Labor Market Scale, Firm Premia, and the Gender Pay Gap: Evidence from Hungarian Districts

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Objective and Contribution

Gender pay gaps (GPG) remain a persistent and stagnating feature of global labor markets (Blau & Kahn, 2017). In Hungary, the unadjusted gross hourly earnings gap was approximately 16.9% in 2024 (Eurostat, 2026). However, national averages hide significant spatial dispersion across local labor markets. While classic explanations focus on human capital, recent evidence suggests that a substantial part of the GPG arises from worker sorting into differently paying firms (Card et al., 2016; Penner et al., 2023).

The objective of this research is to investigate how local economic factors, specifically labor-market scale and firm composition, shape the adjusted gender pay gap across Hungary's 197 districts. The study addresses a central theoretical tension: while larger labor markets are often viewed as "equalizers" that reduce disparities through thicker job matching (Duranton & Puga, 2004), they may instead function as "amplifiers" of inequality by rewarding the temporal flexibility that remains male-biased (Goldin, 2014). By analyzing the full urban hierarchy of a transition economy, this paper provides a systematic test of the "Agglomeration Paradox", the phenomenon where more productive, larger districts appear to exacerbate gender pay disparities (Glaeser et al., 2009; Nisic, 2017).

Data and Sample Construction

The empirical analysis utilizes the Admin3 linked employer-employee panel (LEED) from the KRTK Databank, which covers a random 50% longitudinal sample of the Hungarian population from 2003 to 2017. This high-resolution administrative dataset integrates records from the National Tax and Customs Administration (NAV), the Pension Insurance Administration, and the Health Insurance Fund. By linking individual-level employment histories with firm-level characteristics, the Admin3 LEED allows for the

simultaneous identification of worker-specific traits and firm-specific wage policies.

The unit of observation is the worker-firm-month for employees aged 18 to 65 in standard employment. To ensure the reliability of the wage estimates, the sample focuses exclusively on the primary labor market, excluding the self-employed, military personnel, and participants in public work schemes. The outcome variable is the log gross hourly wage. Hourly wages are meticulously constructed by adjusting monthly earnings for actual days worked and reported weekly hours, effectively removing bias stemming from systematic gender differences in labor supply, such as the disproportionate share of women in part-time roles.

The geographic unit of analysis is the LAU-1 district (járás), encompassing all 197 districts in Hungary. These boundaries have been harmonized consistently over the 15-year study period to ensure that changes in measured labor-market scale reflect actual shifts in local employment density rather than administrative re-zoning. This spatial granularity allows for a much more nuanced analysis than traditional urban-rural binaries, capturing the full hierarchy of Hungary's economic geography.

Methods and Identification Strategy

The empirical strategy follows the high-dimensional fixed effects framework established by Card et al. (2016) for linked employer-employee data. To capture the full scope of local gender inequality, the analysis proceeds in two integrated stages.

Stage 1: Saturated Model and Firm-Level Decomposition

To manage the computational scale of the 269-million-observation panel, the study employs a saturated fixed effects specification that absorbs 394 district-by-gender interactions (α_{dg}). This identifies local disparities conditional on individual human capital (age, education), industry structure (1-digit NACE), and occupational sorting. The local adjusted GPG is recovered post-estimation by calculating the difference between estimated female and male fixed effects: $GPG_d = \hat{\alpha}_{d,female} - \hat{\alpha}_{d,male}$.

The sequence of models tracks spatial and temporal dynamics:

- Model 1 (Baseline): $y_{ijdt} = X_i\beta + \lambda_t + \alpha_{dg} + \epsilon_{ijdt}$
  Establishes the benchmark spatial pattern of gender inequality across 197 districts, netting out national year shocks and worker characteristics.

- Model 2 (Firm FE): $y_{ijdt} = X_i\beta + \lambda_t + \psi_j + \alpha_{dg} + \epsilon_{ijdt}$
  Incorporates approximately 648,225 firm fixed effects (ψ_j) to identify the extent to which local GPGs are driven by gendered sorting into differently paying firms.

- Model 3 (Time Dynamics): $y_{ijdt} = X_i\beta + \alpha_{dgt} + \epsilon_{ijdt}$
  Tracks 5,910 annual district-gender cells, allowing for the study of local convergence or divergence in pay gaps over the 15-year period.

- Model 4 (Saturated): $y_{ijdt} = X_i\beta + \psi_j + \alpha_{dgt} + \epsilon_{ijdt}$
  The most rigorous specification, isolating within-firm, within-year wage differences to identify the "residual" local gender penalty.

Stage 2: Identification of Scale Effects

The second stage identifies the wage returns associated with changes in local labor-market scale using an individual fixed effects model (Card et al., 2025):

$$ln(w_{idt}) = \beta_2 ln(Size_{dt}) + \beta_3(Female_i \times ln(Size_{dt})) + X'_{idt}\gamma + \delta_t + \theta_{k(i,t)} + \alpha_i + \epsilon_{idt}$$

Where α_i represents time-invariant worker fixed effects. Identification of β_3 relies on within-worker variation from individuals who relocate between districts of different scales. The term δ_t captures year-specific shocks common to all districts, while $\theta_{k(i,t)}$ denotes fixed effects for broad industry categories. This approach nets out unobserved spatial sorting on permanent individual skills or preferences, providing a within-worker estimate of how labor-market scale affects the gender wage gap.

