UNIVERSITY OF OREGON

Global Firms, Local Students: Multinational Presence Shapes College Major Choice

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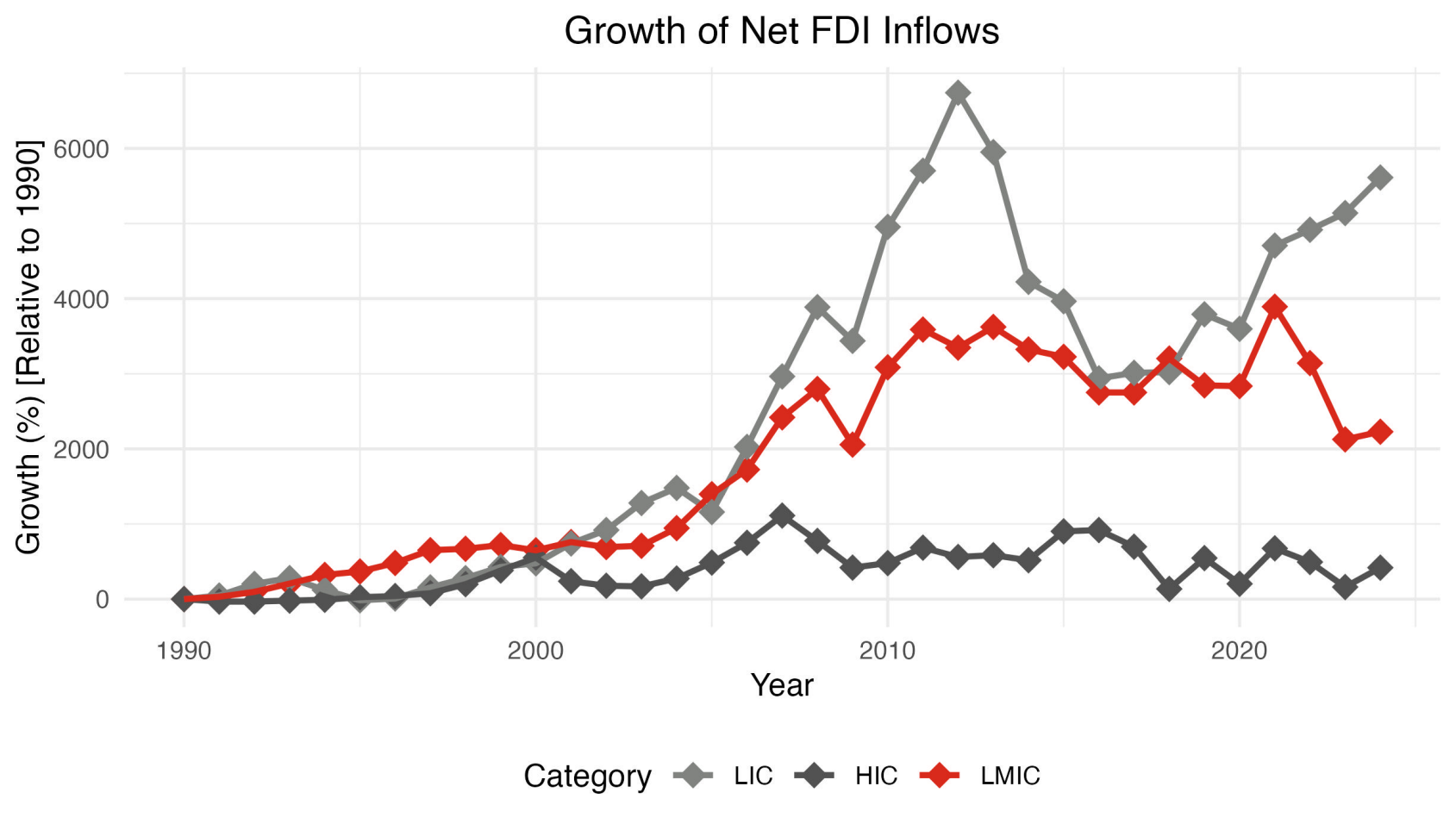
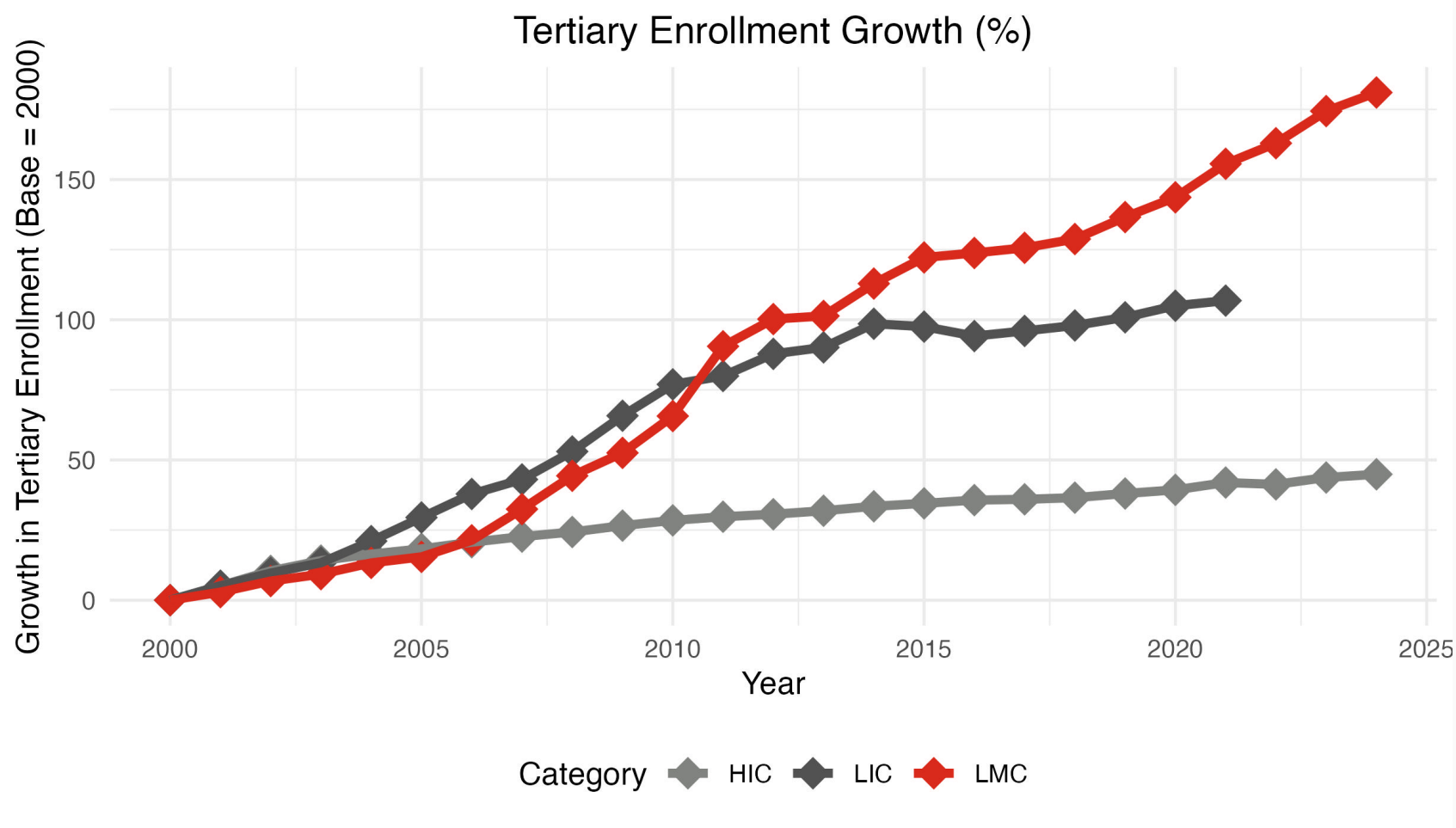
Growth of FDI in LMICs



Lower- and Middle-Income Countries (LMICs) have seen an increasing rate of fdi inflow in recent decades

Source: World Bank

Tertiary Enrollment Growth in LMICs



Tertiary enrollment rates have increased in LMICs

Source: World Bank

Research Question

Hypothesis: Multinational Firms affect skill specialization decisions

- Use administrative data on student applications and location of MNC-exclusive industrial parks in Costa Rica for 2010 to 2019

▸ Costa Rica FDI ▸ Costa Rica Enrollment

Empirical Strategy

- Estimate Multinomial Logit model of field of study choice
- **Key Variable:** Exposure to MNCs in local labor market

FDI and Local Labor Markets

- Positive effects (Hale and Xu, 2016)
- Creative destruction (Jude and Silaghi, 2016)
- There is an established link between FDI and Human Capital Accumulation
  - Complementarities (Borensztein et al., 1998; Wang and Wong, 2011)
  - Decreases in educational attainment (Mughal and Vechiu, 2011; Atkin, 2016; Blanchard and Olney, 2017)
  - Coordination between FDI and institutions is important to positive outcomes (Kheng et al., 2017; Dey and Mishra, 2018; Jung, 2020)

Multinational Entry Matters

- Trend of employment shifts toward the tails of the skill distribution (Blanchard and Willmann, 2016; Goos et al., 2014)
- Should expect similar to follow in MNC-receiving nations as employment is both low-skill (Atkin, 2016) and high-skill (Feenstra and Hanson, 1997; Javorcik, 2015; Alfaro-Ureña et al., 2021; Setzler and Tintelnot, 2021)
- Multinational firms have measureable effects on receiving nations (Smarzynska Javorcik, 2004; Harrison and Rodríguez-Clare, 2010; Davidson and Sly, 2013; Javorcik, 2015; Alfaro-Ureña et al., 2021)

Preview of Results

- There are statistically significant effects of Multinational Firm presence on choice of major
- An increase in the presence of Manufacturing MNCs by one firm-year in district of residence, increases the probability of choosing a major within STEM and Applied Sciences by 84 p.p.
  - Decreases probability of choosing Arts by 56 p.p. and Social Sciences by 29 p.p.
- Trends are robust after removing link between field of study and industry
- Heterogeneity effects by sex show no differences between men and women

Contributions

This paper highlights a mechanism of fdi shifting human capital specialization decisions

Literature on determinants of college major choice

- Wages (Carneiro et al., 2011; Arcidiacono et al., 2012, 2020; Beffy et al., 2012; Carroll et al., 2014; Kirkeboen et al., 2016; Bleemer and Mehta, 2022)
- Non-pecuniary (Altonji, 1993)
- Ability and preference sorting (Arcidiacono, 2004; Kinsler and Pavan, 2015)
- Information availability (Jensen, 2010; Kaufmann, 2014)

Contributions

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Effects of increased trade/fdi inflow effects on local labor markets

- Increase in skilled labor demand Feenstra and Hanson (1997); Javorcik (2015); Alfaro-Ureña et al. (2021); Setzler and Tintelnot (2021)
- Skill acquisition (Blanchard and Willmann, 2016)

Costa Rica Context

Education

- Public universities require applicants to list their two preferred majors when applying ▸ Example
  1. Helps observe demand for major, rather than observing equilibrium enrollment outcomes
  2. Applicants submit relevant demographic information

Multinational Firms

- Costa Rica incentivizes FDI inflows through dedicated Free Trade Zone (FTZ) regime
  1. Firms locate within multinational-dedicated industrial parks
  2. The FTZ regime has captured over 60% of all FDI $'s in the last 5 years ▸ FDI Inflows (CRI)

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Data on Education

- 230,162 Individual applications over 2010 - 2019 time period
  - Arts (20,985), STEM (92,273), Social Science (116,904)

  ▸ Yearly
- 82 Cantons and 434 Districts ▸ Country ▸ Central Valley

Categorization of Field of Study

STEM & Applied Sciences: Natural Sciences, Engineering, Information Tech., Agriculture, Health
Social Sciences & Professional Studies: Business Admin., Social Sciences, Education
Arts, Writing, & Culture: Arts & Humanities, Tourism[a]

Data on Multinational Firms

- 253 Unique Multinational firms
- Six Industries (2-digit ISIC) with average of 40 firms per industry ▸ Composition
  - Administrative and Support Services (69 firms)
  - Information and Communication (39 firms)
  - Manufacturing (39 firms)
  - Wholesale (35 firms)
  - Professional, Scientific and Technical Activities (20 firms)
  - Transportation and Storage (9 firms)
- 19 Cantons and 39 Districts ▸ Country ▸ Central Valley

Student's Choice Utility

Individuals Utility from Studying in Field of Study (m) is:

$$U_{idmt} = \beta_m \left(\sum_j p_{mjt} \times \Gamma_{djt} \right) + \gamma_i X_i' + \alpha_c + \alpha_t + \varepsilon_{idmt}, \qquad (1)$$

Subscripts

i = individual, d = district, m = field-of-study,
j = industry, c = canton, t = year

- Γ_{djt}: MNC Presence Index
- p_{mjt}: Industry Attachment Probabilities
- X_i': Individual Characteristics Vector
- α_c: Regional component across cantons
- α_t: Temporal component

MNC Presence Index

$$\Gamma_{djt} = \sum_{d'} \sum_{f(j)} \frac{\tau_{f(j)}}{exp\left(\mu^{\vec{dd'}}\right)}, \tag{2}$$

Subscripts

- d: district
- $\tau_{f(j)}$: tenure of firm f in industry j in district d' operating in year t
- $\mu^{\vec{dd'}}$: Distance (in km) from district d (student) to district d' (firm)

▸ Admin ▸ Information ▸ Mfg ▸ Wholesale ▸ Prof. Sci. ▸ Transportation

Estimation Method

- **Multinomial Logit (MNL) estimation** and then estimate the **Average Marginal Effects (AMEs)** by industry

$$P(Y_i = m) = \frac{\overbrace{exp(\beta_m \left(\sum_j p_{mjt} \times \Gamma_{djt} \right) + \gamma_i X_i' + \alpha_c + \alpha_t + \varepsilon_{idmt})}^{\text{Utility of chosen field-of-study}}}{\underbrace{\sum_{m'} exp(\beta_{m'} \left(\sum_j p_{m'jt} \times \Gamma_{djt} \right) + \gamma_i X_i' + \alpha_c + \alpha_t + \varepsilon_{idm't}))}_{\text{Utilities across all possible field-of-study choices}}} \quad (3)$$

