Global Firms, Local Students
Multinational Presence Shapes College Major Choice

Job Market Paper

Jose Rojas-Fallas

October 23, 2025

Abstract

Multinational firms shape local economies by changing the returns of skill acquisition and through changes in labor demand. In this paper, I study a specific pathway through which they do so, by reorienting college graduates towards fields of specialization in demand by Multinational Corporations (MNCs). Using administrative data from a large public university in Costa Rica, I examine whether the local presence of MNCs affects the field of study preference of prospective university students. To capture local exposure to MNC activity, I develop a measure of multinational firm presence by industry and location, incorporating spatial proximity between firms and university applicants. I estimate a multinomial logit model where students choose among broad field of study categories, allowing for hetergeneous effects to MNC presence across industry and academic discipline pairings. Results show that MNCs impact students decisions, with effects varying by industry and field of study. These findings highlight an important and previously understudied channel through which FDI can shape human capital formation in receiving nations.

1 Introduction

Over the past several decades, foreign direct investments (FDI) have become a driving force in shaping developing economies (Koepke, 2019)[1]. In FDI-receiving countries, multinational corporations (MNCs) not only influence wages, productivity, and technological adoption[2], but also alter the composition of local labor markets (Dustmann and Glitz, 2015; Jude and Silaghi, 2016; Hale and Xu, 2016). A key, but underexplored question is how FDI may influence the skills that individuals choose to acquire through tertiary education (Blomström and Kokko, 2003; Meyer, 2004; Paul and Feliciano-Cestero, 2021). The introduction of MNCs into local economies shift employment opportunitites toward two possible ends, low-skill or high-skill jobs. Labor supply, now driven by MNC demand, shifts toward new equilibriums (Blanchard and Willmann, 2016). Employment trends have crowded-out middle-skill opportunities in industrialized economies (Goos and Manning, 2007; Goos et al., 2014) and we should expect simlar shifts to follow in developing nations as MNC offer low-skill jobs (Feenstra and Hanson, 1997; Atkin, 2016) and high skill jobs (Javorcik, 2015; Alfaro-Ureña et al., 2021; Setzler and Tintelnot, 2021).

This paper shows that MNCs influence labor markets by shaping the composition of the university-educated, future high-skill labor force. I study this in Costa Rica, which has experienced significant growth in FDI inflows since 2009. This setting is particularly well-suited because of the many incentives that the country has provided to attract FDI investments and because of the detailed administrative level education data from from a large public university. Further, Alfaro-Ureña et al. (2021) have provided evidence of an MNC wage premium of up to 9% and a higher demand for highly educated individuals than domestic private firms in Costa Rica. By linking administrative education data with spatial variation in local MNC exposure over time, I examine how multinational presence shapes field of study

[1]FDI reached $916 billion (more than 70% of global flows, in 2022. $208 billion alone entered Latin America and the Caribbean) United Nations Conference on Trade and Development (2023)

[2]See Lipsey (2004); Jung and Mercenier (2009); Dustmann and Glitz (2015) for work on different channels and absorption of FDI

choices among high-skill individuals.

Conceptually, prospective university students view a field of study as targeted skill acquisition which assists them in efforts to be employed in a given industry. For example, to obtain employment in the semiconductor manufacturing industry, they are generally aware that some form of engineering discipline would endow them with the necessary skills. Additionally, students are exposed to local labor market opportunities, which inherently vary by location. As FDI projects increase in quantity and given the greater attractiveness of MNCs relative to domestic private firms, existing foreign firms become more relvant to the student's decision-making process. MNCs may offer additional factors that make them attractive as they may allow for non-pecuniary returns, better future employment opportunitites, or possible migration opportunities. As labor supply adjust to changing labor market composition, students adjust their skill acquisition decisions accordingly. This adjustment should be considered similarly to those experienced after trade shocks (Artuç et al., 2010).

To conduct an empirical analysis, I need data on student's demand for major (before enrollment equilibrium) and MNC industry and location to identify local labor markets. For data on student demand for major, I use administrative data on university applications to a large public university from 2010 to 2019. For data on MNC firms, I use firms that operate within the MNC-exclusive Free Trade Zone regime in Costa Rica. I then estimate MNC effects on field of study choice using a Multinomial Logit model.

Using an empirical model of field of study choice where students choose a major subject to MNC presence allows me to measure both magnitude and direction of these effects. Students are differentially exposed to MNCs based off of their district of residence and year of application. MNC exposure is captured by a tenure-weighted presence index which is derived from a Gravity model approach using both the firm's and applicant's residence. I then create field of study to industry attachment probabilities so that major choices have a proportionate and labor market relevant response to each industry. This also allows for heterogenous responses

across field of study by industry.

Identification in this paper relies on spatial and temporal variation in exposure to multinational firms across districts and years. By including canton (higher regional level) and year fixed effects, the model controls for time-invariant local and national shocks, isolating plausibly exogenous change in MNC presence. The identifying assumption is that, conditional on individual characteristics and local economic controls, changes in MNC industry composition are unrelated to unobserved determinants of student's education specialization choices. The exposure measure is weighed by field-industry attachment probabilities, so varying changes in relevant industries are also identified from industry exposure across fields within the same region and year.

I find that greaer exposure to MNC industries dows have an effect on the probability that students choose a given field of study, with effects varying across field of study by industry pairings. Notably, an increase in the presence of MNCs in the Manufacturing industry, the largest MNC industry in Costa Rica, increases the likelihood of selecting a major in the STEM and Applied Science category by 0.84 percentage points. At the same time, the probability of choosing a major in the Social Science and Professional Studies category decreases by 0.28 p.p. and in the Arts by 0.55 p.p. These results are consistent across cohorts **check using yearly estimations**. There are small but economically significant difference across sex when considering the Manufacturing industry, where female applicants are morel likely to choose a major in the STEM category than men.

This paper contributes to three main strands of existing literature: (1) Interactions between trade and human capital (2) Impact of FDI on host economies and (3) determinants of major choice.

The paper is structured as follows. Section 2 describes the relevant literature and highlights contributions. Section 3 describes the institutional details and context of the project in greater detail. Section 4 presents the data. Section 5 describes the empirical approach.

Section 6 presents the empirical results and Section 7 concludes.

2 Literature Review

The relationship between international trade and human capital formation has been a strong area of research interest analyzed through endogenous growth and theory. Foundational models, such as Romer (1990) and Caballé and Santos (1993), formalize human capital investment decisiosn as drivers of economic growth. As increased FDI enteres developing nations, absorbative capacities of receiving nations may dictate efficient productivity gains (Jung, 2020). FDI has complementarities with schooling, where economic growth benefits may depend on existing levels of schooling. Wang and Wong (2011) show that these levels do not need to be necessarily high, with quality being an important determinant over quantity as was previously shown in Borensztein et al. (1998). From a macroeconomic perspective, FDI has an impact on national average years of schooling attained (Blanchard and Olney, 2017; Kheng et al., 2017; Dey and Mishra, 2018), and aggregate enrollment counts (Mughal and Vechiu, 2011). In OECD countries, tertiary education has a great influence in attracting inward FDI (Pantelopoulos, 2022). Crucially, Blanchard and Olney (2017) provide evidence that these effects are likely determined by the type of sectoral growth: skill-intensive exports increase schooling.

Looking at empirical evidence, FDI impacts receiving economies through backward linkages between multinationals and domestic firms (Smarzynska Javorcik, 2004), skill upgrading of workers (Jung and Mercenier, 2009), wage premia (Javorcik, 2015; Alfaro-Ureña et al., 2021), technology transfers (Zhuang, 2017), and labor market composition changes (Blanchard and Willmann, 2016). Importantly to the context of this paper, Alvarado et al. (2017) cautions on the efficacy of FDI in driving growth in Latin America, where high-income countries seem to be the only true beneficiaries.

FDI inflows may also contribute to broader structural transformations of local markets,

through industry composition and patterns of skill demand in the host economy. Blanchard and Willmann (2016) develop a model of skill acquisition where trade impacts education and employment attainment. They conclude that targeted educational policies would benefit middle-skilled workers when exposed to effects of increased trade. Empirically, Goos and Manning (2007) and Goos et al. (2014) highlight a polarization of jobs toward the skill-distribution extremes; low- and high-skill jobs. There is evidence of negative effects on educational attainment levels stemming from greater trade (Feenstra and Hanson, 1997; Atkin, 2016) and demand for higher-skill labor (Javorcik, 2015; Setzler and Tintelnot, 2021).

This paper also relates to literature of determinants of major choice. A large proportion of existing work has focused on the impact of expected earnings on major choice. Observational studies (Altonji, 1993; Carneiro et al., 2011; Beffy et al., 2012; Hastings et al., 2013; Kirkeboen et al., 2016) and laboratory experiments (Arcidiacono et al., 2012, 2020) suggest that expected earnings are an important determinant of university major choices.[3] Since students are directly influenced by futur expected earnings, the wage premia offered by multinational firms in local labor markets should be an influence into which fields attracts students. Availability of information is also an important factor for students' decision-making. Previous research shows that changing expectations of returns to education lead to chagnes in educational attainment efforts. In work done by Jensen (2010), eighth-grade boys in the Dominican Republic completed 0.20 to 0.35 more years of school, on average, after learning of higher returns to education.

Another important factor influencing individuals' choice of field of study is their endogenous abilities, a phenomenon often referred to as ability sorting. Arcidiacono (2004) confirms earning premia exist as a determinant of choice but are not able to fully explain sorting across majors. They state that sorting is mainly due to individual preferences for a given field. Kinsler and Pavan (2015) provide evidence that selection into majors plays a role in generating wage gaps across fields. Intuitively, preferences are subject to their surrounding

[3]See Altonji et al. (2012) for a review of both theoretical and empirical existing literature.

environment and are subject to change. In this project, individuals are subject to their local labor markets and shifting MNC compositions.

The existing literature contextualizes the choice of major through expected wages and endogenous abilities. This paper contributes to the determinants of major choice by highlighting a different channel: the influence of their surrounding labor market composition. I study how the expansion of multinational firms in developing economies shapes students' field-of-study decisions through changes in local labor market opportunities.

3 Institutional Details

There are a total of four public universities: Universidad de Costa Rica (UCR), Universidad Nacional (UNA), Instituto Tecnológico Costarricense (TEC), Universidad Estatal a Distancia (UNED), Universidad Técnica Nacional (UTN). Universities offer a wide selection of fields for students to specialize in. These range from social sciences and education to traditional STEM fields, totalling 69 unique majors. Tuition costs are generally low in Costa Rica, with a university credit costing roughly $30 in 2025.[4] Obtaining a tertiary degree (I only consider bachelor's degrees in this project) will usually take students 5 years on average. Due to data availability, I only observe applications into UNA.

Admissions Process

The admissions process to a public university in Costa Rica is done through a decentralized process, where individuals apply directly to each university seperately. In order to apply to any public institution, the applicant must take an entry exam meant to evaluate verbal and mathematical reasoning skills. When applying, each student is asked to rank their two prefered majors.[5] The institution has determined, through budgetary and internal processes,

[4]This corresponds to nearly $400 for a full credit load semester. Over 50% of students receive some form of scholarship.

[5]An example from Universidad de Costa Rica can be seen in figure A1.

how many seats it will award for each major each year but this is unknown to the student at the time of application. Universities generate an entry score for each prospective student through a weighted average of their performance on the entry exam and their performance over the last two years of their high school education.

However, the institutions make public the historic cut-off grades for being admitted into each major. Although this is does not guarantee admission simply by having a higher entry score than previous years, it does provide the student with important information as they can better guide themselves when choosing majors. Once the application deadline passes, the university rank-orders each student by major and entry score. The university then admits students into their first choice major going down in order of entry score until there are no more seats availble. This constitutes the "cut-off" grade for being admitted into the major, which is essentially the last student to have been accepted. Once this sorting finalizes, students are informed of their application status, and they are allowed to enroll into the institution.

