Be'er Sheva subdistrict, connected to the national rail network and closer to the central region .

4.2 Key Variables

- **Commuting (C):** Measured as working outside the place of residence (short), outside the subdistrict (medium), or outside the district (long).
- **Net Internal Migration (NM):** Calculated as the population leaving a region minus the population entering that region.

- **Socio-Economic Index (SL):** A weighted score (1-10) incorporating 14 variables categorized into four primary domains: Education, Employment, Well-being, and Demographics.

4.3 Analytical Models

The primary model for commuting patterns is defined as:

$$C_{c,j,t}^p = \beta_0 + \beta_1 \cdot S_{c,1,t}^p + \beta_2 \cdot D_{c,1,t}^p + \beta_3 \cdot t + \varepsilon$$

Where $S_{c,1,t}^p$ is the high-skill labour supply ratio, $D_{c,1,t}^p$ is regional innovation-led job demand, and t is the longitudinal trend.

The migration model incorporates the housing price index ratio ($HR_{c,t}^p$) and binary dummy variables for specific outliers in 2003 and 2014:

$$NM_{c,t}^p = \beta_0 + \beta_1 \cdot D_{c,1,t}^p + \beta_2 \cdot HR_{c,t}^p + \beta_3 \cdot Du_{2003} + \beta_4 \cdot Du_{2014} + \beta_5 \cdot t + \varepsilon$$

The SL model incorporates vehicle asset value ($VAV_{c,t}^p$) as a proxy for household wealth and mobility capacity:

$$SL_{c,t}^p = \beta_0 + \beta_1 \cdot S_{c,1,t}^p + \beta_2 \cdot (VAV_{c,t}^p) + \beta_3 \cdot t + \varepsilon$$

5. Results

5.1 Commuting Trends

Analysis suggests a notable trend of increasing worker commuting in both the centre and periphery. The slope of the trendline for this increase is steeper in the periphery than in the centre across all distances. For short distances, the periphery saw an increase from 31.7% to 43.8% (2003-2020), while the centre rose from 45.7% to 53.6%.

Regression results show a stark contrast in the longitudinal time trend (YEARS). The coefficient for medium-distance commuting (23.16) is nearly

triple that of long-distance commuting (8.88), indicating that the periphery is functioning as a regional labour pool for adjacent economic hubs. Long-distance commuting shows that associations with high-skill labour supply (S) and regional demand (D) are not statistically significant, suggesting commuting is a structural substitute for relocation and a 'default' employment strategy resilient to annual changes.

5.2 Spatial Heterogeneity: Near and Far Periphery

Segmented analysis reveals a clear distance-decay effect. The time trend is more intense in the near periphery (3.85) compared to the far periphery (2.75). Both are significant, but the negative SL coefficient in the far periphery suggests local economic 'push' factors unique to more distant regions.

5.3 Internal Migration (NM)

Analysis reveals no significant overall trend in inter-regional migration between the periphery and the centre. The longitudinal time trend (YEARS = 1,714.65) fails to reach statistical significance. Instead, population movement is characterized by episodic shocks, with structural shocks in 2003 (Dummy2003 = -139,779) and 2014 (Dummy2014 = 223,622) being more strongly associated with fluctuations than regional labour demand or housing price disparities.

5.4 SL Score Divergence

The SL scores reveal a decreasing trend in both regions from 2000 to 2020. However, the slope of decline in the periphery is notably steeper than in the centre, supported by the negative longitudinal time trend (YEARS = -1.56, $p < 0.05$). This relative decline is significantly moderated by persistent

disparities in human capital supply ($S_{\frac{p}{c}} = -229.41$, $p < 0.01$) and vehicle asset value ($VA_{\frac{p}{c}} = 308.5$, $p < 0.01$).

6. Discussion and Conclusion

The concentration of innovation in the central region is associated with a pull for skilled workers from the periphery. Commuting appears to function as a structural substitute for relocation because high housing costs and episodic shocks act as barriers to permanent migration. Consequently, this commuter-based integration is not sufficient to address the widening socio-economic gap, as benefits are not observed in improved living conditions in the periphery.

The decline in relative living standards is associated with a systematic sorting process. While the ability to integrate into high-tech sectors indicates a positive adaptation, the increasing reliance on long commutes may undermine peripheral communities and limit local growth. Proximity to the core further suggests uneven adaptation, with regions closer showing stronger dependence on commuting than the far periphery.

6.1 Recommended Policy Measures

1. **Differentiated Infrastructure:** For the near periphery, focus on mass-transit efficiency. For the far periphery, prioritize internal regional connectivity to create local labour market clusters and encourage regional branches.
2. **Residential Strategy:** Provide state-funded incentives for ‘remote work’ and tax credits for core-based employers who allow peripheral

residents to work remotely. This leverages the cost-of-living advantage and stabilizes peripheral populations.

3. **Local Human Capital:** Offer financial incentives and attractive working conditions to attract and retain high-quality teachers in disadvantaged schools to counter the ‘sorting’ process.
4. **Innovation in Non-Technological Activities:** Support industries such as ag-tech or traditional manufacturing to increase local productivity for residents not integrated into the central high-tech hub.
5. **Asset Accumulation and Public Services:** Improve the quality of public services and healthcare in poorer municipalities to raise the overall standard of living and reduce financial burdens on households.

By targeting the observed structural trends of labour mobility and socio-economic divergence, Israel can work toward a more balanced and inclusive regional development model.

7. Potential Limitations

- Absence of disaggregated commuting and migration data by occupation.
- Findings remain associative rather than definitively revealing causal directions due to national dataset constraints.
- Focus on national-level trends may limit the ability to capture localised variations.
- Sole reliance on a weighted SL score may obscure specific contributing factors.

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