Subscripts

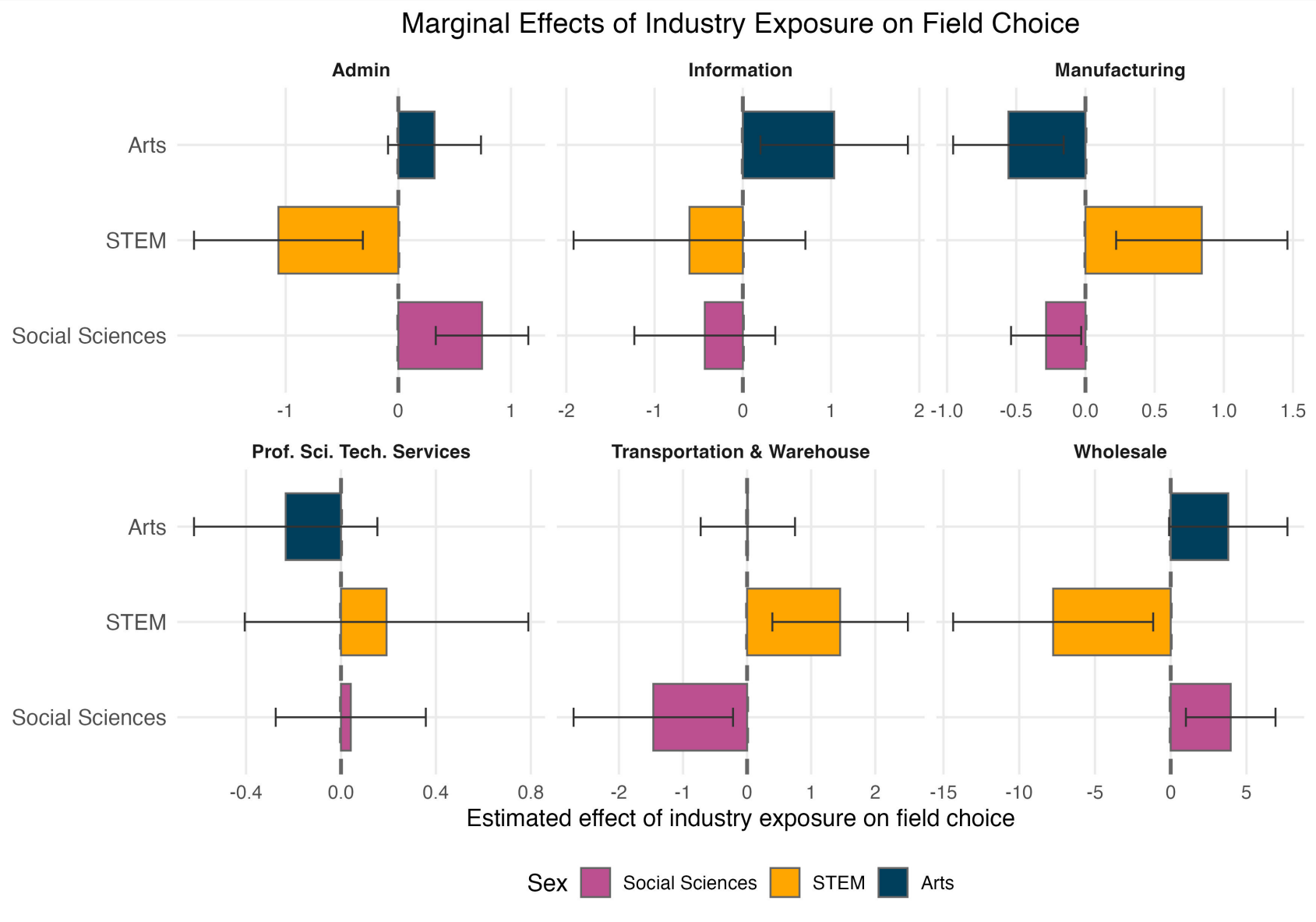
i = individual, d = district, m = field-of-study,
j = industry, c = canton, t = year

Average Marginal Effects (Industry × Field of Study)

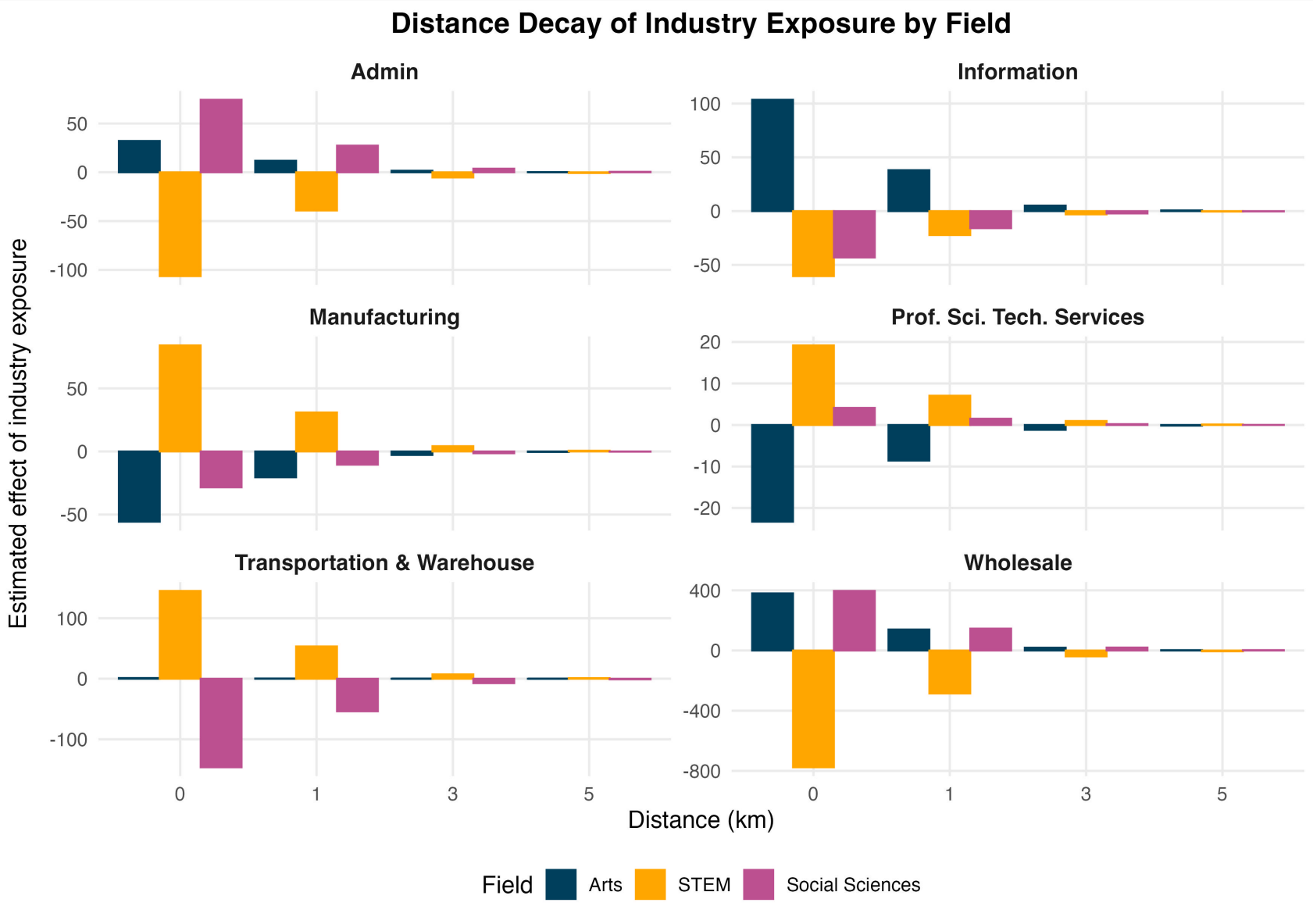
	Field of Study Choice		
	Arts, Writing & Culture	STEM & Applied Sciences	Social Science & Prof. Studies
Administration	0.3212	-1.064***	0.743***
	(0.2104)	(0.382)	(0.2096)
Information	1.0349**	-0.6043	-0.4307
	(0.4261)	(0.6701)	(0.4074)
Manufacturing	-0.5566***	0.8408***	-0.2842**
	(0.2038)	(0.3158)	(0.1293)
Prof. Science & Tech. Services	-0.2331	0.1919	0.0412
	(0.1972)	(0.3049)	(0.1614)
Transportation & Warehouse	0.0118	1.4516***	-1.4633**
	(0.3755)	(0.5395)	(0.6348)
Wholesale	3.8000*	-7.7612**	3.9612***
	(1.9937)	(3.3693)	(1.5092)
Controls	✓	✓	✓
District FE	✓	✓	✓
Year FE	✓	✓	✓
Applications	20,985	92,273	116,904
Pseudo-R2	0.0436	0.0436	0.0436

Statistical significance is displayed as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