Free Trade Zone Requirements & Incentives

The Free Trade Zone regime in Costa Rica is a set of incentives and benefits given to firms that realize new FDI projects that meet all local requirements. It is mandated by Free Trade Zone Law N7210 and all articles therewithin. Firms that are accepted into the regime establish their activities within determined industrial parks which are strictly designated for firms operating under the FTZ regime. It is possible for firms to obtain authorization from the government to establish operations outside the industrial park but these are rare cases. For simplicity, I remove all firms that are reported as operating outside of the industrial parks in the data.[6]

There is a required minimum investment amount of $150,000 in fixed assets. This investment

[6]Firms may request special permission to operate outside of the Industrial Park but this is subject to approval by the governing body.

requirement is less for firms that locate themselves outside the Greater Metropolitan Area (GAM, for its initials in Spanish), being required to a minimum investment amount of $100,000. These investments must be completed in the initial 3 years after the firm has been notified of their acceptance into the regime. Beyond the initial financial investment requirement, firms must also abide by both local and international strict environmental policies and must be able to prove they abide by them.

Firms are allowed to carry out all regular business activities, plus other specific ones outlined by the law, without limiting their overall scope. Firms that provide services can serve both firms in the FTZ and foreign clients. Manufacturing and processing firms can perform a broad range of activities on goods for export/re-export, except for activities prohibited by provisions in the law. Outsourcing of services is allowed without limitations if these services are provided to foreign firms or to firms also operating within the FTZ regime. If services are provided to firms outside the FTZs, only a maximum of 50% of total sales may come from these clients. Similarly, local sale of products by processing firms may represent up to 25% of the firm's total sales, except in the case that the firm is labeled as a "Type f processing firm", as indicated in subsection (f) of Article 17 of the FTZ Law. Subsection (f) firms may sell 100% of their output in the local market, meaning that they are not required to export in order to benefit from the FTZ regime.

4 Data

MNCs Operating Within FTZ Regime

Firms under this regime are by definition Multinational Corporations. I begin with the entire universe of firms operating within the FTZ regime as of 2023. The data contains each firm's name, location at the province-canton-district level, whether they operate inside the industrial park or not, industries they engage in, and a unique corporate identity number. A crucial part of my identification strategy is the time of entry of each firm, which is missing

in this data. To remedy this, I use each firm's unique corporate identity number to identify their earliest date of registry with the Costa Rican government using the Costa Rica National Registry.[7] From this data I select the earliest date possible and assign it to the respective firm.

These economic activity codes are equivalent to the 4-digit International Standard Industrial Classification (ISIC Rev.4). For simplicity, I use the first reported code in the data. I then concord these codes to their 2-digit categories in order to properly concord it with the industry × field-of-study mapping I detail below. This produces 31 unique 2-digit ISIC Rev. 4 categories, with the largest proportion of firms being in Manufcaturing (29.5%). The full list can be found in table A3 of the Appendix.

Education

Data on university applications from the Universidad Nacional (UNA) are sourced directly from the university. Each observation is an anonimized individual application containing the year they applied, their province-canton-district of residence, age, sex, type of high school they attended, entry score grade, their first and second choices for major and the respective International Standard Classification of Education (ISCED) category as determined by UNESCO. For UNA, there are 77 unique majors which are categorized into 10 Broad Categories. Table A1 in the Appendix shows these with examples of majors within each category. The data from UNA goes from 2010 to 2019 and contains 230,162 applications.

To make the possible choice set for each student more tractable, I aggregate the possible majors using the ISCED broad categories into three fields-of-study. These are Arts, Writing and Tourism, STEM and Applied Sciences, and Social Sciences and Professional Studies. These are the possible choices each individual will face when applying.

In Section 5, I detail how I map industries to the fields-of-study in my analysis. They are

[7] Access to the registry can be completed online at http://www.registronacional.go.cr

probability attachment weights which capture how likely a given field-of-study is to have employment in a given industry. To do so, I use the American Community Survey (ACS) for each year of the sample period.[8] The ACS surveys individuals on their education attainment and which industry they are employed in, if any, amongst many other questions. One question asks respondents which field they have a degree in, which using the same ISCED categorization structure as in the education data above, I sort into the three aggregated fields-of-study.

5 Methodology

Model

In order to estimate how MNC presence impacts field-of-study choice, I model individuals utility as:

$$U_{idmt} = \beta_{mj}(p_{mjt} \times \Gamma_{djt}) + \gamma_i X_i' + \alpha_c + \alpha_t + \varepsilon_{idmt}, \tag{1}$$

where individual i from district d chooses the field-of-study m in year t that maximizes their utility. β_{mj} captures the effect of MNC presence on field-of-study choice. The MNC-industry presence index (Γ_{djt}) is interacted with field-of-study and industry attachment probabilities (p_{mjt}) in order to create industry $\times$ field-of-study direct influences. In this way, fields with a higher likelihood of being employed in a given industry receive a higher influence, and vice-versa. Each individual also has demographic characteristics X_i', like their age, sex, entry score, and local unemployment rate. They are also subject canton and year fixed effects that absorb unobserved factors that will influence all individuals in the same canton or year. While they shift the overall level of utility, they do not affect choice probabilities directly in the multinomial logit regressoin because choice depends on differences on utility across alternatives. Individuals are also subject to an indiosyncratic shock ε_{idmt}. The possible

[8] I am unaware of similar data existing for Costa Rica.

field-of-study choices are those noted in table A2.

The individual choice is estimated using a Multinomial Logit (MNL) model where individuals choose the field-of-study which gives them the highest utility:

$$P(Y_i = m) = \frac{\overbrace{exp(\beta_{mj}(p_{mjt} \times \Gamma_{djt}) + \gamma_i X_i' + \alpha_c + \alpha_t + \varepsilon_{idmt})}^{\text{Utility of chosen field-of-study}}}{\underbrace{\sum_{m'} exp(\beta_{m'j}(p_{m'jt} \times \Gamma_{djt}) + \gamma_i X_i' + \alpha_c + \alpha_t + \varepsilon_{idm't}))}_{\text{Utilities across all possible field-of-study choices}}} \tag{2}$$

This gives the probabilities of choosing field-of-study m as determined by the utility function above. The coefficients of interest are β_{mj}, which capture the effects of MNEs through their industry to choose a field-of-study m. Specifically, Γ_{djt} is an index of the presence of an economic activity j in year t weighted by the distance between firms and individual i weighted by the attachment probabilities of field-of-study m to industry j. By allowing β_{mj} to vary across field-of-study m and economic activity j, the model tests whether industries affect education choices differently. These coefficients quantify the extent to which students' field-of-study choices respond to influences of MNCs in the local labor market.

Average Marginal Effects

To better interpret the effects of MNCs on prospective students' field-of-study choices, I compute the average marginal effects (AMEs) from the above model. While the multinomial logit model coefficients β_{mj} describe how industry-specific presence Γ_{djt} affects the latent utility of choosing a specific field-of-study m, they are not directly interpretable in terms of choice probabilities due to the non-linear form of the logit model.

AMEs allow for a direct interpretation by transforming the estimated logit utilities into changes in predicted probabilities. Specifically, the marginal effect of an industry presence variable Γ_{djt} on the probability that individual i chooses field-of-study m is given by:

$$\frac{\partial P_{im}}{\partial \Gamma_{djt}} = P_{im}\left(\beta_{mj} - \sum_{m'} P_{im'}\beta_{m'j}\right), \tag{3}$$

where P_{im} is the predicted probability of individual i chooses field-of-study m, and the summation term reflects the average effect of Γ_{djt} across all possible field-of-study choices. This captures the reallocation of probability mass across competing alternatives from a change in local MNC-industry conditions.

I compute the average marginal effects, which essentially computes this for each individual and averages over the sample:

$$\text{AME}_{mj} = \frac{1}{N}\sum_{i=1}^{N} \frac{\partial P_{im}}{\partial \Gamma_{djt}}. \tag{4}$$

These AMEs represent the expected change in the probability of choosing field-of-study m with a one-unit increase the presence index of industry j, holding all else equal. Because these are direct predictions on changes in probability, there is no reference category and all probabilities should sum to zero. The coefficients shown in table 1 are in percentage points.

MNC Presence Index

In order to create an index that captures how individuals experience the presence of MNCs, I use the following gravity model structure:

$$\Gamma_{djt} = \sum_{d'} \sum_{f \in F_{jd't}} \frac{\tau_{f \in F_{jd't}}}{exp\left(\mu^{\vec{dd'}}\right)}, \tag{5}$$

where the numerator $\tau_{f \in F_{jd't}}$ is the tenure of firm f in industry j in district d' operating in year t. A firm's tenure is used to capture the "size" of the presence an individual may capture from any firm, where an older firm is thought to factor increasingly in an individual's decision-making as they have been aware of their presence for more years. Each year applicants are

exposed to a different stock of firms, and thus different industry compositions, as new firms are likely to enter in a given year. The denominator $exp(\mu^{\vec{dd'}})$ serves as the distance weight, where it measures the distance (in kilometers) from district d (residence of applicant) to district d' (residence of firm). Distance is exponentiated to account for circumstances where the applicant and firms share the same district and distance is measured as zero.[9] This index is non-negative, and summary statistics are reported in **INDEX MEASURES HERE**.

Given how the MNC presence index is constructed, an increase of one unit in the index can potentially come fromtwo possibilities: (1) Individuals relocate closer to the firms or (2) New firms enter the economy. Because the data are repeated cross-sections, there is no possibility of migration. Without migration as a mechanism of change leaves new firms entering as the only possibility of an increase. Given that the index is also weighed by spatial distance, one new firm does not necessarily equal one unit increase in the index.

Education to Industry Mapping

A crucial detail for this project is the ability to map individual industry effects to possible fields-of-study. Given that any given degree could theoretically lead to employment across multiple industries, it is necessary to address how I can differentiate across education $\times$ industry pairings. Because each employed individual is asked assigned an industry of employment, I am able to create a probabilistic attachment weight from each field-of-study to observed industries. Reported industries are given using the North American Industry Classification System (NAICS) and the amount of detail varies by individual. To remedy this, I concord them to their 2-digit categories. Firms ISIC Rev.4 industry codes are then concorded with their 2-digit NAICS counterparts, creating a harmonized dataset.

These attachment weights allow me to assign probabilistic importance of each field-of-study to each existing industry. This reflects the fact that, although any given industry, for ex-

[9] $exp(0) = 1$, which then gives full weight to immediately located firm-industries

ample, may hire an individual with a degree in chemical engineering they may also find employment with a financial firm although that is less likely. It creates differential effects across the education by industry pairings choice set. The mapping can be found on the **Appendix**.

6 Estimation Results

Results show the Average Marginal Effects (AMEs) of MNC presence, measured at the district level for all 6 2-digit NAICS industries in the sample period, on the probability of choosing one of the three field-of-study possible choices: *Arts, Writing and Tourism, STEM & Applied Sciences,* and *Social Sciences & Professional Studies*. Each column reflects how an increased presence of that given industry shifts the likelihood of applicants choosing a field-of-study, conditional on individual characteristics (age, sex, entry score) and the unemployment rate they observe in their local labor market. There are also fixed effects for canton and year that control for unobserved characteristics at a wider geographical region, and the year that students apply into university.

Table 1: MNC Industry Presence Effects on Field of Study Choice

	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	✓	✓	✓
Canton FE	✓	✓	✓
Year FE	✓	✓	✓
Applications	20,985	92,273	116,904
Pseudo-R2	0.0436	0.0436	0.0436

Statistical significance is displayed as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$
Field of Study Fields grouped up as shown in table A2.
Standard errors are clustered at the District level
By defition of AMEs, each row (industry) coefficients should sum to zero

Results in table 1 show that the presence of Multinational firms in their respective industries shifts educational investments in intuitive directions.

