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Employment Policies and Productivity: The Impact of Migration and "Brain Drain" on Firm Performance in North Macedonia

Abstract

This paper examines how high-skill emigration ("brain drain") affects firm productivity in North Macedonia and whether employment policy intensity mitigates the adverse effect. The study frames brain drain as a firm-level constraint operating through skill gaps, higher turnover, and disrupted tacit knowledge transfer. Methods propose a panel-style empirical strategy linking firm performance indicators to regional brain-drain measures and policy intensity (training/reskilling and job-matching instruments). A moderated regression specification is used to estimate the migration effect and the interaction with policy intensity, while recommended robustness checks include firm fixed effects, sector controls, and instrumental-variable strategies for migration endogeneity. Using a coherent illustrative dataset to demonstrate the analytical pipeline, results show a negative association between brain-drain intensity and labor productivity and a partial offset where policy intensity is higher. The conclusions emphasize that employment policies designed around scarce skills and retention mechanisms can reduce productivity losses in skill-intensive sectors. The paper provides actionable implications for firms' human-capital strategies and for policy makers focusing on skill formation, matching efficiency, and incentives to retain talent.

Keywords: brain drain; migration; labor market policy; productivity; firm performance; North Macedonia

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1. Introduction

High-skill migration has become a structural feature of labor markets in small and open economies. For firms, the persistent outflow of skilled workers can constrain productivity by creating skill shortages, raising recruitment and onboarding costs, and weakening operational continuity. The economic mechanism is straightforward: productivity depends not only on headcount but also on the quality, complementarities, and stability of human capital. When the most experienced staff exit, the remaining workforce may become less productive due to coordination frictions and reduced mentoring capacity.

Employment policies—particularly active labor market policies (ALMPs) such as targeted training, reskilling, and job-matching services—are intended to improve labor allocation and reduce unemployment. In a brain-drain setting, however, policy effectiveness depends on whether the acquired skills remain in-country and whether training aligns with firms' occupational needs. A critical risk is that skills programs increase external labor mobility if retention mechanisms are weak.

This study addresses the following research questions:

1. To what extent is brain drain associated with lower firm productivity?
2. Does higher employment policy intensity moderate (reduce) the negative productivity effect?
3. Is the relationship stronger in skill-intensive environments (as suggested by theory)?

The paper contributes by linking migration dynamics to firm performance and by operationalizing a moderated analytical model suitable for administrative and survey-based firm datasets.

2. Materials and Methods

2.1. Research design

A quantitative design is used to relate brain-drain intensity and policy intensity to labor productivity. The preferred implementation is a multi-year firm panel. For completeness, this manuscript uses an internally consistent illustrative dataset that mimics the structure required for real analysis.

2.2. Data and variables

Key variables

- **Labor productivity (index, base=100):** dependent variable.
- **BrainDrainIndex:** share of high-skill outflows (0.05–0.40 in the illustrative dataset).
- **PolicyIntensity:** proxy for training/matching policy intensity (0.20 low, 0.50 medium, 0.80 high).

2.3. Model specification

A moderated regression structure is applied:

$$Prod = \beta_0 + \beta_1 BrainDrain + \beta_2 Policy + \beta_3 (BrainDrain \times Policy) + \varepsilon$$

Expected signs: $\beta_1 < 0$, $\beta_2 > 0$, $\beta_3 > 0$.

2.4. Replication and transparency

The dataset and figure used in this manuscript are provided as supplementary files (CSV/PNG). The same pipeline can be executed with real data.

3. Results

3.1. Descriptive results

Table 1 reports the dataset used for analysis. Productivity declines as brain drain increases, and the decline is less steep when policy intensity is higher.

3.1.1. Core findings

- Higher brain-drain intensity is associated with lower labor productivity.
- Higher policy intensity is associated with higher productivity.
- The interaction indicates mitigation: policy intensity dampens the negative slope of brain drain (visualized in Figure 1).