Average Marginal Effects Visualized



Distance Decay

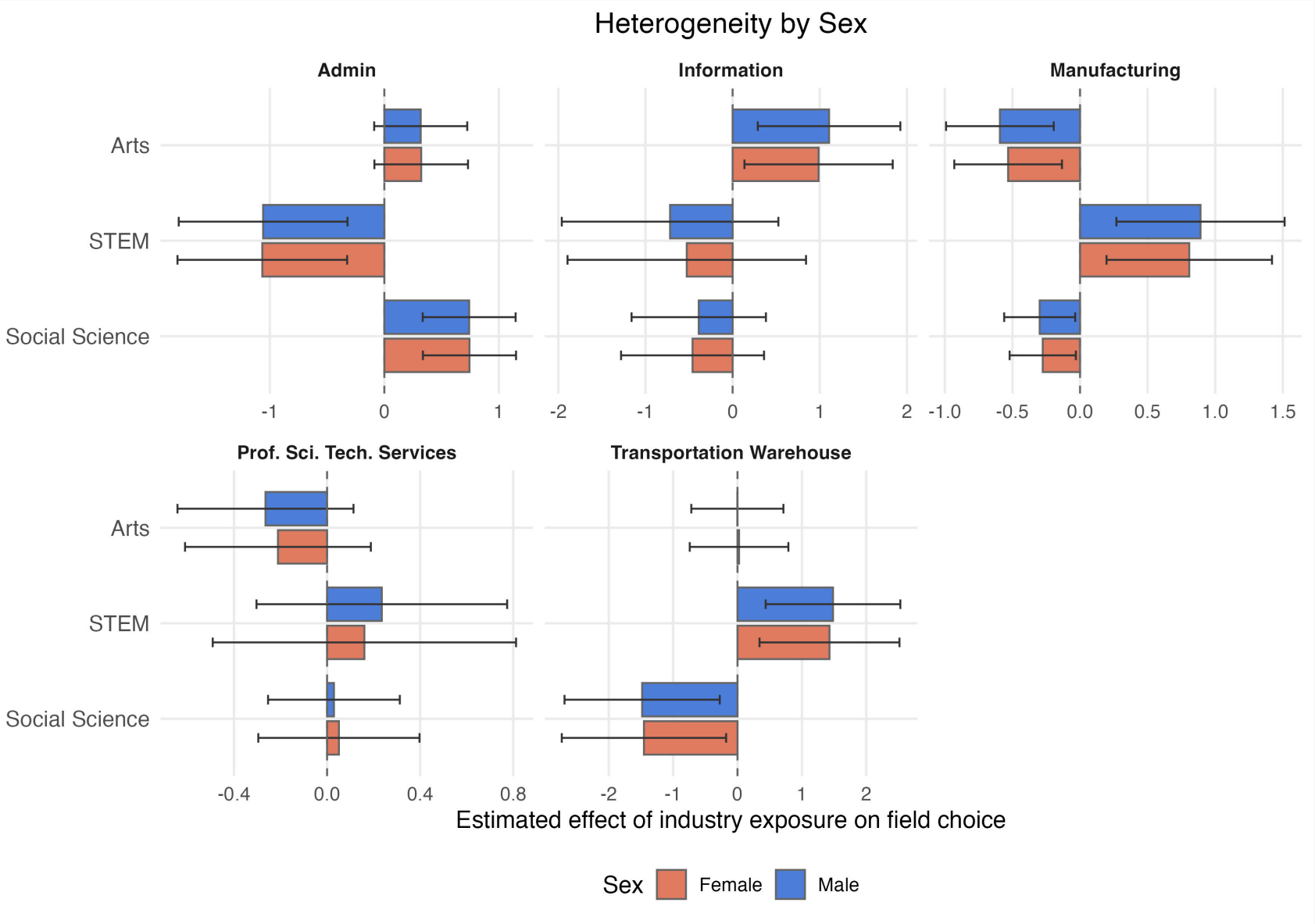


▸ Example

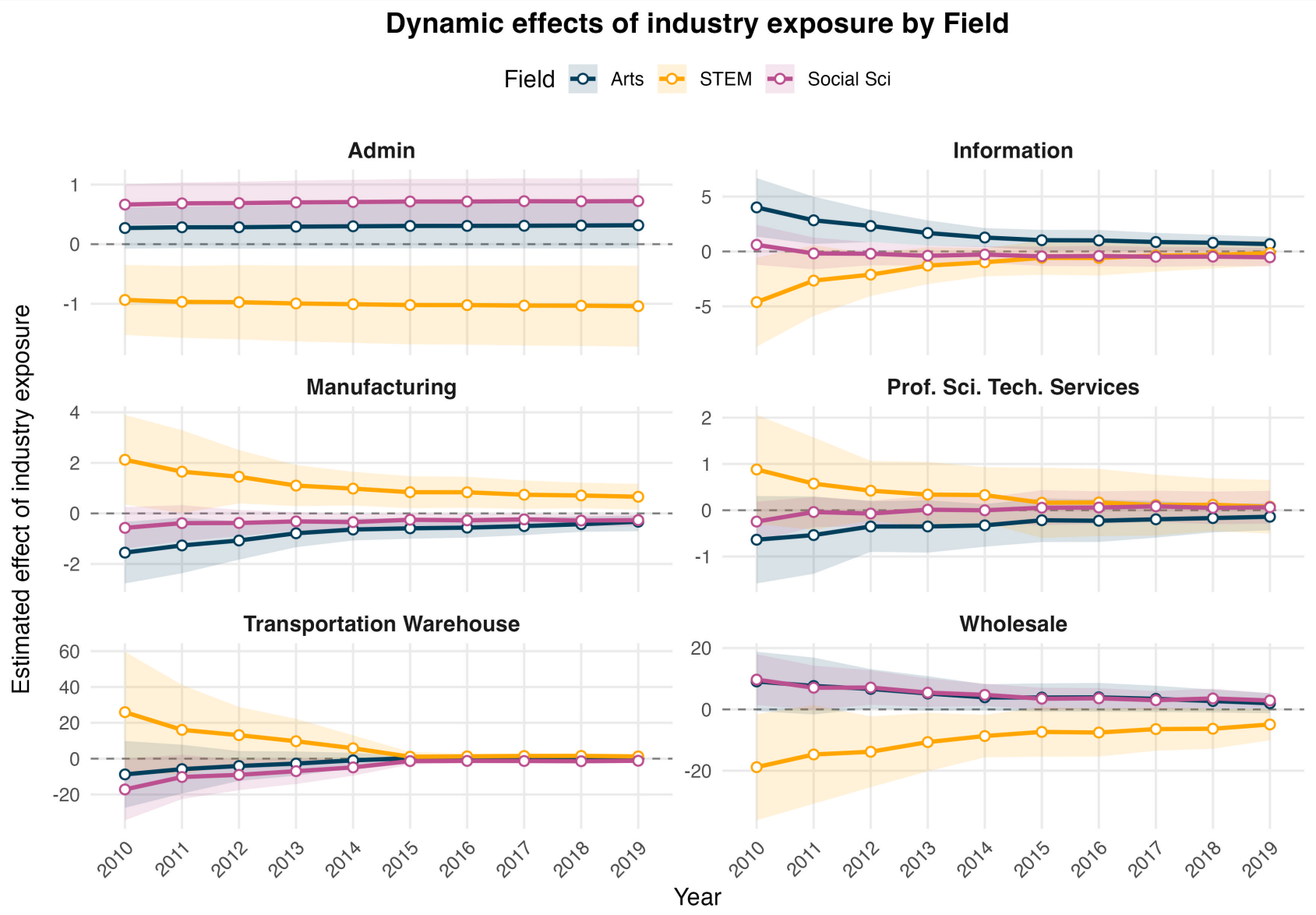
Robustness (No Attachment Probability Weights) ▸ Graph

	Field of Study Choice		
	Arts, Writing & Culture	STEM & Applied Sciences	Social Science & Prof. Studies
Administration	-.00014	-0.0002	0.0003**
	(0.0001)	(0.0001)	(0.0001)
Information	0.00012	-0.0005	0.0003
	(0.0002)	(0.0004)	(0.0003)
Manufacturing	-0.0002	0.0007**	-0.0005**
	(0.2038)	(0.0003)	(0.0002)
Prof. Science & Tech. Services	-0.0005**	-0.0014	0.0020***
	(0.0004)	(0.0005)	(0.0005)
Transportation & Warehouse	-0.0014	-0.0004	0.0017
	(0.3755)	(0.0012)	(0.6348)
Wholesale	0.0015	-0.0007	0.0008
	(0.0010)	(0.0014)	(1.5092)
Controls	✓	✓	✓
Canton FE	✓	✓	✓
Year FE	✓	✓	✓
Applications	20,985	92,273	116,904
Pseudo-R2	0.0347	0.0347	0.0347

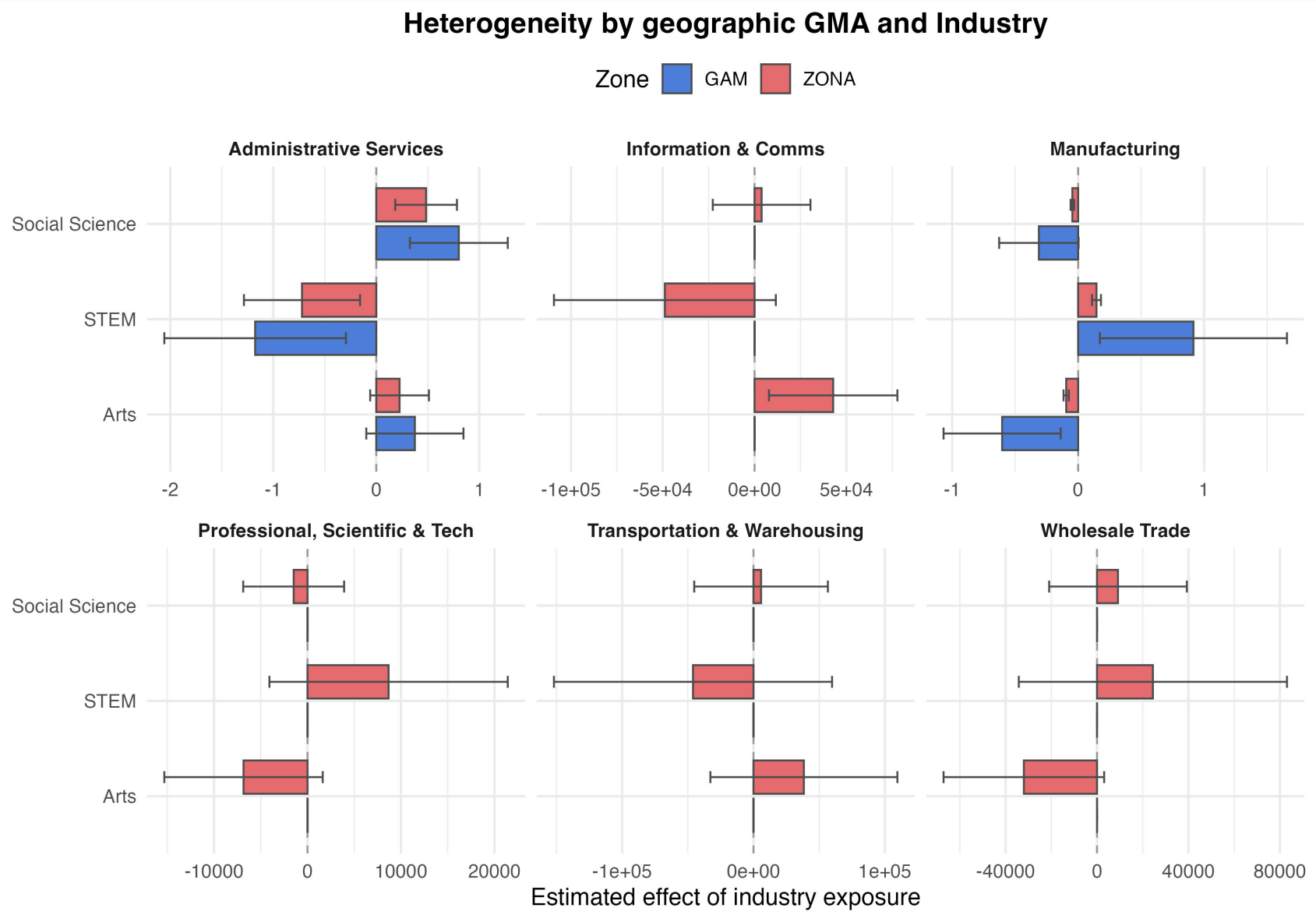
Differences by Sex



Differences by Cohort



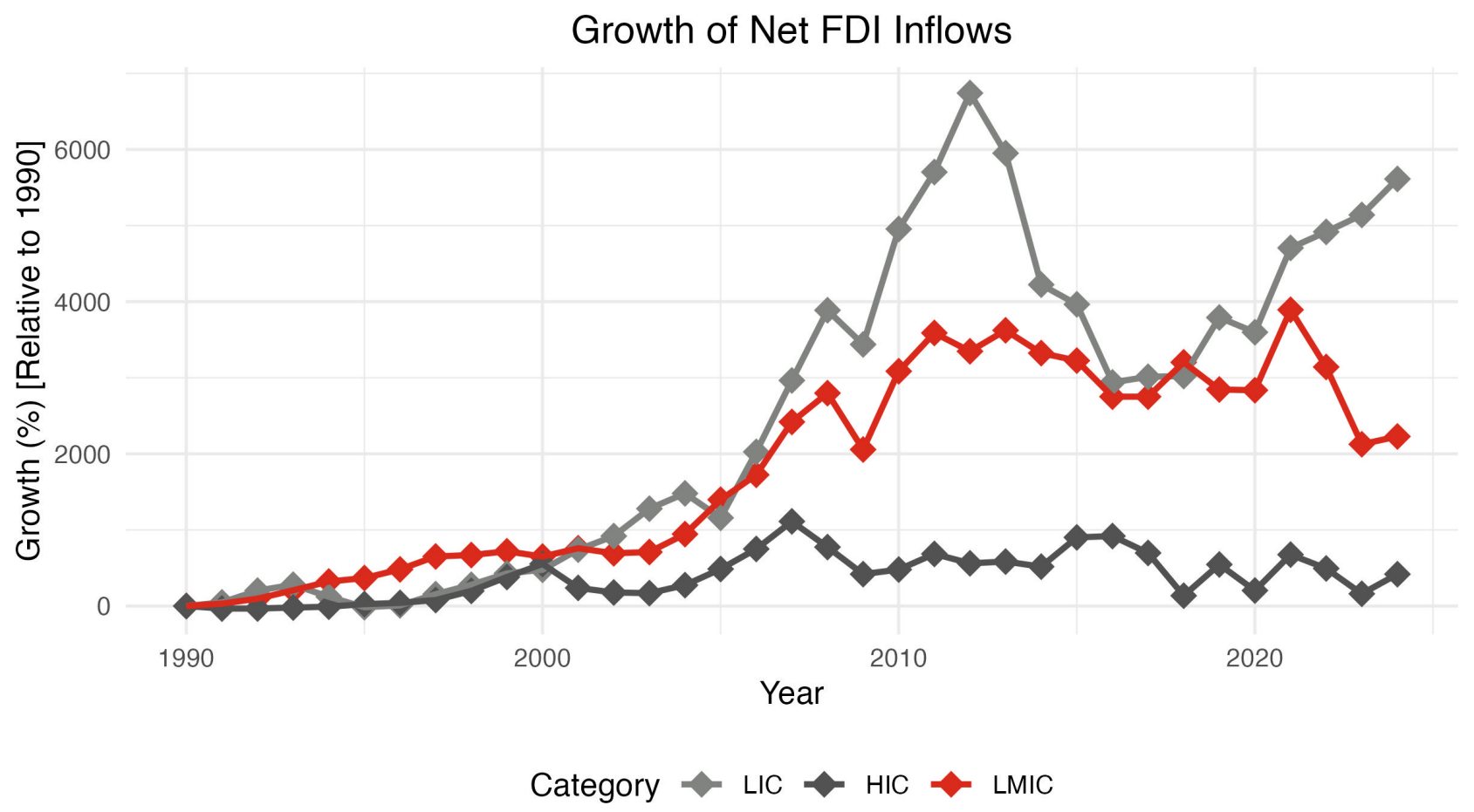
Differences by Greater Metropolitan Area



Conclusion

- Multinationals reshape local incentives to acquire certain skills
- I ask if this influence impacts students choice of university field of study
- Using local labor market exposure to multinational firms, I estimate how exposure to MNC activity shapes field of study preferences
- Results suggest that students are influenced to choosing majors that better align with MNC industry needs
- Highlights new channel through which FDI shapes formation of human capital in LMICs