Manufacturing is a significant industry in Costa Rica as it relates to FDI inflows. Over the sample period (2009 to 2019), it represents the majority share of all FDI inflows (36.8%), and ranges from 0.67% to 3.05% of GDP. Being the largest industry (as measured in inflow dollars), observed effects of this industry are of economic interest.

An increase in the presence of manufacturing MNCs leads to a significant rise in the probability of choosing a major in STEM and Applied Sciences, which are accompanied by declines in the Arts and Social Science programs. To be more precise, an increase of one unit in the manufacturing MNC presence index increases the probability of choosing a discipline in STEM & Applied Sciences by 0.84 percentage points. This is accompanied by a decrease in the probability of choosing a discipline in the Arts and in Social Sciences by 0.56 and 0.29 percentage points, respectively. This pattern may indicate that the presence of production and technology intensive firms raises the perceived returns from more technical human capital fields, steering students toward science and engineering disciplines.

The Transportation & Warehouse industry produces similar results. An increase in the presence of MNCs in this indutry leads to a greater probability of choosing a discipline in STEM while reducing the probability of choosing a discipline in Social Sciences. This industry likely expands local demand for quantitative and logistical skills, creating a stronger incentives to choosing technical education found in STEM and Applied Sciences disciplines.

By contrast, an increase in the presence of MNCs in the Administration industry is associated with a shift away from STEM and Applied Science (a probability decrease of 1.06 percentage points) toward Social Sciences and Professional Studies (a probability increase of 0.74 percentage points). This suggests that firms more likely to engage in managerial or organizational services encourage human capital investment in business-related or professional skills over technical ones. In a similar way, the Wholesale industry shows a similar

pattern. Social Sciences and Professional Studies and Arts see a probability increase of 3.96 percentage points and 3.8 percentage points, respectively. This industry is also associated with a sharp decrease in disciplines in STEM and Applied Sciences. This is consistent with these industries rewarding interpersonal and communication-based skills.

Overall, the estimation results show that multinational corporations industry presence through regional proximity impacts educational choices at the intensive margin and in predictable ways. Exposure to technologically intensive or primarily production based MNCs pushes students toward the STEM and Applied Science field-of-study. At the same time, increased exposure to administrative, wholesale, or information-focused MNCs shifts students toward social and communication oriented disciplines. These results provide evidence that MNC participation in local-labor markets influences human capital formation at a field-of-study level.

Robustness Tests

No Attachment Probabilities

To evaluate the role of the attachment probability weights in shaping the estimated effects, I re-estimate the model without applying them to the industry index. This removes the direct link between industry and field-of-study pairings. Results are shown in table 2. The resulting coefficients remain broadly consistent with the baseline estimates, suggesting that the main findings are not driven by the weighting scheme. There are changes in the statistical significance across industry and field-of-study pairings, with many coefficient estimates no longer being significant. More noticeable, there are significant reductions in the magnitude of the coefficients. The smaller underweighted coefficient likely reflects the loss of the direct link between individual field-of-study attachment probabilities and the respective industry. Without the weights, the model assigns equal exposure between industry and field-of-study, diluting the observed connections between specific industries and disciplines.

Table 2: Unweighted MNC Industry Presence Effects on Field of Study Choice

	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	✓	✓	✓
District FE	✓	✓	✓
Year FE	✓	✓	✓
Applications	20,985	92,273	116,904
Pseudo-R2	0.0347	0.0347	0.0347

Statistical significance is displayed as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$
Field of Study Fields grouped up as shown in table A2.
Standard errors are clustered at the District level
By defition of AMEs, each row (industry) coefficients should sum to zero

7 Conclusion

Human capital attainment is an important aspect of economic growth and FDI has become a popular choice for developing economies as a growth strategy. As a consequence, greater FDI inflows into developing nations has an influence on the local labor market composition, and through human capital investment adaptation, on educational attainment. The intensive margin of educational attainment, as observed through field-of-study choices, is an important consequence of increased FDI inflows. Educational attainment decisions are influenced by many factors, such as expected wages or endogenous ability sorting. Local labor market composition may also directly influence educational attainment decisions. Specifically, local market composition as influenced by higher MNC participation directly affects field-of-study decisions.

In this analysis, I directly measure how the presence of MNCs influence the field-of-study chosen by university applicants. Using data of applicants from a large Costa Rican public university and MNCs operating under the Free Trade Zone regime in the country, I estimate a Multinomial Logit model in where individuals choose among possible field-of-study in their application process. Results show that industries have differing effects across industry and field-of-study pairings. When looking at the 6 largest MNC industries in the country, results suggest that industries intuitively impact educational decision

Overall, these results suggest that higher levels of FDI does influence human capital specialization decisions. Given the heterogeneity in both magnitude and sign of response to increasing MNC presence by industry and field-of-study pairing, it is suggestive of individuals adapting differently to different levels of exposure. Because there is large heterogeneity in the industry/field-of-study effects, its suggestive of how some fields may be better insulated from MNC presence. It also may be that industry concentration may be of particular interest as compositions are likely to vary across economies due to historic and comparative advantages. The results underscore the need for education and industrial policy coordination

to ensure that specialization patterns evolve in step with economic transformation.

References

Alfaro-Ureña, A., Isabela, M., and Vasquez, J. (2021). The Effects of Multinationals on Workers: Evidence from Costa Rican microdata. *Working Paper*, No. 285.

Altonji, J. G. (1993). The Demand for and Return to Education When Education Outcomes are Uncertain. *Journal of Labor Economics*, 11(1).

Altonji, J. G., Blom, E., and Meghir, C. (2012). Heterogeneity in Human Capital Investments: High School Curriculum, College Major, and Careers. *Annual Review of Economics*, 4:185–223.

Alvarado, R., Iñiguez, M., and Ponce, P. (2017). Foreign direct investment and economic growth in Latin America. *Economic Analysis and Policy*, 56:176–187.

Arcidiacono, P. (2004). Ability sorting and the returns to college major. *Journal of Econometrics*, 121(1-2):343–375.

Arcidiacono, P., Hotz, V. J., and Kang, S. (2012). Modeling college major choices using elicited measures of expectations and counterfactuals. *Journal of Econometrics*, 166(1):3–16.

Arcidiacono, P., Hotz, V. J., Maurel, A., and Romano, T. (2020). Ex Ante Returns and Occupational Choice. *Journal of Political Economy*, 128(12):4475–4522.

Artuç, E., Chaudhuri, S., and McLaren, J. (2010). Trade Shocks and Labor Adjustment: A Structural Empirical Approach. *American Economic Review*, 100(3):1008–1045.

Atkin, D. (2016). Endogenous Skill Acquisition and Export Manufacturing in Mexico. *American Economic Review*, 106(8):2046–2085.

Beffy, M., Denis, F., and Maurel, A. (2012). Choosing the Field of Study in Postsecondary Education: Do Expected Earnings Matter? *The Review of Economic and Statistics*, 94(1):334–347.

Blanchard, E. and Willmann, G. (2016). Trade, education, and the shrinking middle class. *Journal of International Economics*, 99:263–278.

Blanchard, E. J. and Olney, W. W. (2017). Globalization and human capital investment: Export composition drives educational attainment. *Journal of International Economics*, 106:165–183.

Blomström, M. and Kokko, A. (2003). Human Capital and Inward FDI. *CEPR*.

Borensztein, E., De Gregorio, J., and Lee, J.-W. (1998). How does foreign direct investment affect economic growth? *Journal of international Economics*, 45(1):115–135.

Caballé, J. and Santos, M. S. (1993). On endogenous growth with physical and human capital. *Journal of Political Economy*, 101(6):1042–1067.

Carneiro, P., Heckman, J. J., and Vytlacil, E. J. (2011). Estimating Marginal Returns to Education. *American Economic Review*, 101(6):2754–2781.

Dey, D. and Mishra, A. S. (2018). A Study on FDI in Education Sector and Its Impact on Gross Enrolment Ratio in Higher Education in India: An Econometric Approach. *International Journal of Management Studies*, V(3(6)):44.

Dustmann, C. and Glitz, A. (2015). How Do Industries and Firms Respond to Changes in Local Labor Supply? *Journal of Labor Economics*, 33(3):711–750.

Feenstra, R. and Hanson, G. (1997). Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladors. *Journal of International Economics*, 42:371–393.

Goos, M. and Manning, A. (2007). Lousy and Lovely Jobs: The Rising Polarization of Work in Britain. *Review of Economics and Statistics*, 89(1):118–133.

Goos, M., Manning, A., and Salomons, A. (2014). Explaining Job Polarization: Routine-Biased Technological Change and Offshoring. *American Economic Review*, 104(8):2509–2526.

Hale, G. and Xu, M. (2016). Fdi effects on the labor market of host countries. *Federal Reserve Bank of San Francisco, Working Paper Series*, pages 1–26.

Hastings, J., Neilson, C., and Zimmerman, S. (2013). Are Some Degrees Worth More than Others? Evidence from college admission cutoffs in Chile. Technical Report w19241, National Bureau of Economic Research, Cambridge, MA.

Javorcik, B. S. (2015). Does fdi bring good jobs to host countries? *The World Bank Research Observer*, 30(1):74–94.

Jensen, R. (2010). The (Perceived) Returns to Education and the Demand for Schooling. *The Quarterly Journal of Economics*, 125(2):515–548.

Jude, C. and Silaghi, M. I. P. (2016). Employment effects of foreign direct investment: New evidence from central and eastern european countries. *International Economics*, 145:32–49.

Jung, J. (2020). Institutional quality, fdi, and productivity: A theoretical analysis. *Sustainability*, 12(17):7057.

Jung, J. and Mercenier, J. (2009). A simple model of offshore outsourcing, technology upgrading and welfare.

Kheng, V., Sun, S., and Anwar, S. (2017). Foreign direct investment and human capital in developing countries: a panel data approach. *Economic Change and Restructuring*, 50(4):341–365.

Kinsler, J. and Pavan, R. (2015). The Specificity of General Human Capital: Evidence from College Major Choice. *Journal of Labor Economics*, 33(4):933–972.

Kirkeboen, L. J., Leuven, E., and Mogstad, M. (2016). Field of Study, Earnings, and Self-Selection*. *The Quarterly Journal of Economics*, 131(3):1057–1111.

Koepke, R. (2019). What drives capital flows to emerging markets? a survey of the empirical literature. *Journal of economic surveys*, 33(2):516–540.

Lipsey, R. E. (2004). Home-and host-country effects of foreign direct investment. In *Challenges to globalization: Analyzing the economics*, pages 333–382. University of Chicago Press.

Meyer, K. E. (2004). Perspectives on multinational enterprises in emerging economies. *Journal of International Business Studies*, 35(4):259–276.

Mughal, M. and Vechiu, N. (2011). The role of Foreign Direct Investment in higher education in the developing countries (Does FDI promote education?). *CATT Working Paper No. 10*.

Pantelopoulos, G. (2022). Higher education, gender, and foreign direct investment: Evidence from OECD countries. *Industry and Higher Education*, 36(1):86–93.

Paul, J. and Feliciano-Cestero, M. M. (2021). Five decades of research on foreign direct investment by MNEs: An overview and research agenda. *Journal of Business Research*, 124:800–812.

Romer, P. M. (1990). Endogenous Technological Change. *JPE*, 98(5):71–102.

Setzler, B. and Tintelnot, F. (2021). The Effects of Foreign Multinationals on Workers and Firms in the United States. *The Quarterly Journal of Economics*, 136(3):1943–1991.

Smarzynska Javorcik, B. (2004). Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages. *The American Economic Review*, 94(3):605–627.