Results and Discussion

4.1 The Dominance of Firm Premia

Comparison of the recovered fixed effects reveals that firm-level sorting and internal pay structures are the primary drivers of spatial gender inequality. The variance of the recovered district-level gender pay gaps (GPG) falls sharply from 0.0020 in the baseline to 0.00057 after incorporating firm fixed effects. This variance decomposition indicates that 72% of the cross-district GPG dispersion is accounted for by firm-specific pay premia and the non-random spatial allocation of firms. These results suggest that the local wage structure is predominantly shaped by firm-level heterogeneity rather than invariant district traits.

The "Agglomeration Paradox": Male-Biased Returns

The empirical evidence from the individual fixed effects model provides a robust rejection of the hypothesis that larger labor markets function as equalizing forces for gender disparities. While urban agglomeration yields a positive wage premium, these benefits are captured almost exclusively by male workers. Specifically, a 10% increase in local employment scale is associated with an approximate 0.19% to 0.21% wage increase for men, compared to a negligible 0.02% to 0.03% gain for women. Consequently, the adjusted GPG expands by an estimated 0.17 to 0.18 percentage points for every 10% growth in district size.

Underlying Mechanisms

The research identifies two salient structural mechanisms that drive the observed male-biased urban premium and the resulting expansion of the GPG in larger districts.

First, dense labor markets function as hubs for high-productivity roles in sectors such as finance, consulting, and corporate management, which often function as "greedy jobs" (Goldin, 2014). These roles disproportionately reward long, rigid, and unpredictable

working hours. Because women in Hungary continue to bear a disproportionate burden of domestic labor and childcare (the "second shift"), they face a structural "time penalty" that prevents them from fully accessing these high-return urban roles. This results in a scenario where men capture the majority of the "size premium" offered by large cities.

Second, the geographic complexity of larger districts imposes higher commuting costs, leading to a phenomenon of "spatial entrapment" (England, 1993; Hanson & Pratt, 1995). While men typically utilize the full spatial scale of the district to optimize their job matching, women frequently limit their job searches to proximity-based options to balance family responsibilities. This restricted search radius grants local firms higher monopsony power over female workers, allowing them to offer lower wages than firms located in more competitive central business districts. In larger districts, where travel times are higher, this entrapment effect is amplified, further widening the pay gap.

Conclusion and Policy Implications

This analysis demonstrates that urban growth in Hungary reinforces male wage advantages through firm-level policies and rigid job structures. The findings confirm that large, high-wage districts do not automatically deliver pay equity and instead require targeted interventions to dismantle specific structural barriers. To mitigate this "Agglomeration Paradox," policymakers should prioritize workplace reforms that encourage large firms to adopt flexible working arrangements. Furthermore, improving public transit connectivity is essential to counteract spatial entrapment and expand women's effective search radii. Without such interventions, urbanization will continue to drive aggregate productivity while systematically leaving female workers behind in the spatial wage hierarchy.

References

Blau, F. D., & Kahn, L. M. (2017). The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature*, *55*(3), 789–865.

Card, D., Cardoso, A. R., & Kline, P. (2016). Bargaining, sorting, and the gender wage gap: Quantifying the impact of firms on the relative pay of women. *The Quarterly Journal of Economics*, *131*(2), 633–686. https://doi.org/10.1093/qje/qjv038

Card, D., Rothstein, J., & Yi, M. (2025). Location, location, location. *American Economic Journal: Applied Economics*, *17*(1), 297–336. https://doi.org/10.1257/app.20220427

Duranton, G., & Puga, D. (2004). Micro-foundations of urban agglomeration economies. In J. V. Henderson & J.-F. Thisse (Eds.), *Handbook of regional and urban economics* (pp. 2063–2117). Elsevier. https://doi.org/10.1016/S1574-0080(04)80005-1

England, K. V. L. (1993). Suburban pink collar ghettos: The spatial entrapment of women? *Annals of the Association of American Geographers*, *83*(2), 225–242. https://doi.org/10.1111/j.1467-8306.1993.tb01933.x

Eurostat. (2026). Gender pay gap in unadjusted form. https://doi.org/10.2908/TESEM180

Glaeser, E. L., Resseger, M., & Tobio, K. (2009). Inequality in cities. *Journal of Regional Science*, *49*(4), 617–646. https://doi.org/10.1111/j.1467-9787.2009.00627.x

Goldin, C. (2014). A grand gender convergence: Its last chapter. *American Economic Review*, *104*(4), 1091–1119.

Hanson, S., & Pratt, G. (1995). *Gender, work, and space*. Routledge.

Nisic, N. (2017). Smaller differences in bigger cities? assessing the regional dimension of the gender wage gap. *European Sociological Review*, *33*(2), 292–304. https://doi.org/10.1093/esr/jcx037

Penner, A. M., Petersen, T., Hermansen, A. S., et al. (2023). Within-job gender pay inequality in 15 countries. *Nature Human Behaviour*, *7*, 184–189. https://doi.org/10.1038/s41562-022-01470-z