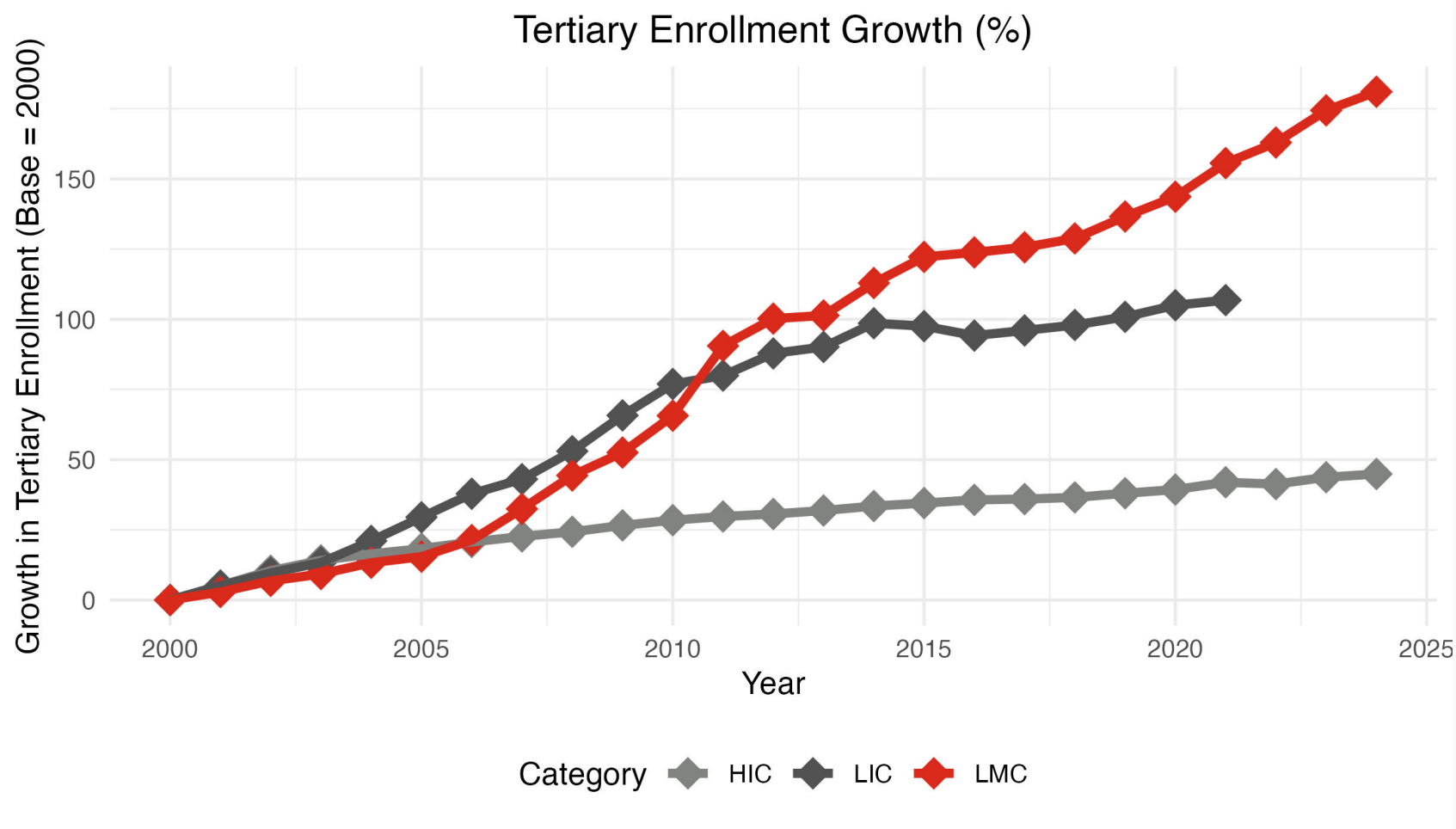
Growth of FDI in LMICs



Source: World Bank

Return

Tertiary Enrollment Growth in LMICs

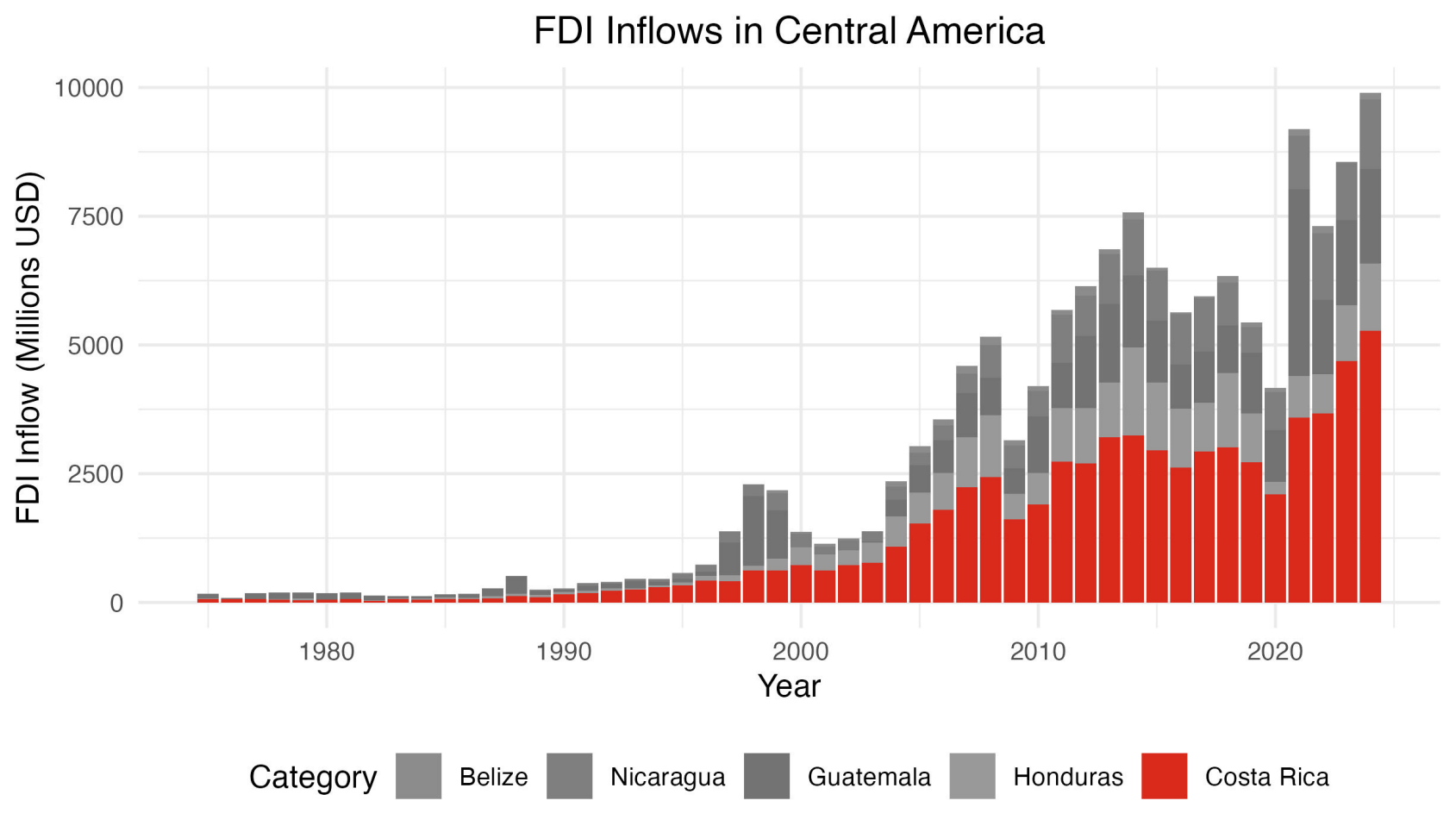


Source: World Bank

Return

FDI by Country in Central America

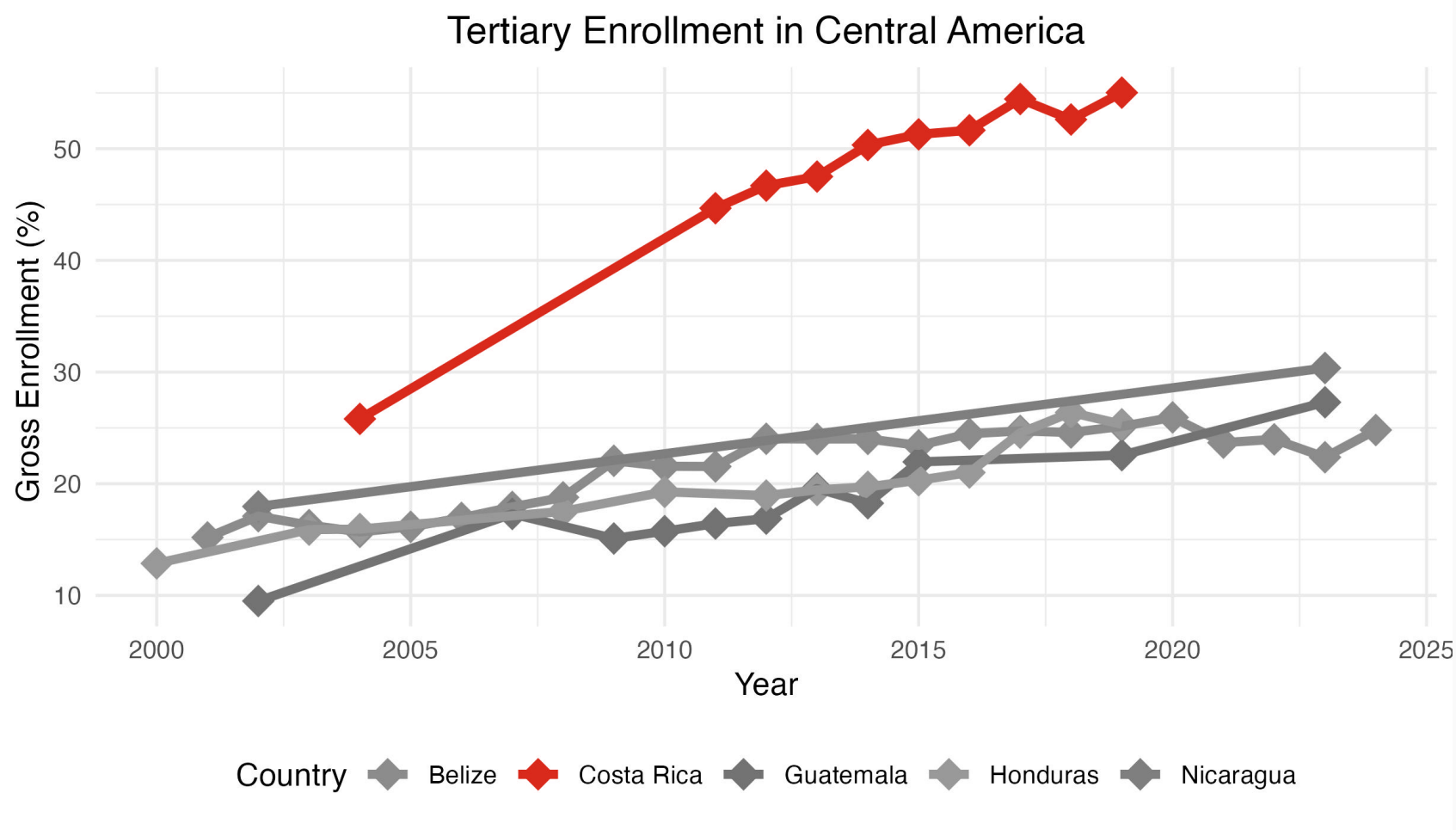
Return



Source: World Bank

Tertiary Enrollment by Country in Central America

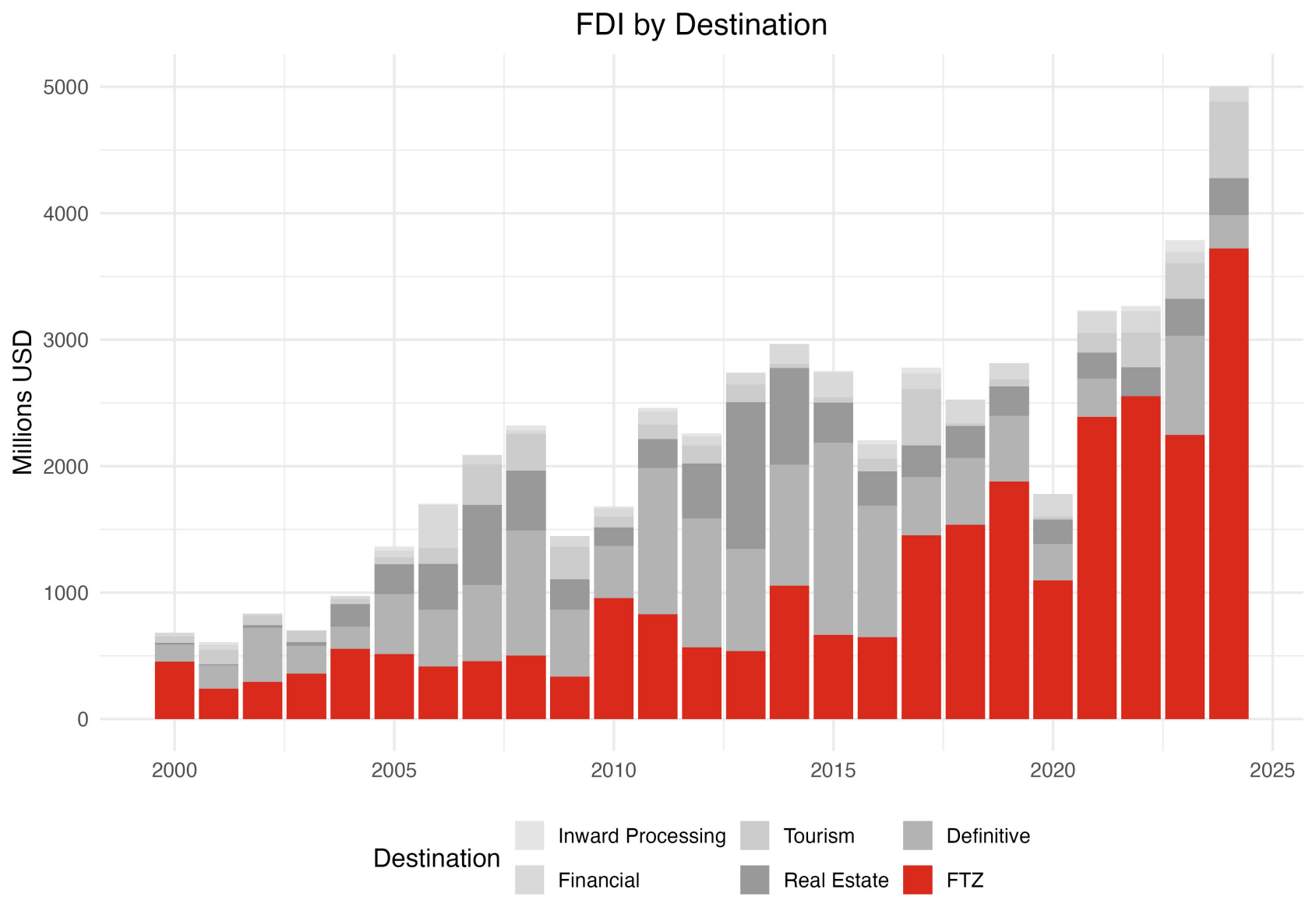
Return



Source: World Bank

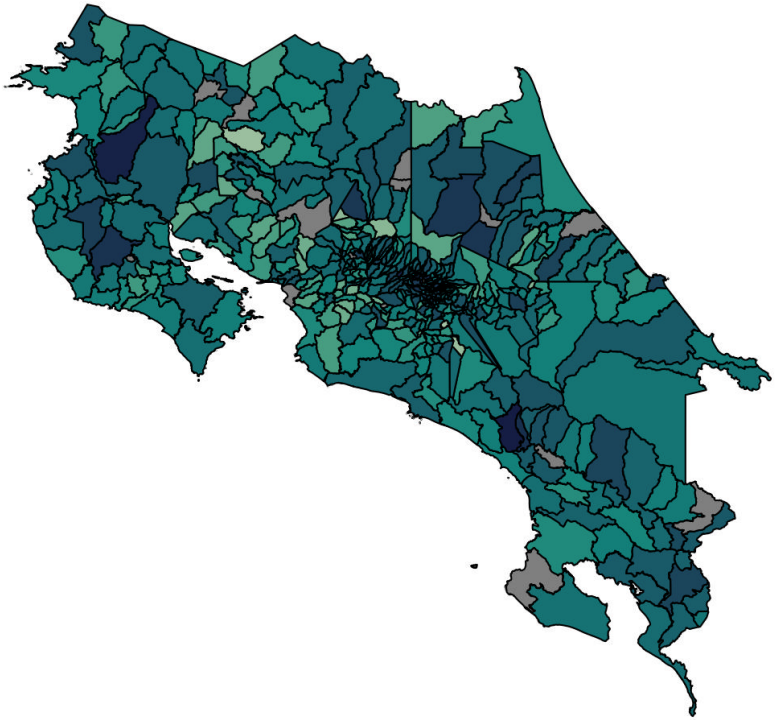
FDI Destination

Return



Source: Costa Rica Central Bank