United Nations Conference on Trade and Development (2023). *World Investment Report 2023: Investing in Sustainable Energy for All*. United Nations, Geneva.

Wang, M. and Wong, M. C. S. (2011). FDI, Education, and Economic Growth: Quality Matters. *Atlantic Economic Journal*, 39(2):103–115.

Zhuang, H. (2017). The effect of foreign direct investment on human capital development in East Asia. *Journal of the Asia Pacific Economy*, 22(2):195–211.

A Appendix

Table A1: Classification of Broad Fields Using ISCED-2013 with Examples

Education: Pedagogy, Specific Topics in Primary and Secondary Teaching[a]
Arts & Humanities: Music, Literature, History, Dance, Languages
Social Sciences: International Relations, Economics, Psychology, Sociology
Business Administration: Business Administration, International Commerce
Natural Sciences, Math & Statistics: Industrial Chemistry, Biology, Geography
Information Technologies: Information Systems
Engineering: Topography, Forestry Sciences, Industrial Bioprocesses
Agriculture & Veterinary: Agronomy, Veterinary Medicine, Aquaculture
Health: Social Work, Medicine, Counseling
Services: Tourist Recreation, Sustainable Tourism Business Management

[a] Topics include Social Studies, Mathematics, English, etc.

Table A2: Aggregation of ISCED Broad Categories

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]

[a] Tourism is not the official category, but rather "Services". It is renamed due to the only majors in this category are some related to tourism activities.

Table A3: Firm Quantity & ISIC4 (2 Digit) Codes

2-Digit Code	ISIC4 Description	Count
	Manufacturing (103 firms)	
10	Manufacture of food products	20
11	Manufacture of beverages	2
13	Manufacture of textiles	2
16	Manufacture of wood and of products of wood and cork, except furniture	2
18	Printing and reproduction of recorded media	1
20	Manufacture of chemicals and chemical products	10
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	2
22	Manufacture of rubber and plastics products	8
23	Manufacture of other non-metallic mineral products	2
24	Manufacture of basic metals	2
25	Manufacture of fabricated metal products, except machinery and equipment	7
26	Manufacture of computer, electronic and optical products	5
27	Manufacture of electrical equipment	2
32	Other manufacturing	33
33	Repair and installation of machinery and equipment	5
	Electricity, Gas, Steam and Air Conditioning (14 firms)	
38	Waste collection, treatment and disposal activities; materials recovery	14
	Wholesale and Retail Trade (13 firms)	
46	Wholesale trade, except of motor vehicles and motorcycles	13
	Transportation and Storage (15 firms)	
52	Warehousing and support activities for transportation	14
56	Food and beverage service activities	1
	Information and Communication (78 firms)	
61	Telecommunications	1
62	Computer programming, consultancy and related activities	64
63	Information service activities	13
	Real Estate Activities (47 firms)	
68	Real estate activities	1
70	Activities of head offices; management consultancy activities	7
71	Architectural and engineering activities; technical testing and analysis	24
72	Scientific research and development	5
73	Advertising and market research	4
74	Other professional, scientific and technical activities	6
	Administrative and Support Service Activities (77 firms)	
78	Employment activities	1
82	Office administrative, office support and other business support activities	76
	Education (1 firm)	
85	Education	1

Table A4: Demographic Summary Statistics

Demographic Information			
	Mean	Std. Dev.	
Age	19.49	(2.65)	
Application Score	568.74	(110.87)	
Female	0.57		
STEM[a]	0.36		
GAM[b]	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	

[a] First choice was a STEM major.
[b] Applicant lives within the Greater Metropolitan Area.

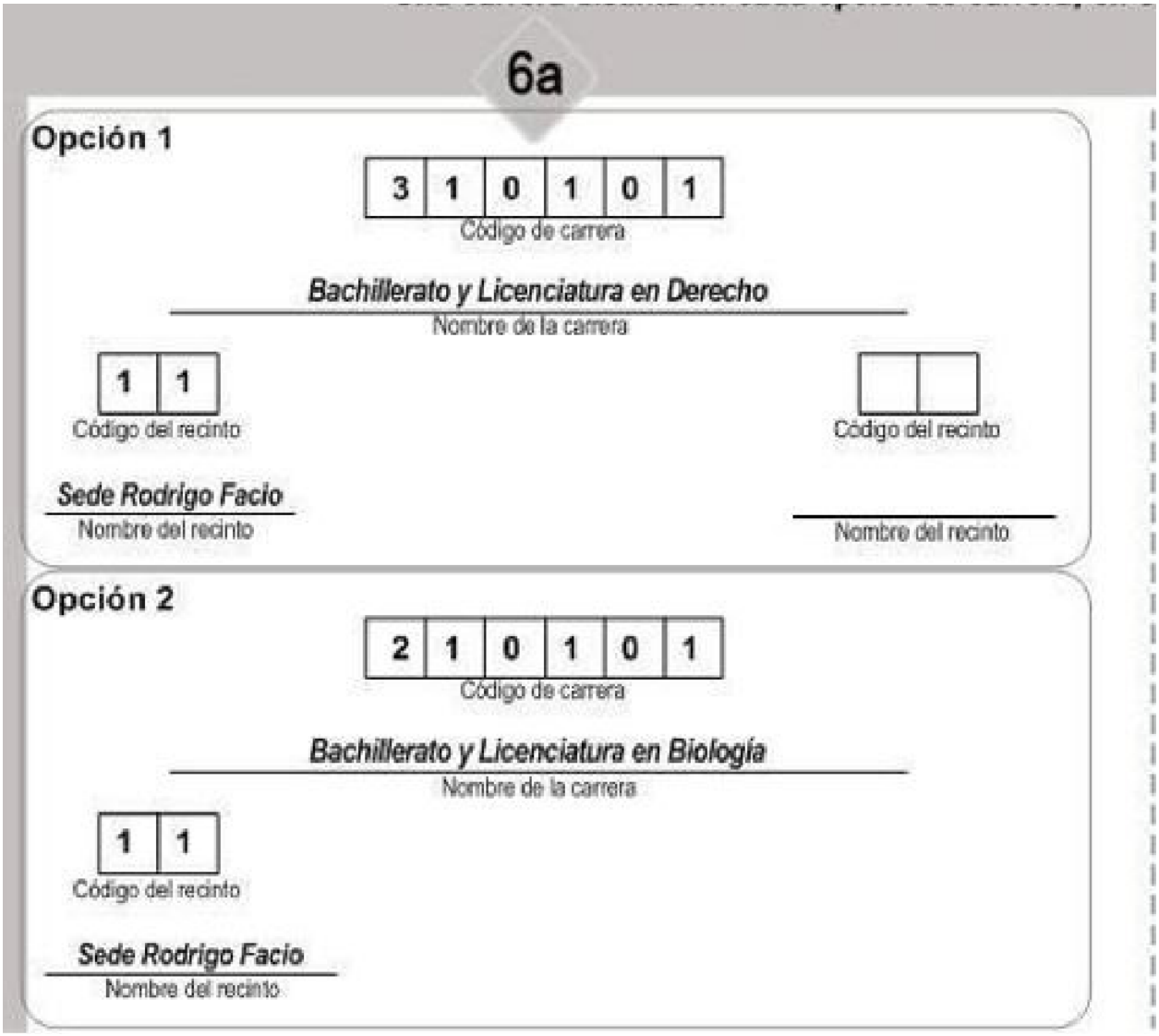


Figure A1: Example of Rank Order of Majors Application

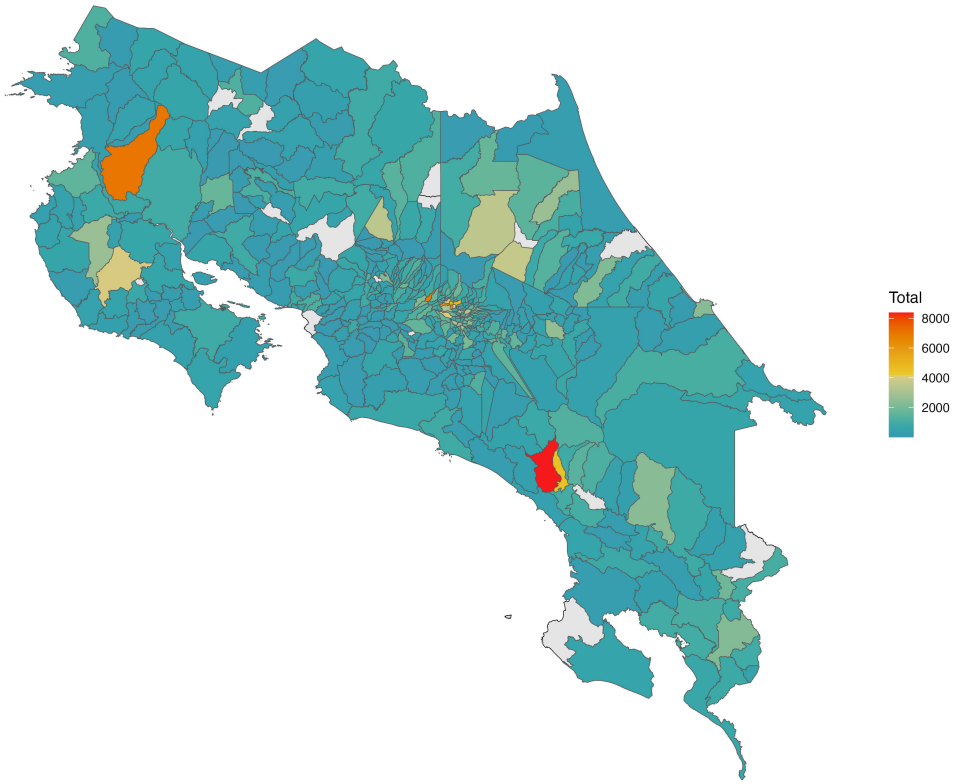


Figure A2: Applications Heatmap (All Years)

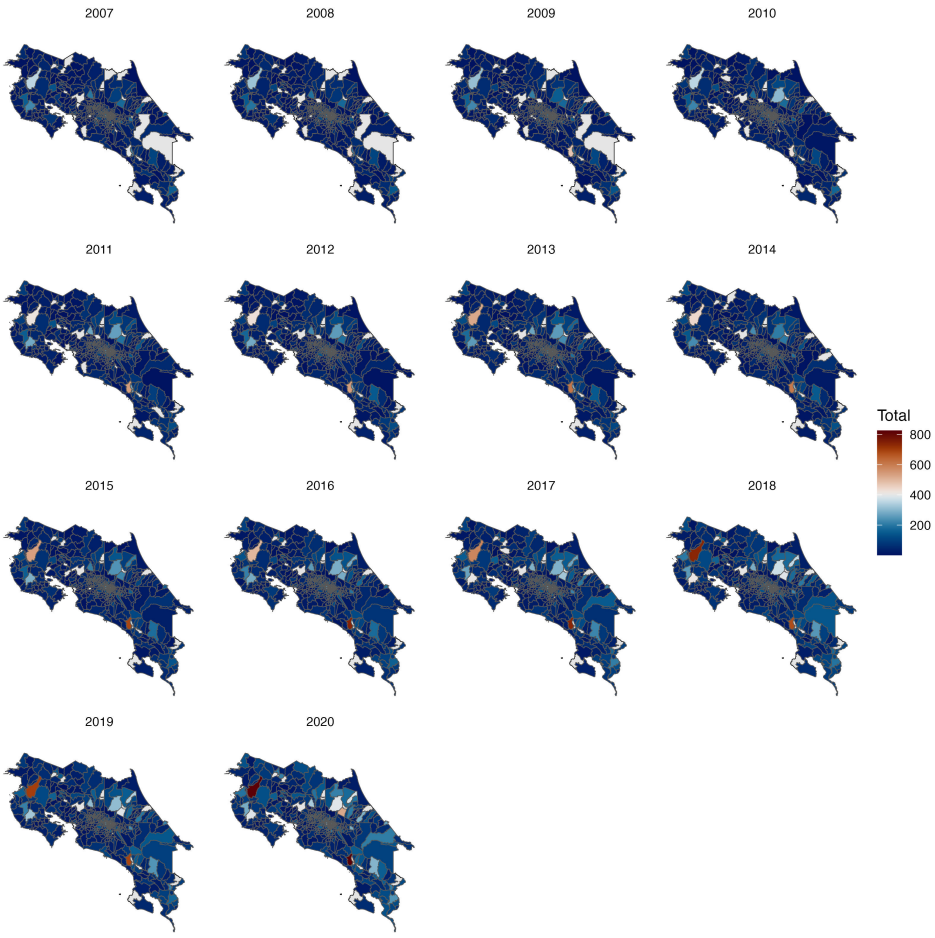


Figure A3: Applications Heatmap (By Year)