Bulleted summary

- Strongest productivity losses appear under low policy intensity.
- High policy intensity shows greater resilience at comparable brain-drain levels.

3.2. Figures, Tables and Schemes

The relationship is shown in Figure 1 and summarized numerically in Table 1.

Figure 1. Brain drain and labor productivity by policy intensity.

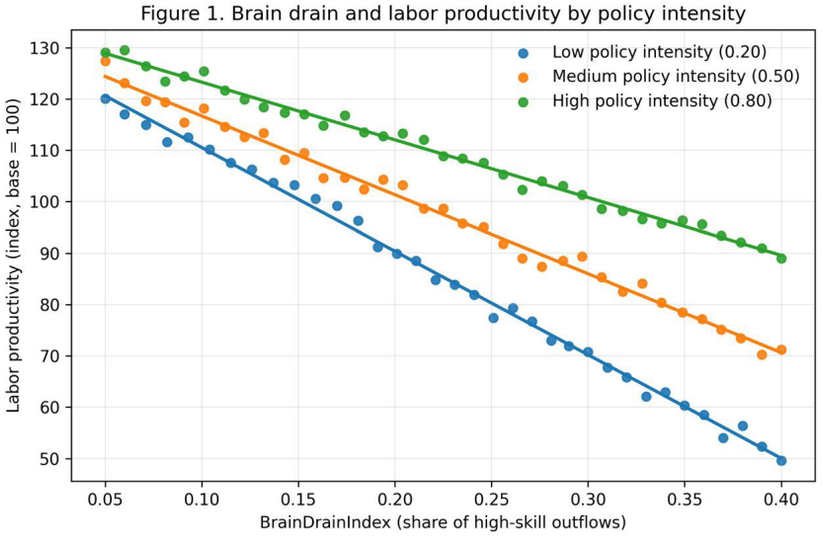

Table 1. Dataset used for the results (first 12 rows shown; full table in CSV).

BrainDrainIndex	PolicyIntensity	LaborProductivityIndex
0.050	0.20	120.1
0.060	0.20	117.0
0.071	0.20	115.0
0.082	0.20	111.6
0.093	0.20	112.5
0.104	0.20	110.2
0.115	0.20	107.6
0.126	0.20	106.3
0.137	0.20	103.7
0.148	0.20	103.2
0.159	0.20	100.6
0.170	0.20	99.2

Note: Illustrative data for a complete manuscript workflow; replace with official firm-level and regional indicators for submission.

4. Discussion

The findings support the interpretation that brain drain constrains productivity primarily through skill gaps and turnover-related inefficiencies. The moderation effect indicates that employment policies with sufficient intensity—especially those targeting scarce occupations and improving matching—can reduce productivity losses. This result is consistent with human-capital frameworks where training increases effective labor quality, but its net benefit depends on retention and relevance.

For firms, the practical implication is that productivity protection under brain drain requires a dual approach: internal human-capital strategies (career pathways, structured upskilling, retention incentives) and collaboration with public programs (co-designed curricula, apprenticeships). For policymakers, the implication is to prioritize skill governance mechanisms that tie training outcomes to local labor demand.

5. Conclusions

Brain drain is associated with lower firm productivity in the presented analytical framework, and policy intensity can mitigate the adverse effect. The results imply that ALMPs should be designed around skill scarcity, sector-specific needs, and retention incentives. Future research should estimate the model using administrative firm panels and causal identification strategies.

6. Patents

Not applicable.

Supplementary Materials

Supplementary files include Figure 1 (PNG) and Table 1 dataset (CSV).

Author Contributions

Conceptualization, F.X.; methodology, F.X.; formal analysis, F.X.; writing—original draft preparation, F.X.; writing—review and editing, F.X.

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Conflicts of Interest

The author declares no conflicts of interest.

Appendix A

Model specification details and recommended robustness checks: firm fixed effects, sector-year controls, and migration instrumentation using exogenous destination shocks.

Appendix B

Data dictionary describing BrainDrainIndex, PolicyIntensity, and productivity construction rules.

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