Student Applications Concentration

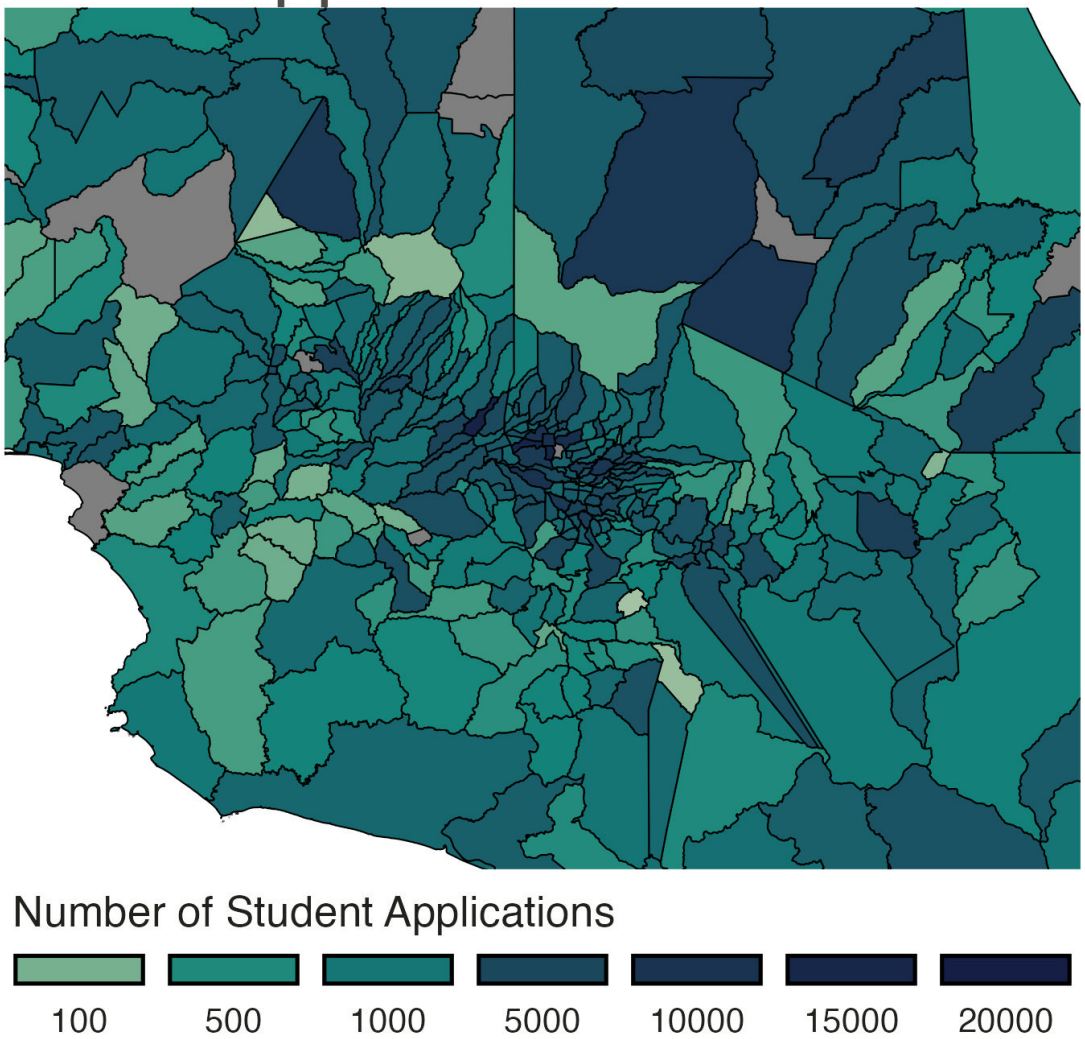


Number of Student Applications

100 500 1000 5000 10000 15000 20000

◂ Return

Student Applications Concentration



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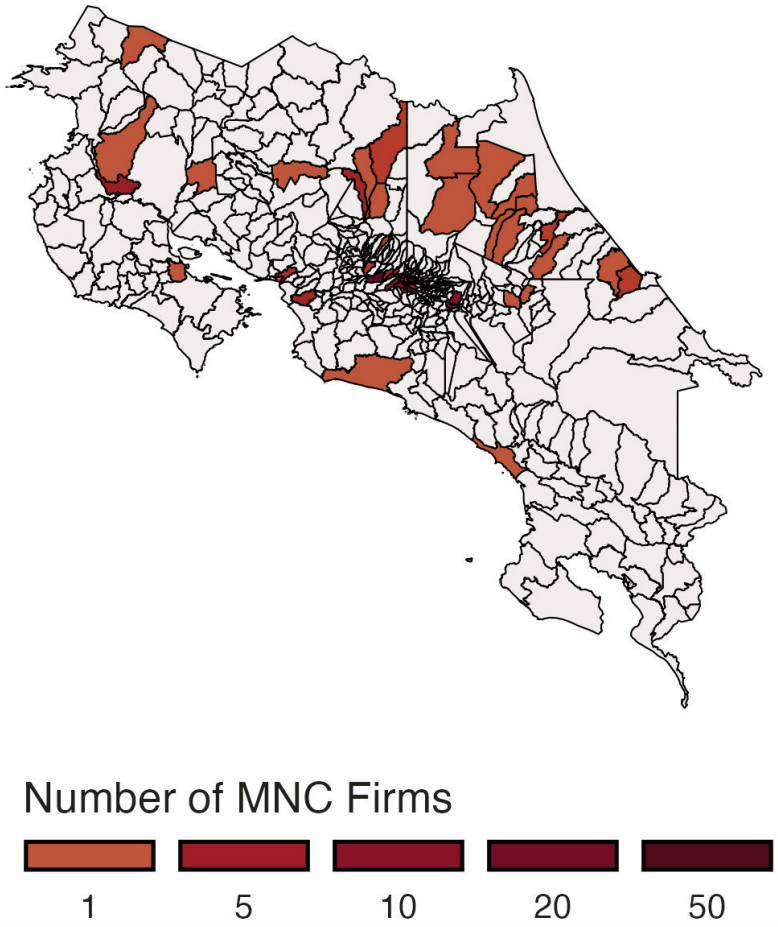
MNC Presence Heatmap



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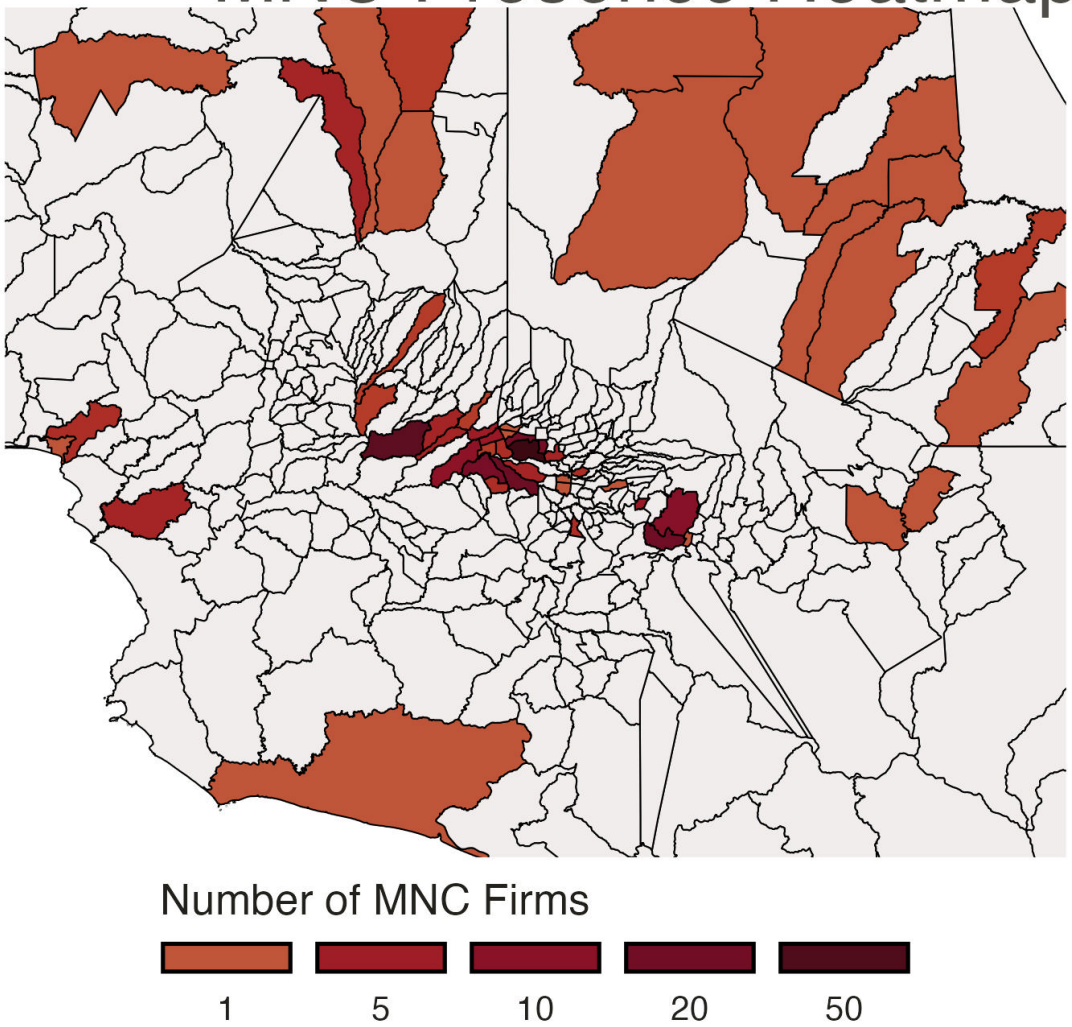
MNC Presence Heatmap



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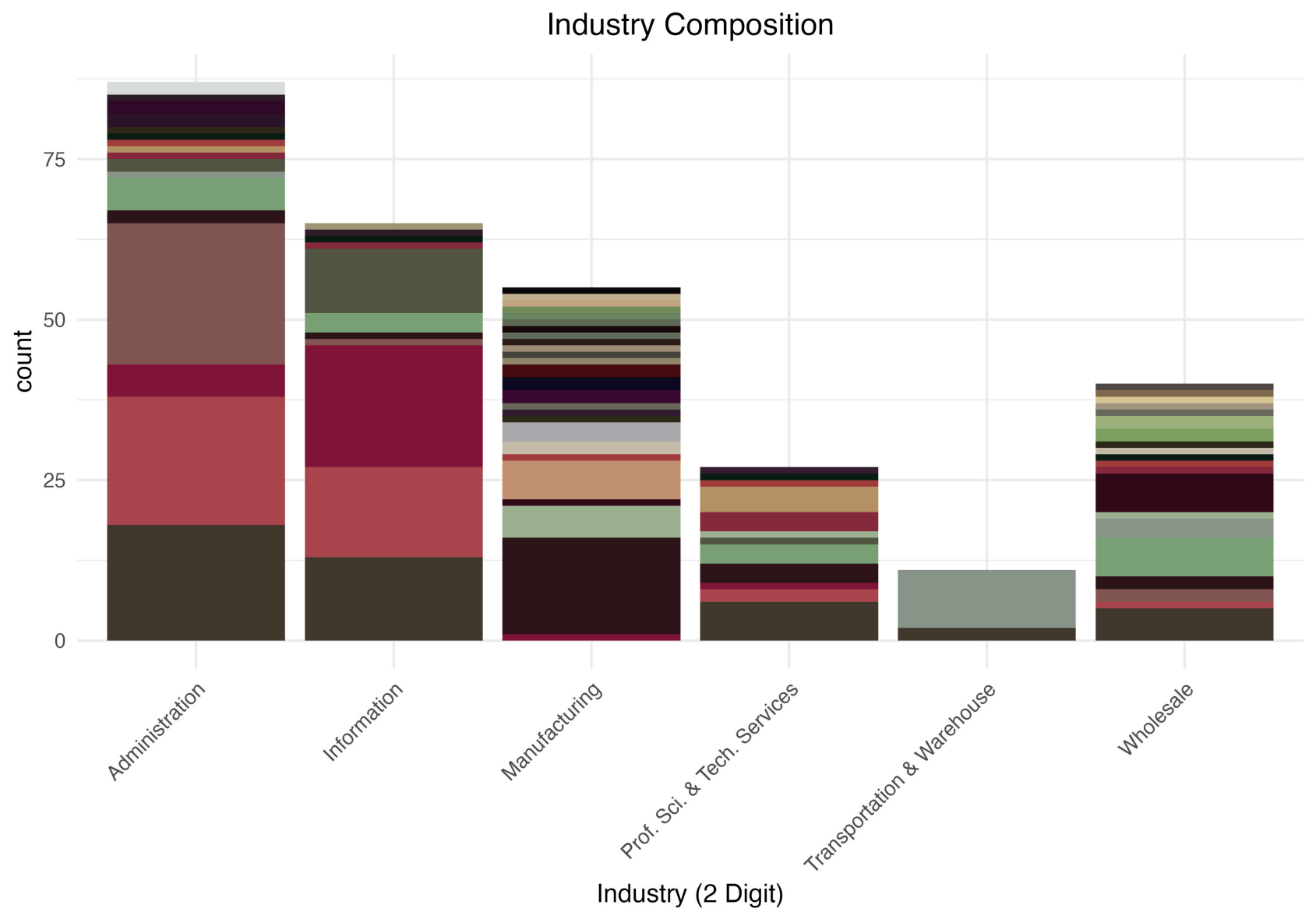
Industry Composition Within FTZ