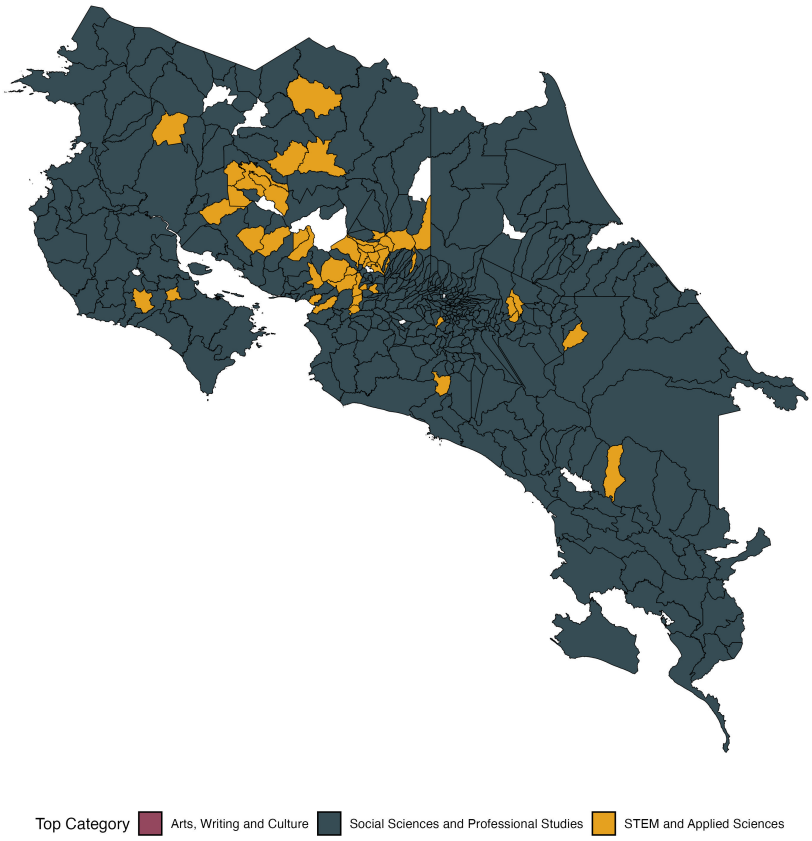


Figure A4: Field-of-Study Majority Applications by District (All Years)

Figure A5: Field-of-Study Majority Applications by District (By Year)

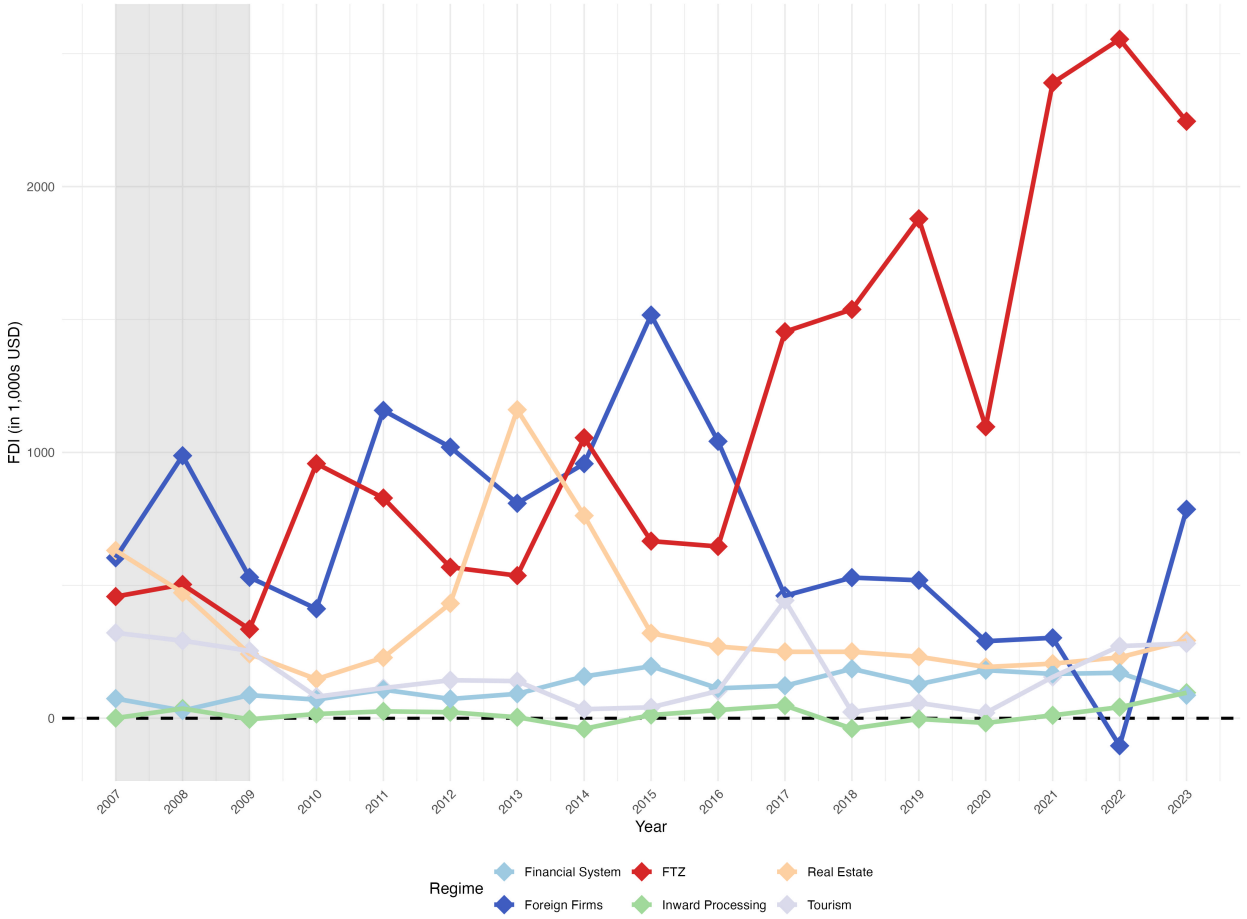


Figure A6: FDI Flows by Regime into Costa Rica

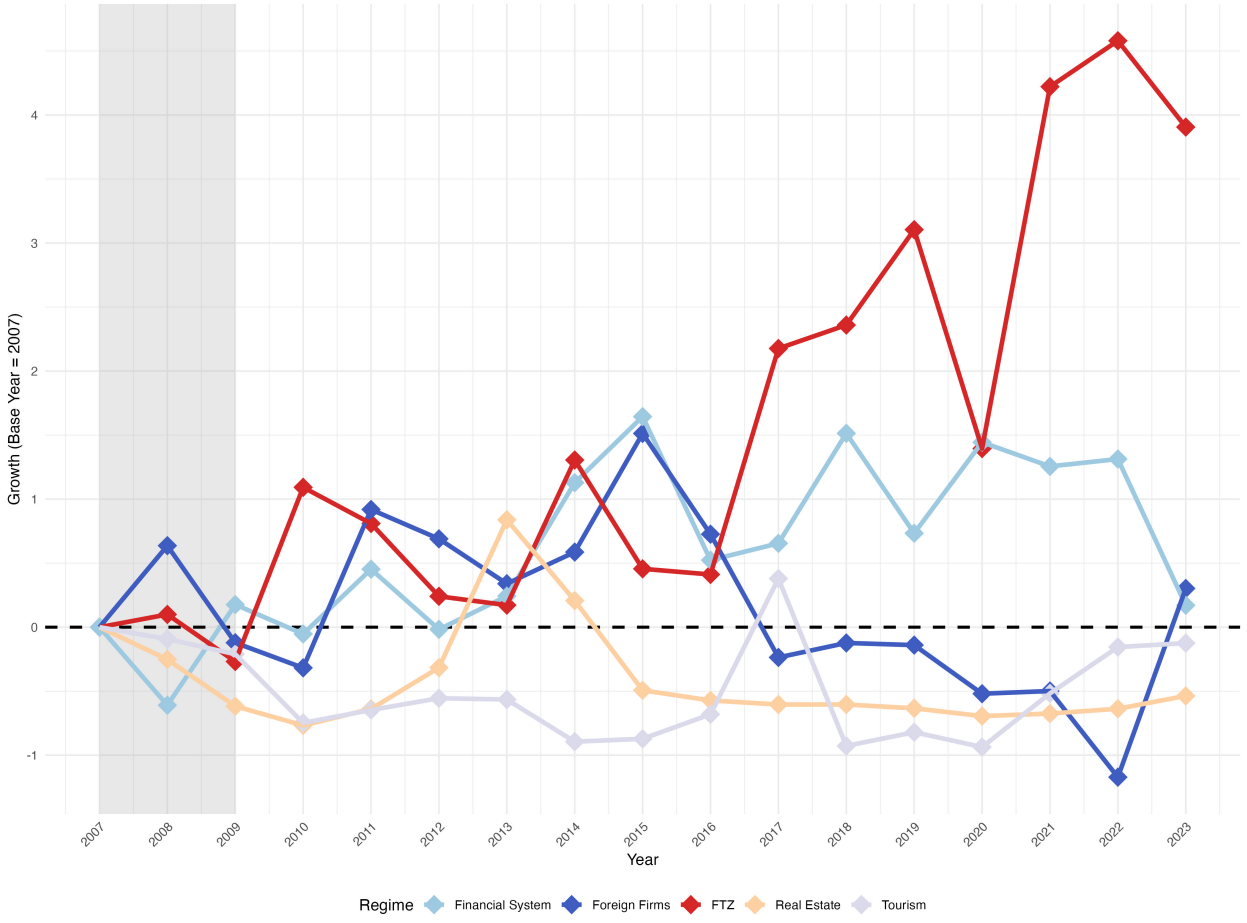


Figure A7: FDI Growth (Base Year = 2007)

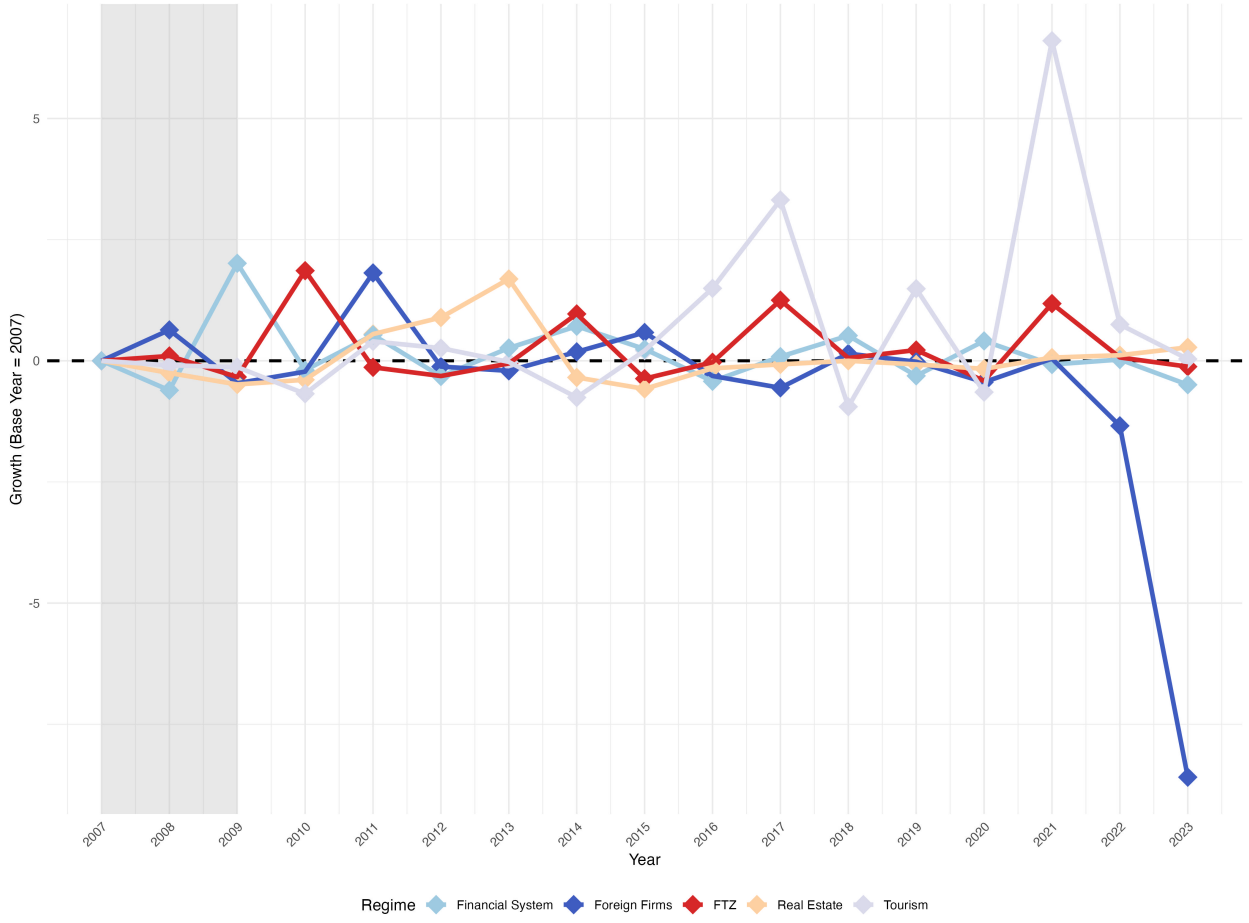


Figure A8: FDI Growth (By Year)

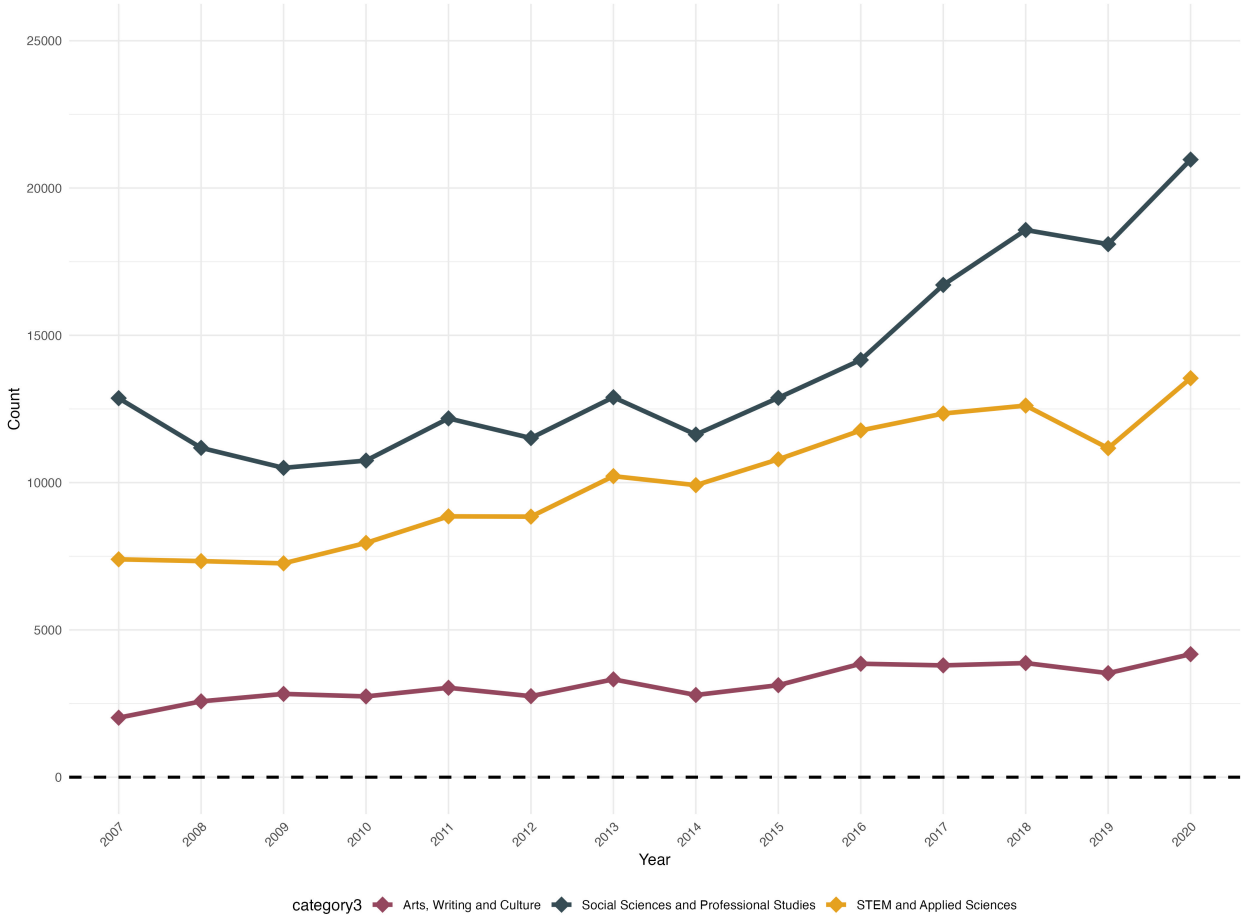


Figure A9: Applications by Field-of-Study by Year

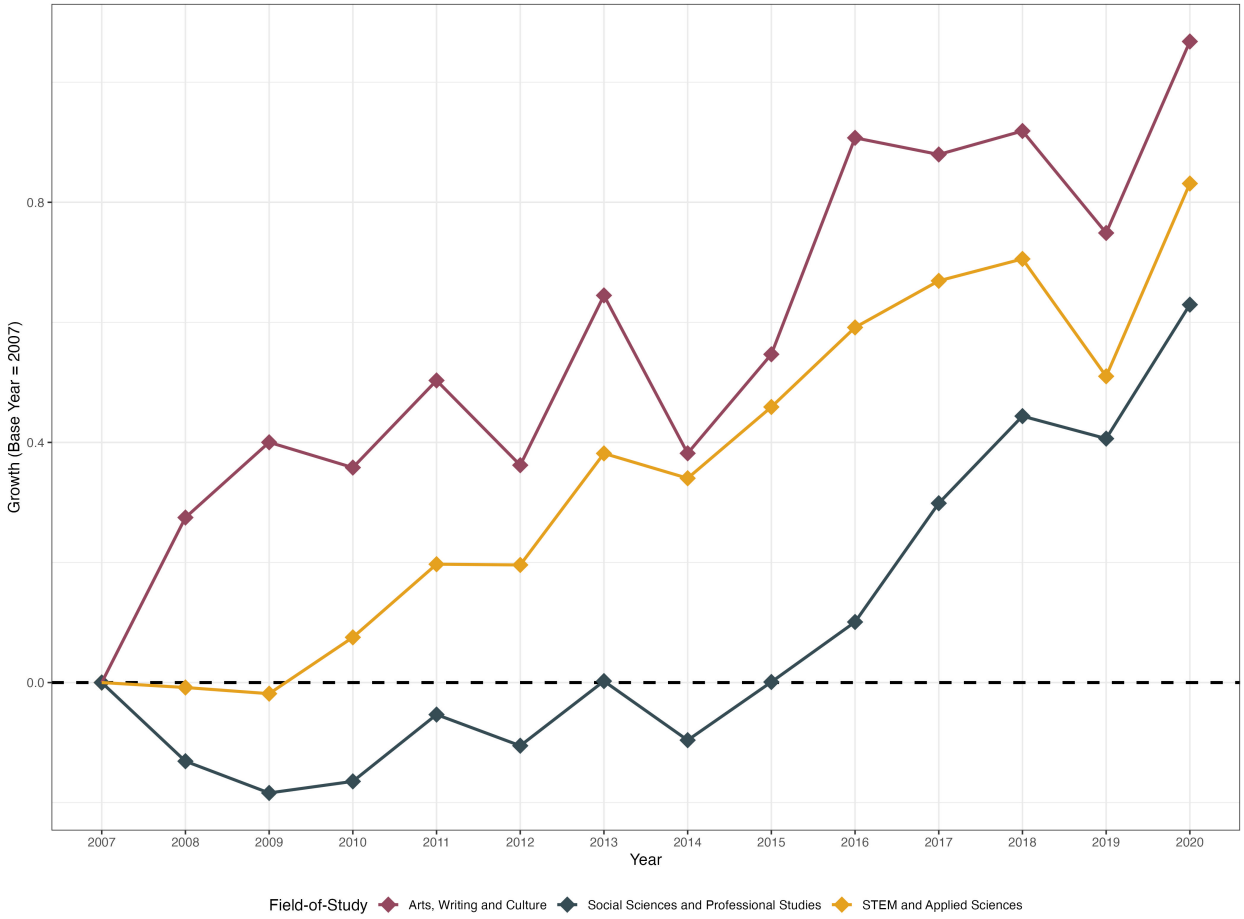


Figure A10: Growth in Applications by Field-of-Study (Base Year = 2007)