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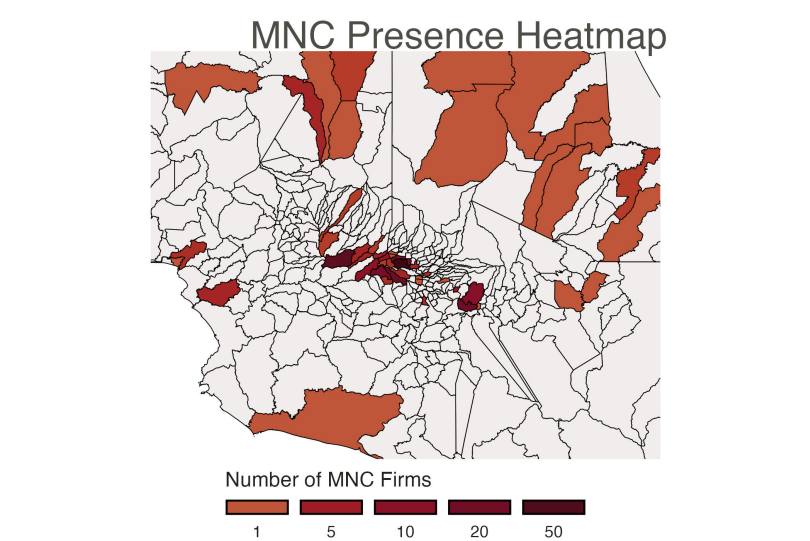
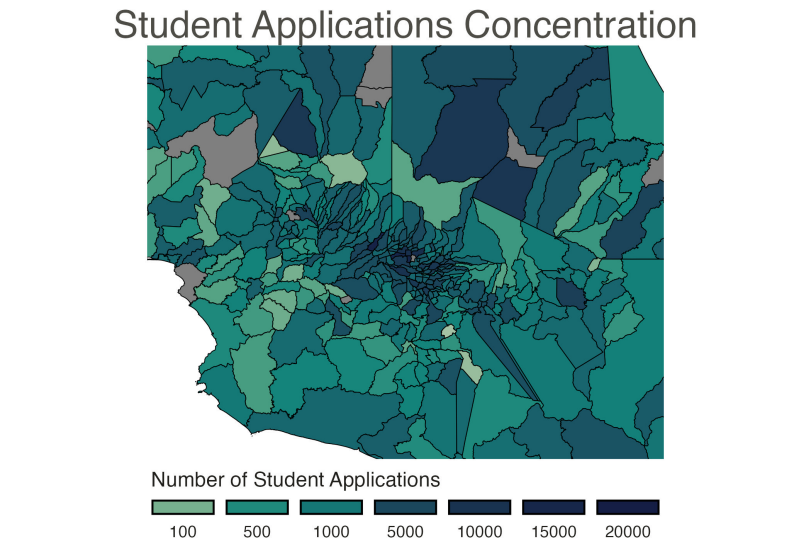
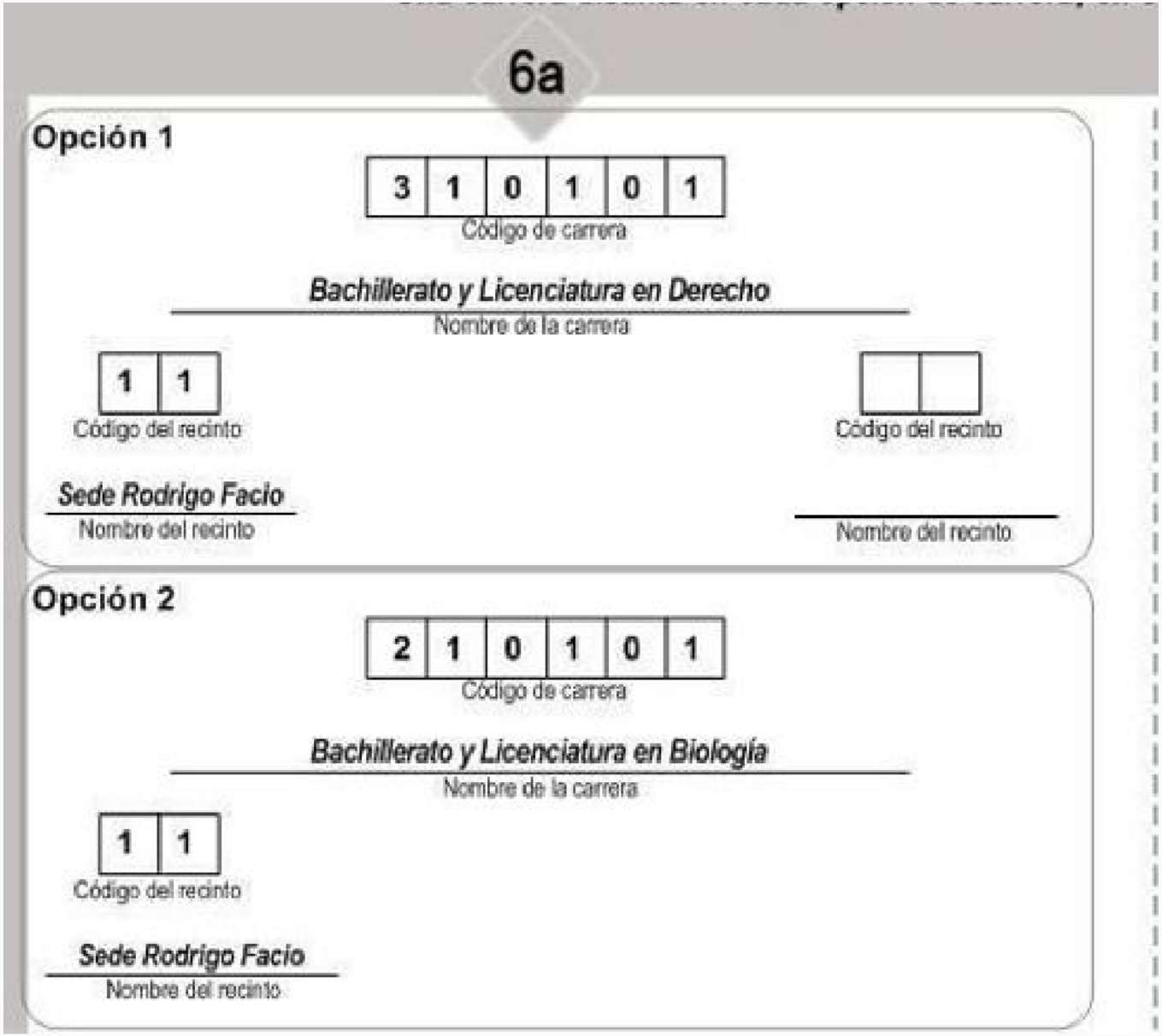
Central Valley Concentration





Application Example

Return



6a

Opción 1

3	1	0	1	0	1

Código de carrera

Bachillerato y Licenciatura en Derecho

Nombre de la carrera

1	1

Código del recinto

Sede Rodrigo Facio

Nombre del recinto

Código del recinto

Nombre del recinto

Opción 2

2	1	0	1	0	1

Código de carrera

Bachillerato y Licenciatura en Biología

Nombre de la carrera

1	1

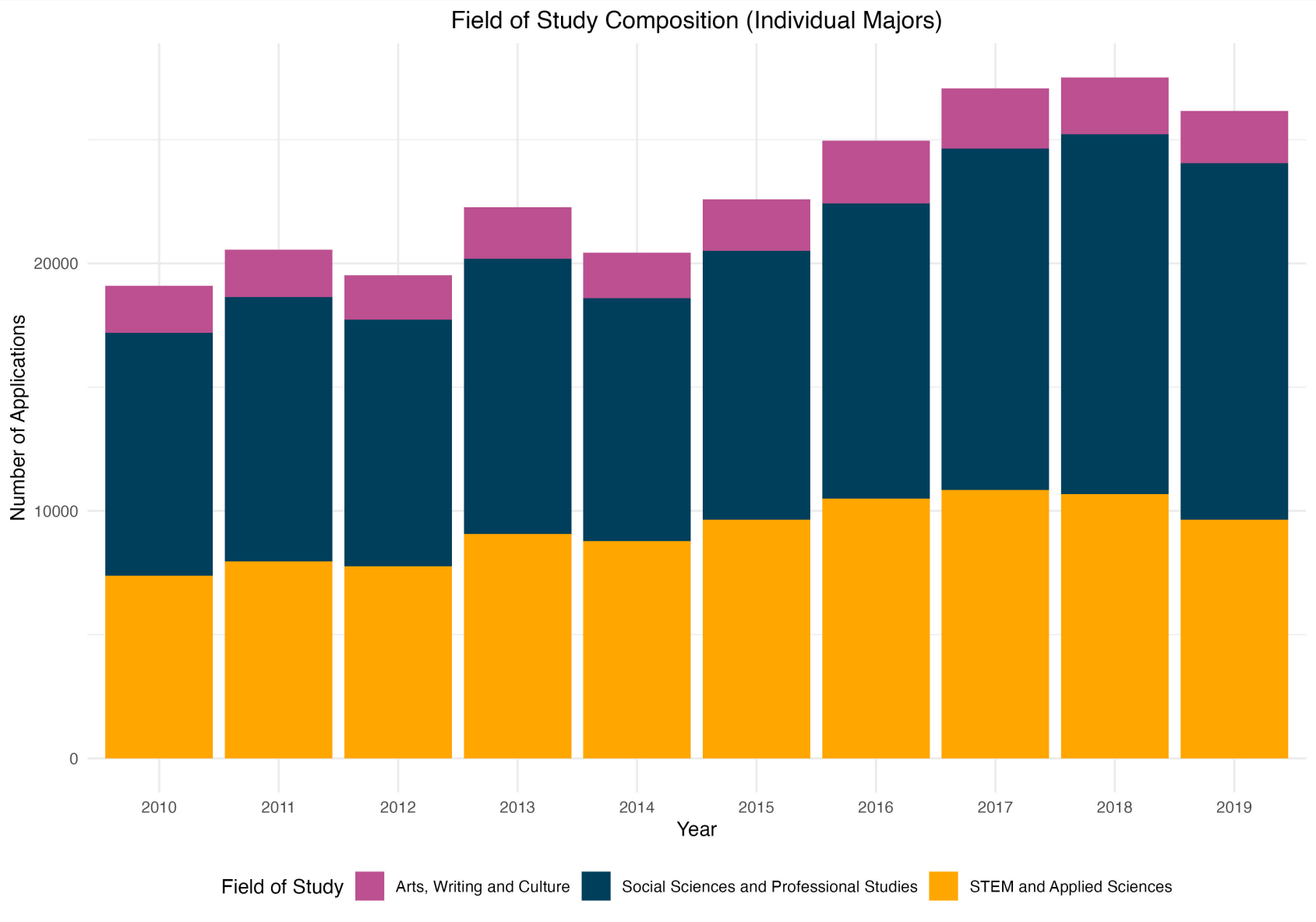
Código del recinto

Sede Rodrigo Facio

Nombre del recinto

Application Composition by Year

Return



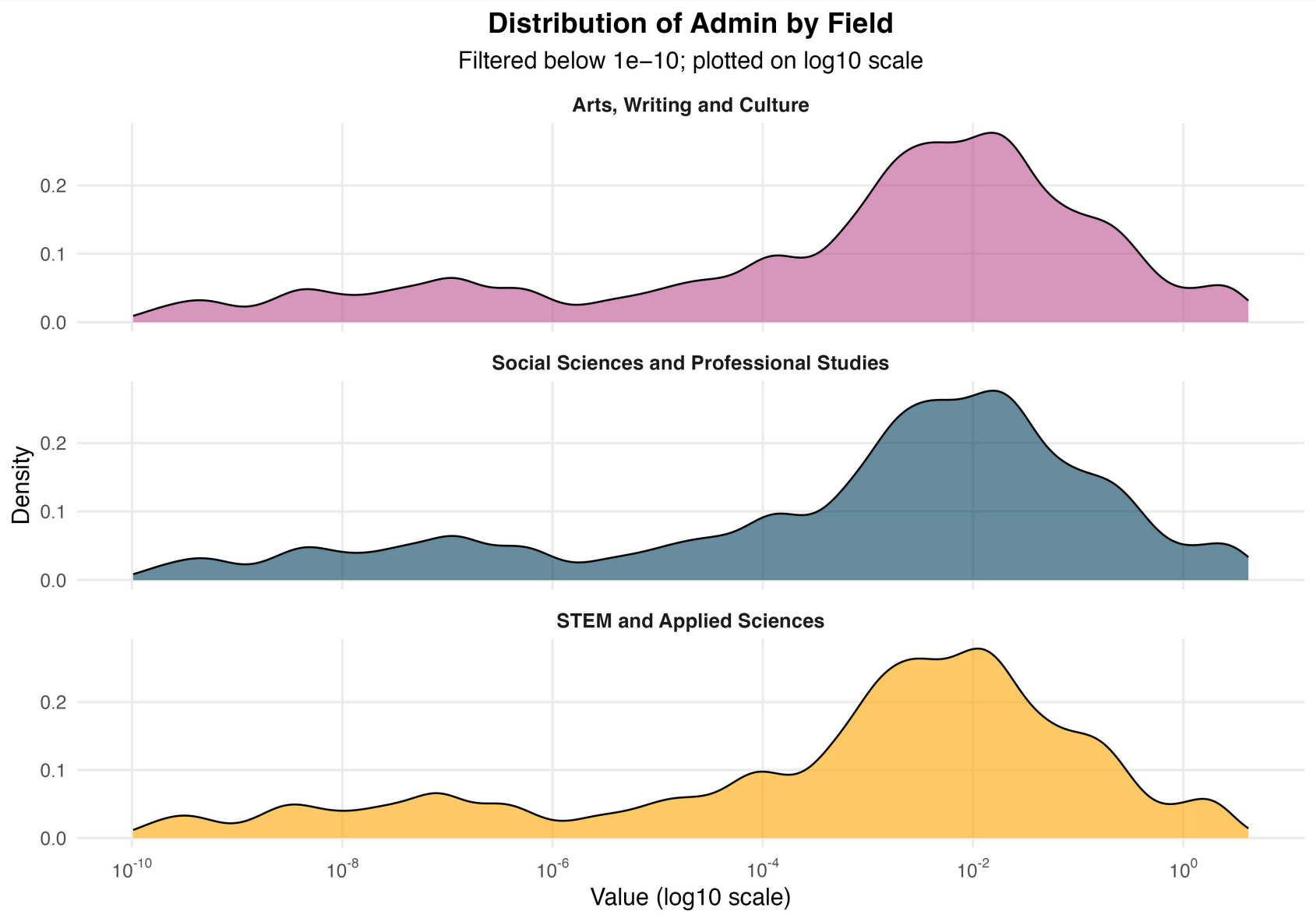
Summary Statistics

Demographic Information		
	Mean	Std. Dev.
Age	19.49	(2.65)
Application Score	568.74	(110.87)
Female	0.57	
STEM	0.36	
GAM	0.55	
Public High School	0.77	