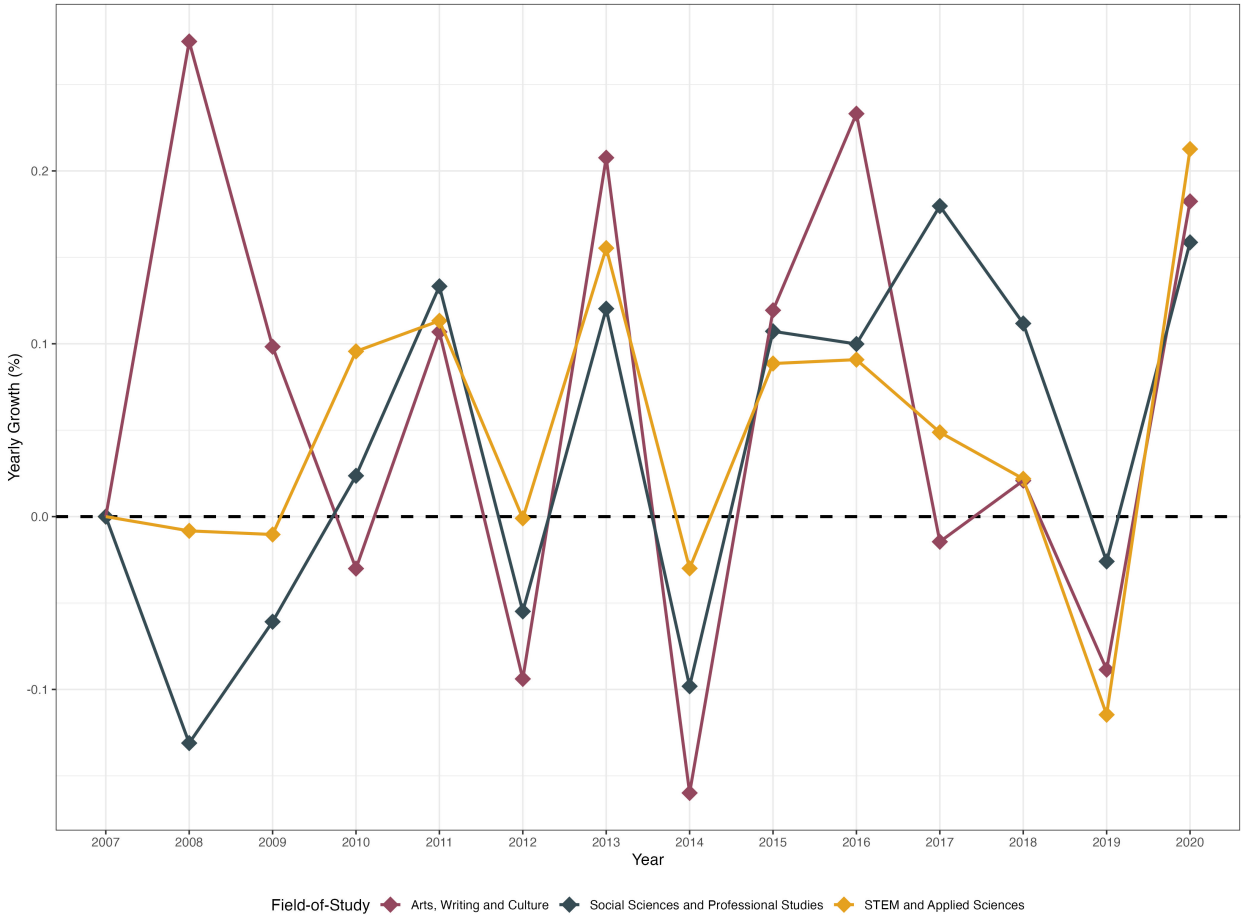


Figure A11: Growth in Applications by Field-of-Study by Year

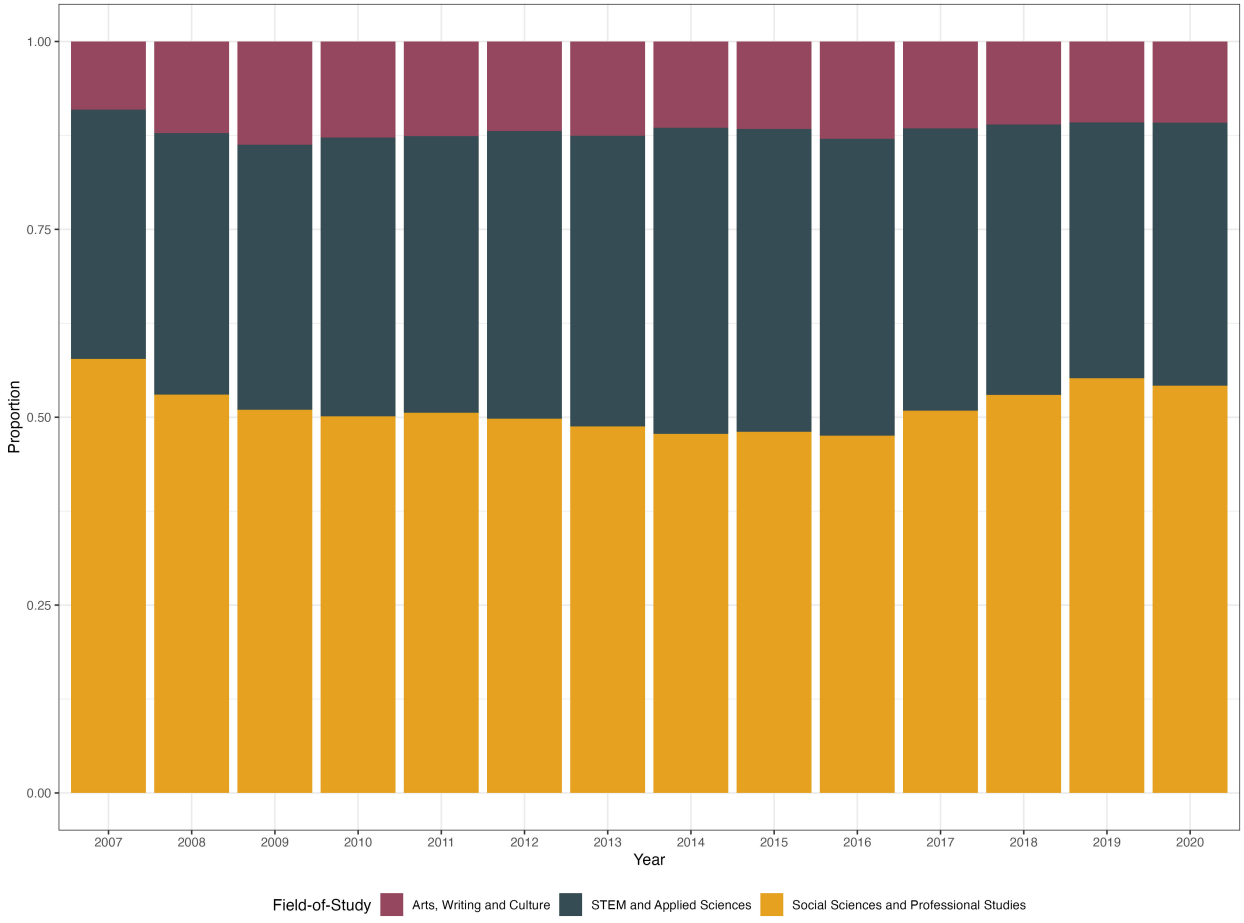
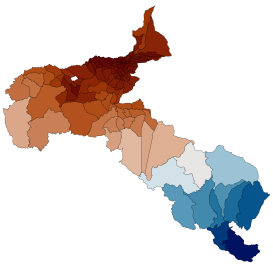
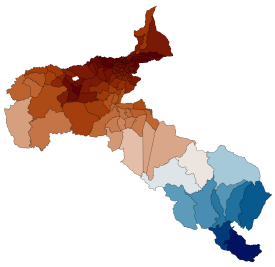


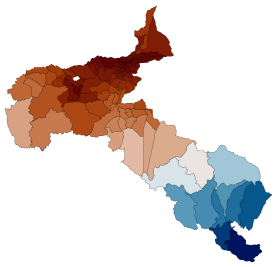
Figure A12: Field-of-Study Categories Proportions



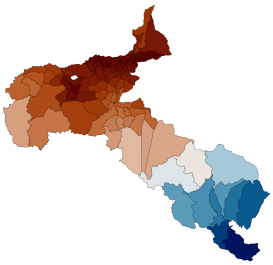
(a) Admin. Services



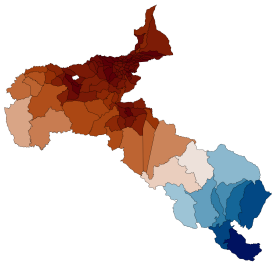
(b) Comp. Programming



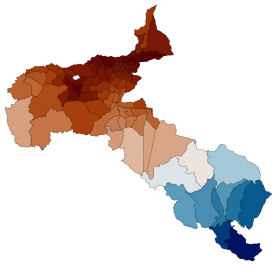
(c) Call Centers



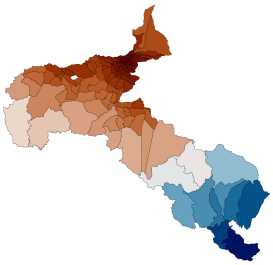
(d) Comp. Consultancy & Mgmt.



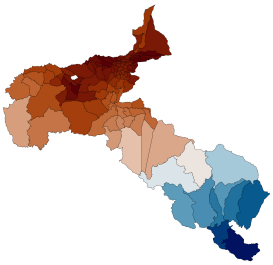
(e) Manu. of Medical Instruments



(f) Architectural & Engineering

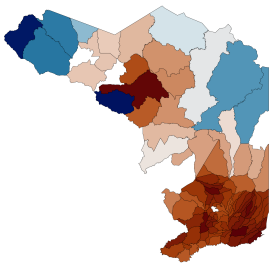


(g) Materials Recovery

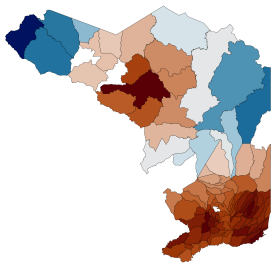


(h) Data Processing

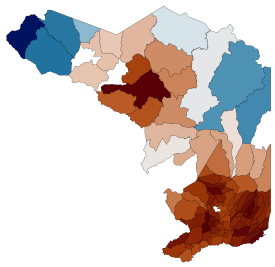
Figure A13: MNC Presence Index (San Jose)



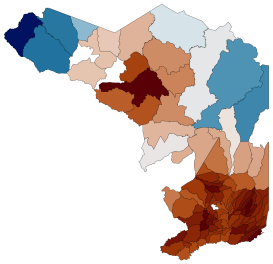
(a) Admin. Services



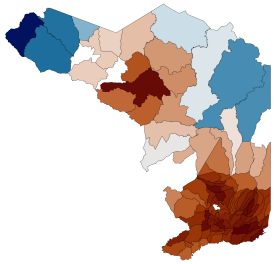
(b) Comp. Programming



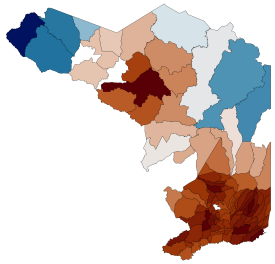
(c) Call Centers



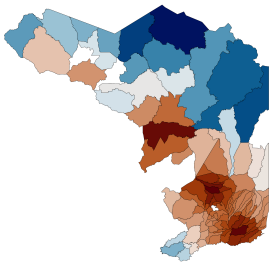
(d) Comp. Consultancy & Mgmt.



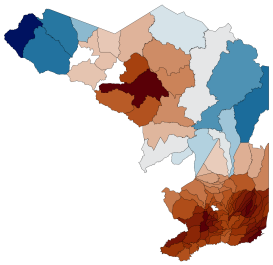
(e) Manu. of Medical Instruments



(f) Architectural & Engineering

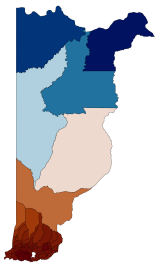


(g) Materials Recovery

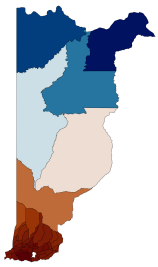


(h) Data Processing

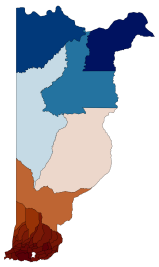
Figure A14: MNC Presence Index (Alajuela)



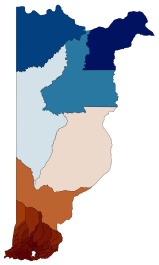
(a) Admin. Services



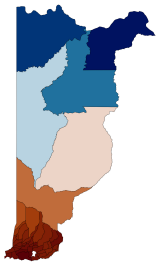
(b) Comp. Programming



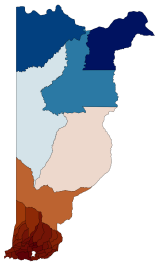
(c) Call Centers



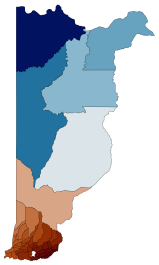
(d) Comp. Consultancy & Mgmt.