Geographical Information			
Province	(%) of Applications	No. of Cantons	No. of Districts
San José	30.67	20	108
Alajuela	19.82	16	94
Heredia	16.64	10	41
Cartago	8.45	8	48
Puntarenas	8.24	11	57
Guanacaste	10.02	11	58
Limón	6.17	6	28
Observations		230,162	

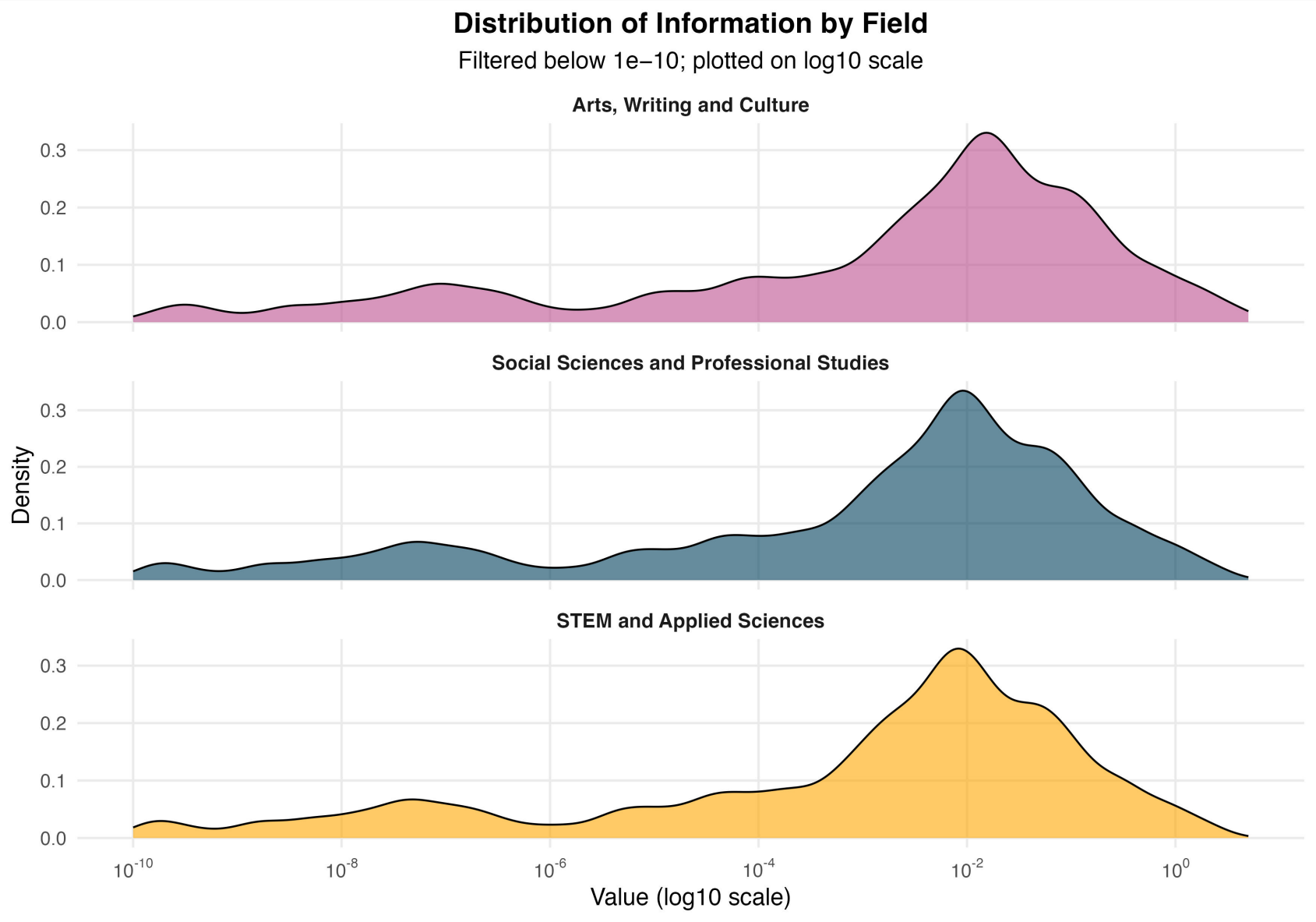
Administrative and Support Service Activities

◂ Return



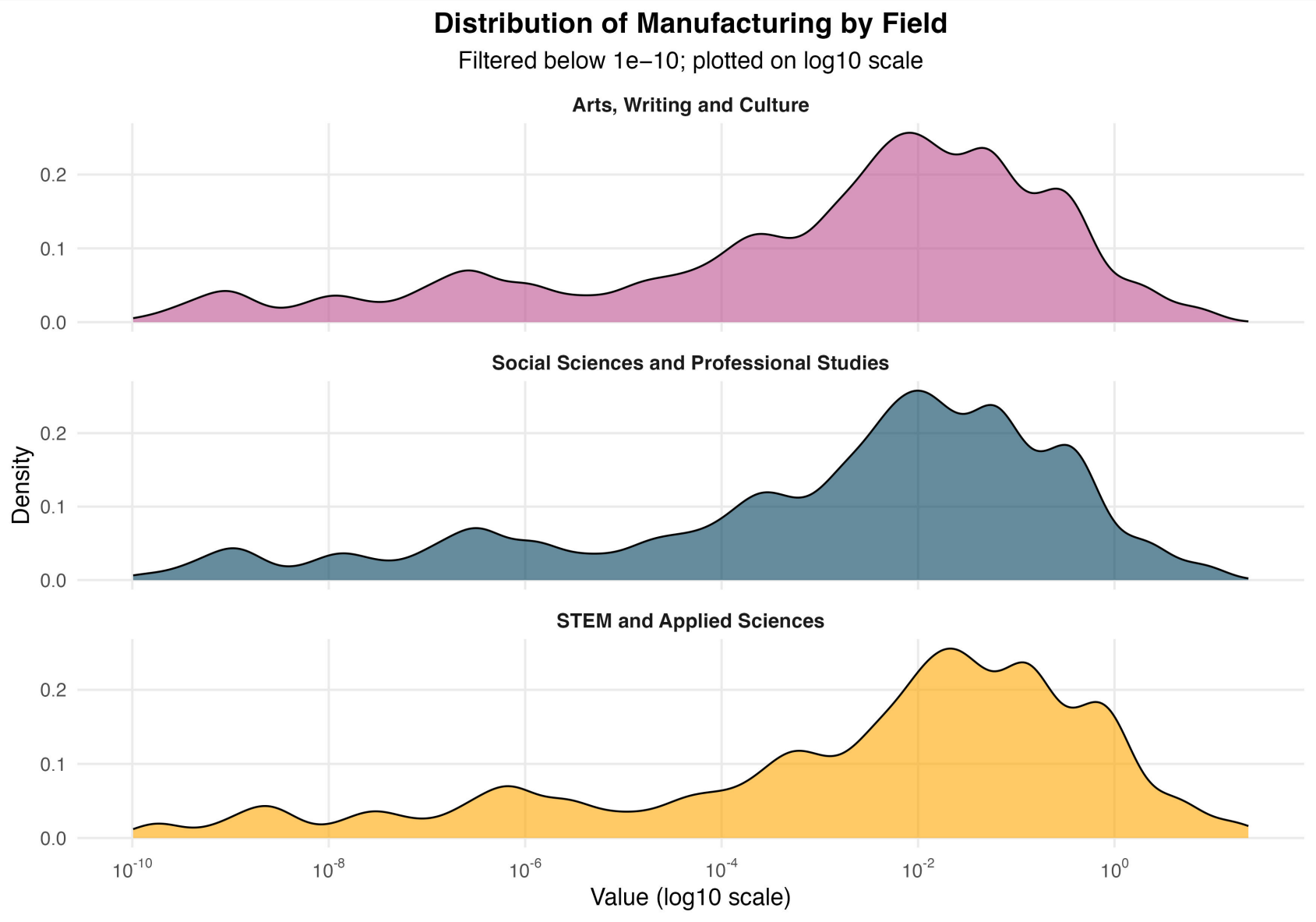
Information and Communications Activities

◂ Return



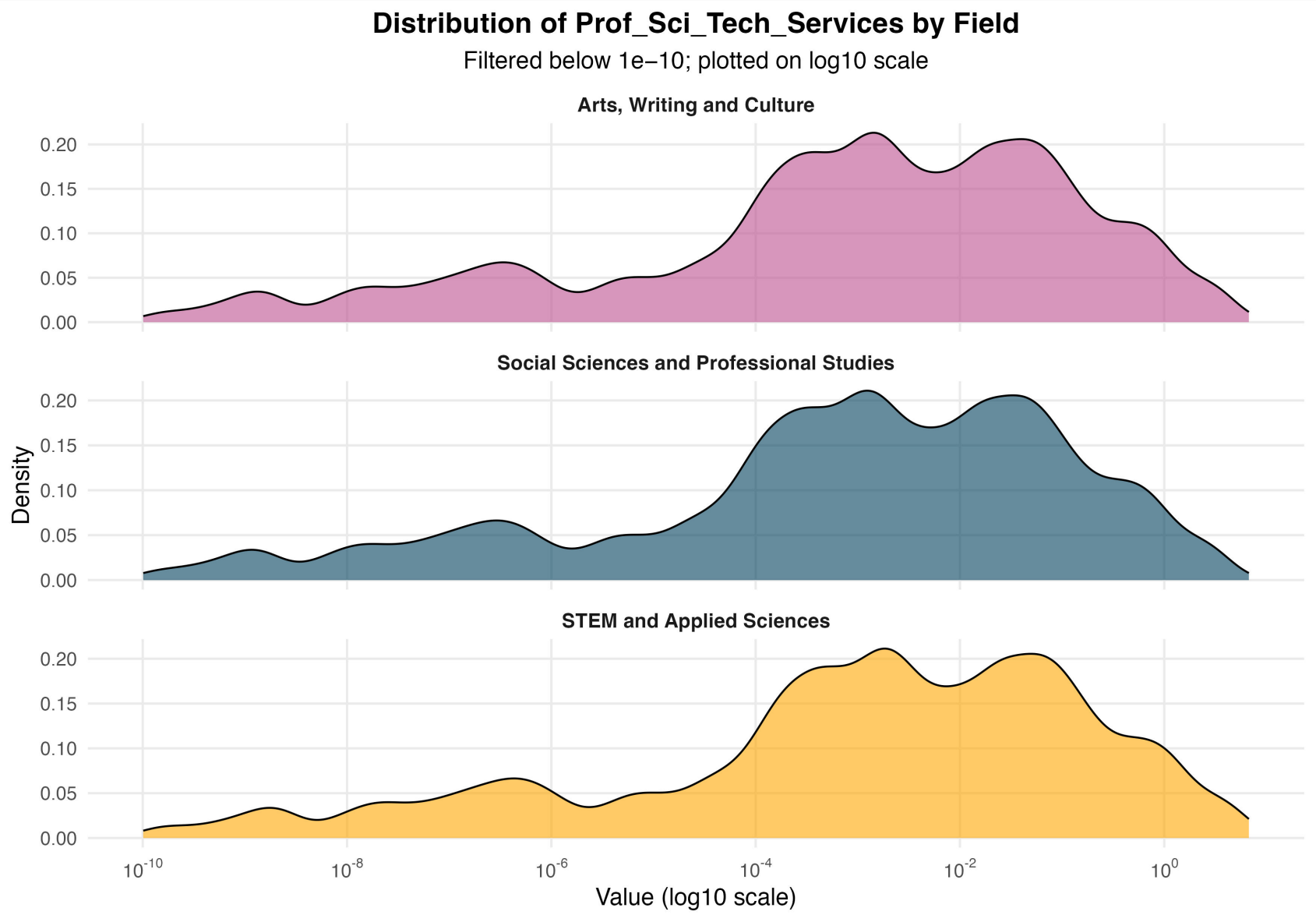
Manufacturing Activities

Return



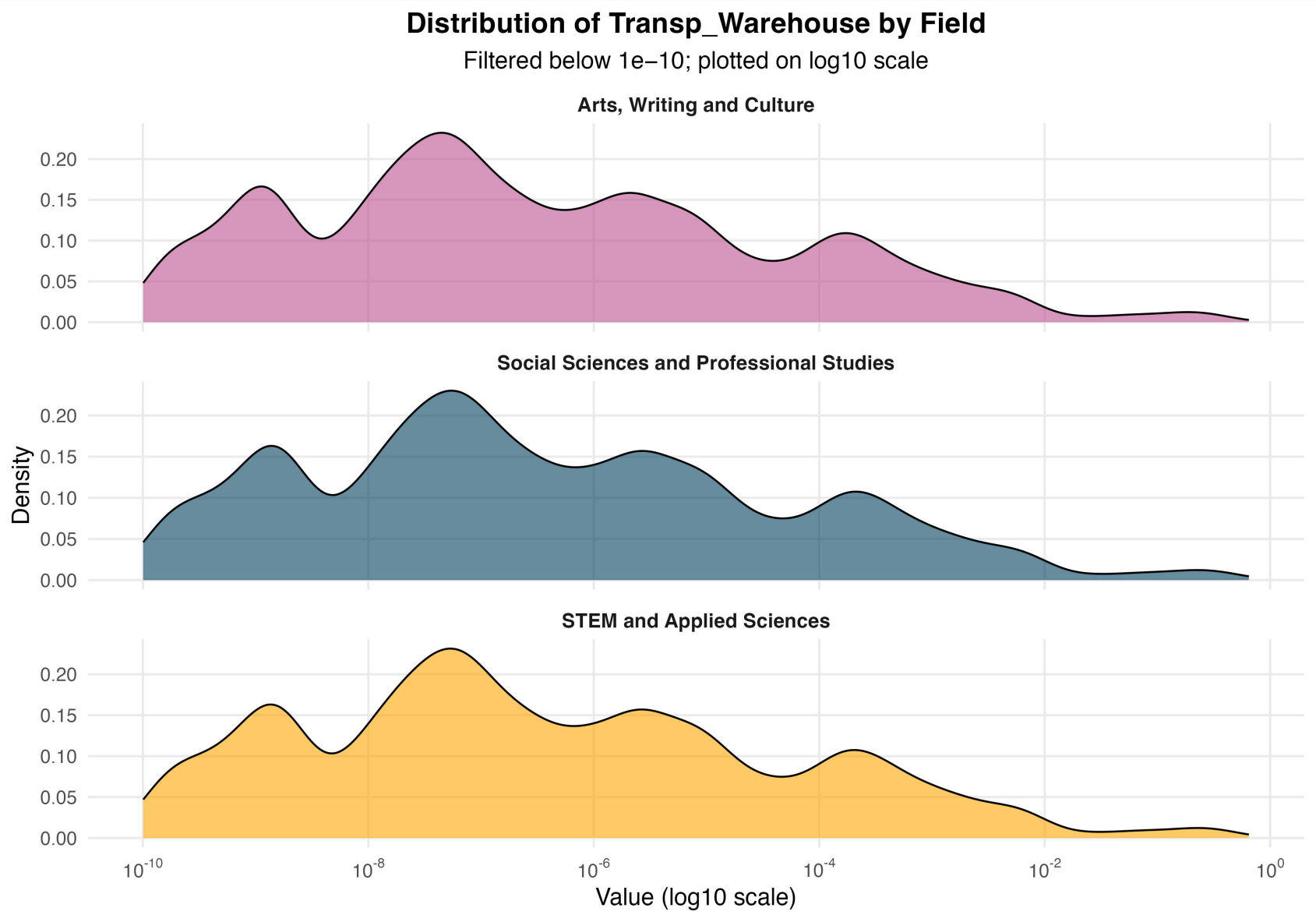
Professional, Scientific and Technical Activities

Return



Transporation and Warehousing Activities

Return



Wholesale

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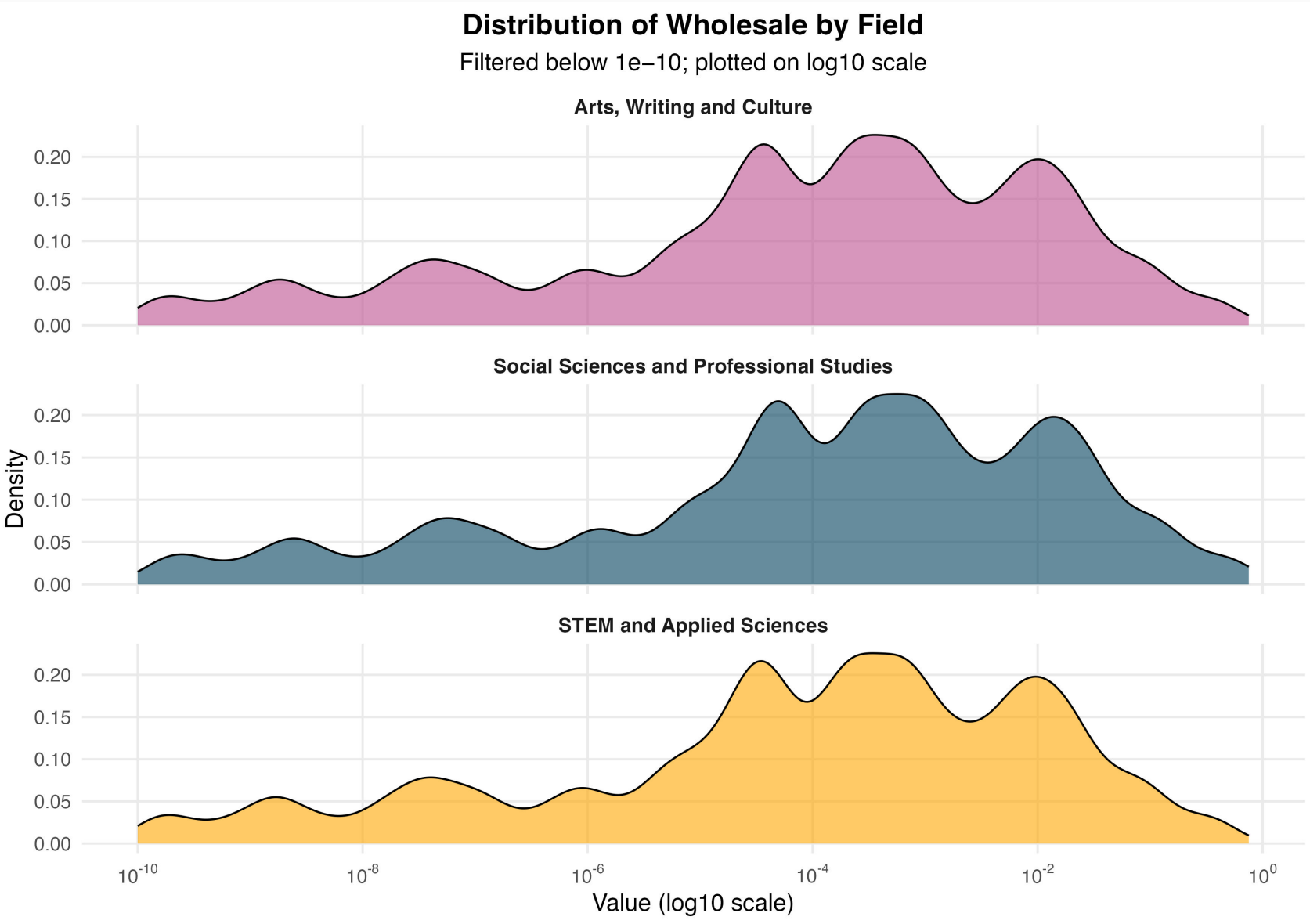
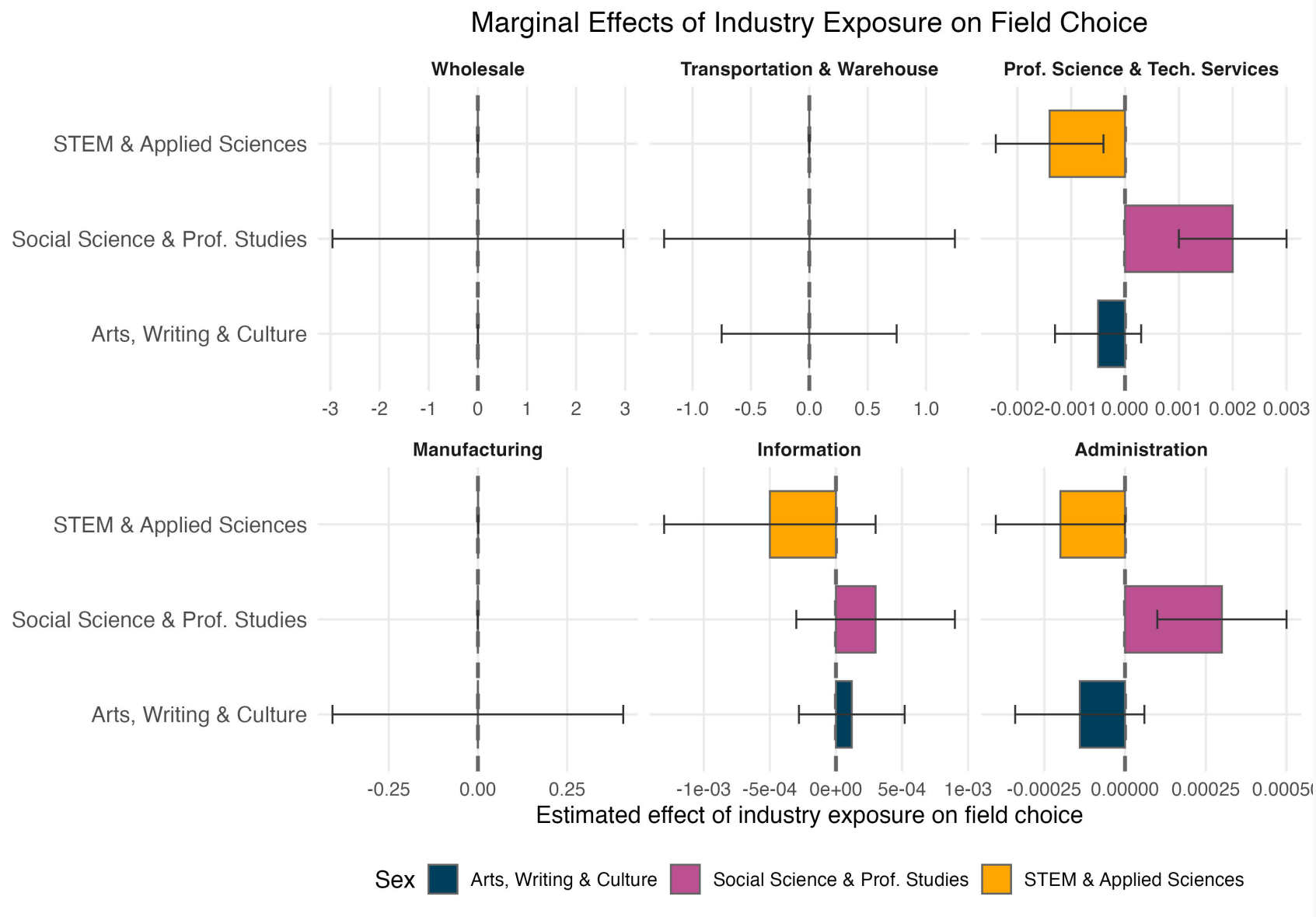


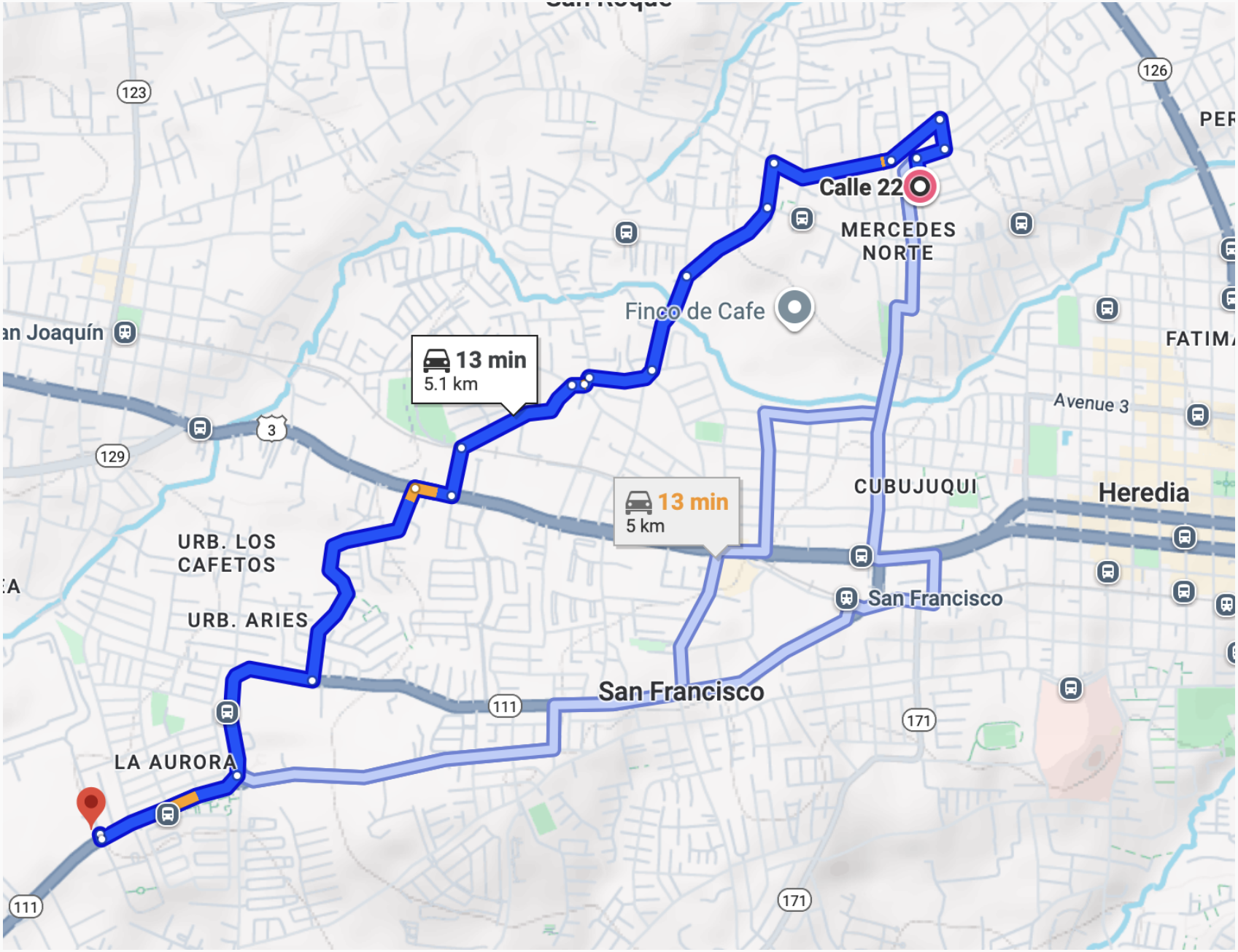
Unweighted Index Results

Return



Distance to Nearest FTZ

Return



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