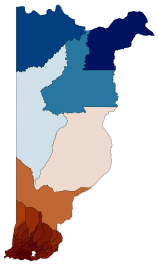
(e) Manu. of Medical Instruments



(f) Architectural & Engineering



(g) Materials Recovery



(h) Data Processing

Figure A15: MNC Presence Index (Heredia)

(a) Admin. Services

(b) Comp. Programming

(c) Call Centers

(d) Comp. Consultancy & Mgmt.

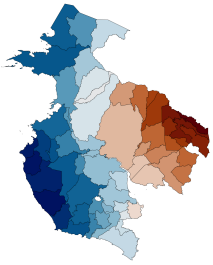
(e) Manu. of Medical Instruments

(f) Architectural & Engineering

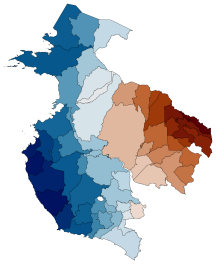
(g) Materials Recovery

(h) Data Processing

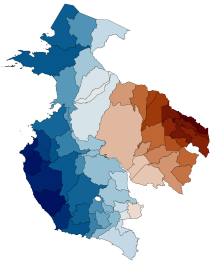
Figure A16: MNC Presence Index (Puntarenas)



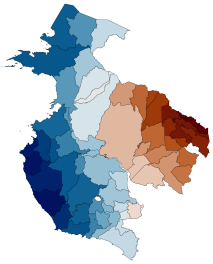
(a) Admin. Services



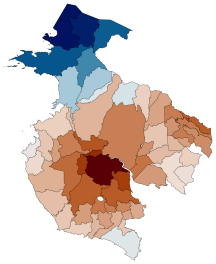
(b) Comp. Programming



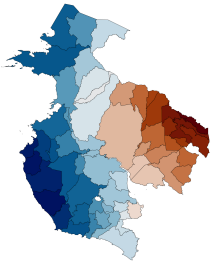
(c) Call Centers



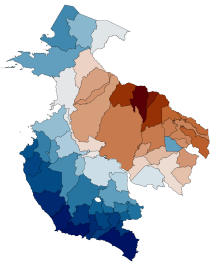
(d) Comp. Consultancy & Mgmt.



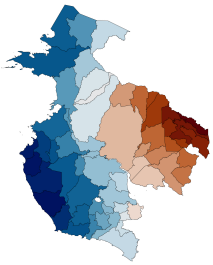
(e) Manu. of Medical Instruments



(f) Architectural & Engineering

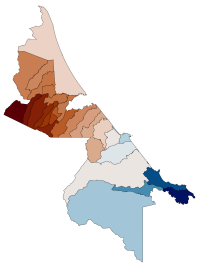


(g) Materials Recovery

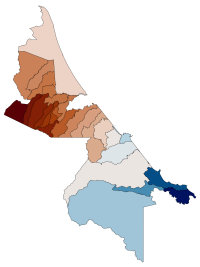


(h) Data Processing

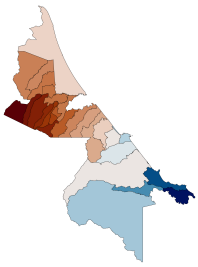
Figure A17: MNC Presence Index (Guanacaste)



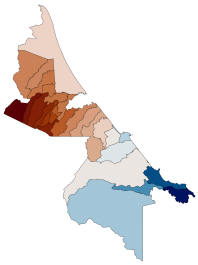
(a) Admin. Services



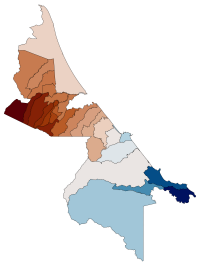
(b) Comp. Programming



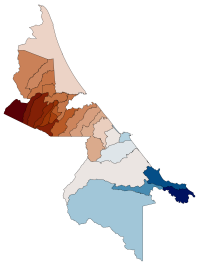
(c) Call Centers



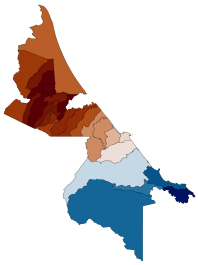
(d) Comp. Consultancy & Mgmt.



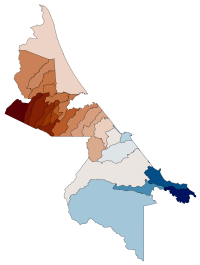
(e) Manu. of Medical Instruments



(f) Architectural & Engineering



(g) Materials Recovery



(h) Data Processing

Figure A18: MNC Presence Index (Limon)

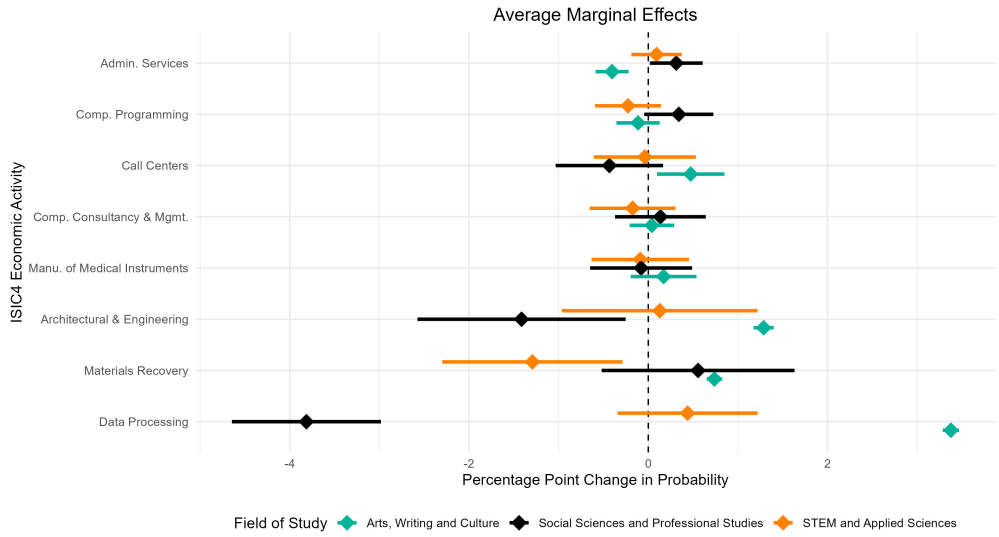


Figure A19: Marginal Effects by Each ISIC4 Economic Activity

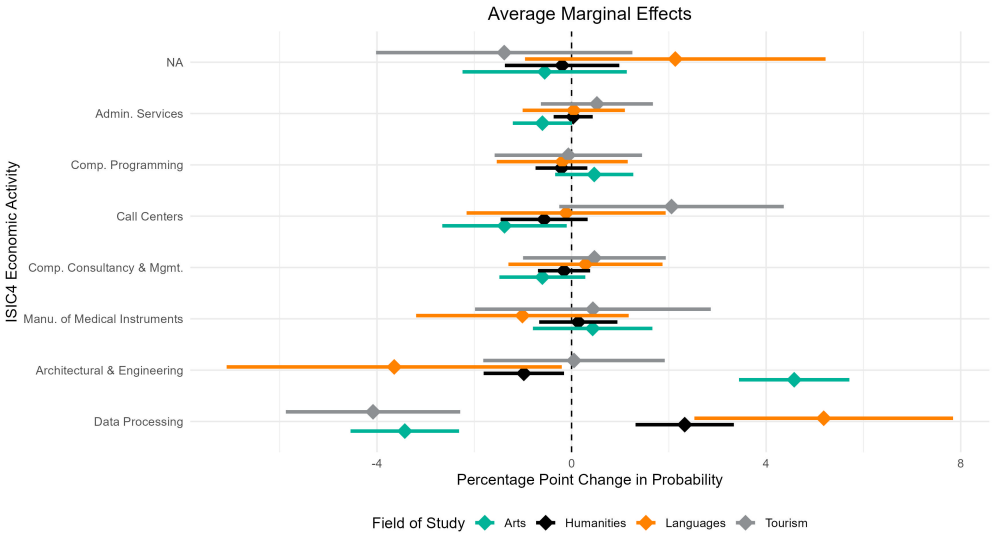


Figure A20: Arts, Writing and Tourism AMEs

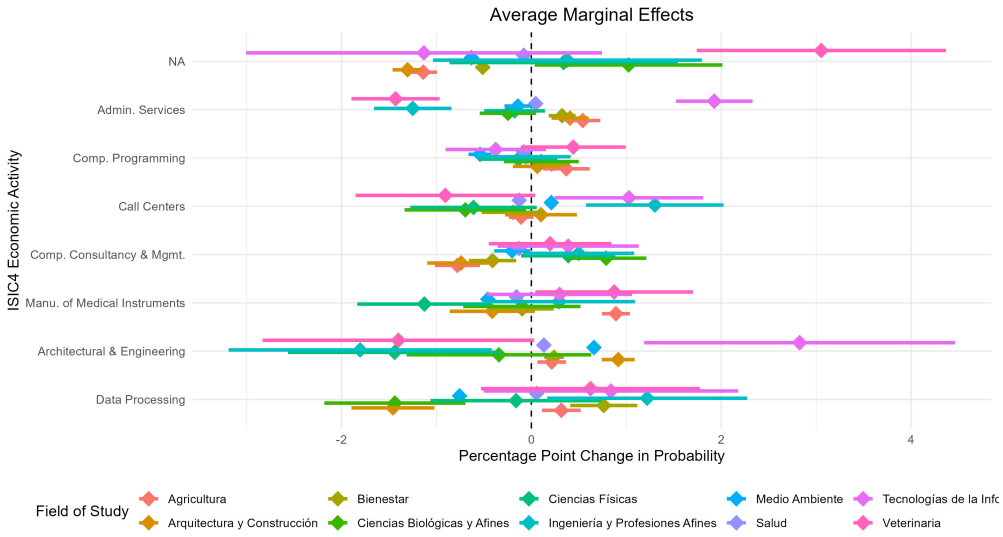


Figure A21: STEM and Applied Sciences AMEs

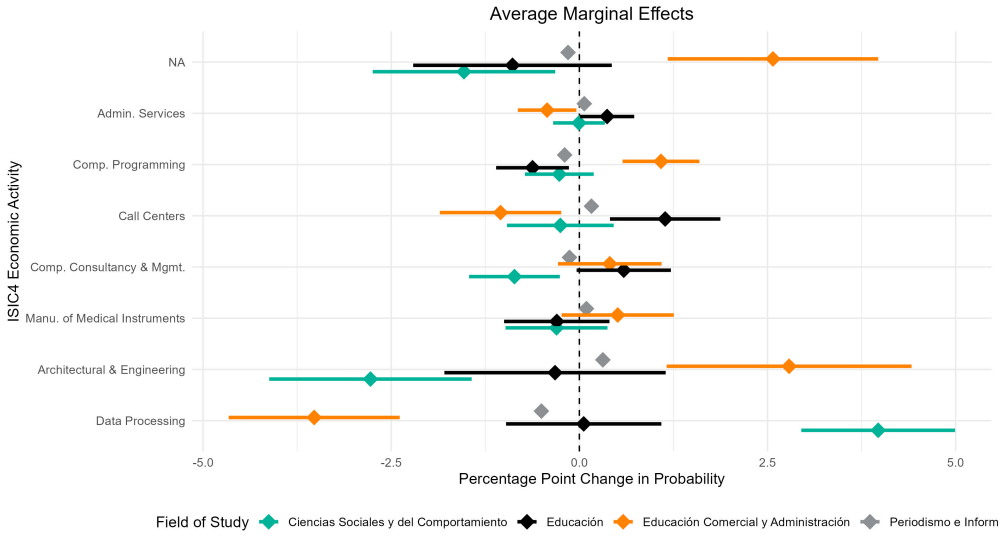


Figure A22: Social Sciences and Professional Studies