FDI & College Major Choice

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Abstract

This paper studies how the local presence of multinational corporations (MNCs) affects students' college major choices in a developing country context. Using administrative data from Costa Rica's two largest public universities covering over half a million applicants from 2007 to 2020, I examine whether exposure to MNCs—measured through firm-level location and industry data from the country's Free Trade Zone (FTZ) regime—shapes individual decisions about field-of-study specialization. I develop a novel index of MNC presence by industry and location, incorporating geographic proximity between applicants and firms. I then estimate a multinomial logit model where students choose among broad and narrow field-of-study categories, allowing for heterogeneous responses to MNC presence across industries. The results show that MNCs meaningfully influence major choice, but the effects vary by industry and field. Service-oriented MNCs, such as those in architectural and engineering services, shift students toward both STEM and arts-related fields, while large manufacturing exporters—like medical device producers—have limited impact on STEM enrollment. Disaggregated analysis reveals that applicants tend to select majors that align with the perceived skill demands of nearby MNCs, suggesting that students respond to local labor market signals when making educational investments. These findings highlight an important and previously understudied channel through which FDI can shape human capital formation—not only through access to education, but also through the type of skills students choose to acquire. The results underscore the need for education and industrial policy coordination to ensure that specialization patterns evolve in step with economic transformation.

1 Introduction

Motivation

Human Capital as Growth Mechanism

Over the past several decades, countries around the world have increasingly emphasized human capital accumulation as a central strategy for promoting economic growth and development. Some of this can be evidenced through skills acquisition effects on wage growth (Adda and Dustmann, 2023). Driven by the recognition that a more educated and capable workforce enhances productivity, fosters innovation, and improves adaptability in a rapidly changing global economy. Foreign capital investments allow for growth beyond what would be capable otherwise. This has created a large incentive on behalf of developing nations to attract Foreign Direct Investment (FDI) as a growth mechanism. As Multinational Corporations (MNCs) are considered to be more productive than local firms (Melitz, 2003), this higher productivity should move the local economy toward a more productive setting. This should then translate into labor demand shifting toward these more productive industries or crowding out of industries induced by higher trade (Blanchard and Willmann, 2016). Employment offered by new MNCs will be both low-skill jobs (Feenstra and Hanson, 1997; Atkin, 2016). As Alfaro-Ureña et al. (2021) show that in Costa Rica MNCs offer a 9% wage premium and have more employees with higher education than domestic private firms. This shift is evident both in high-income countries, where knowledge-intensive sectors play a dominant role, and in emerging economies seeking to move up the value chain by transitioning away from low-skill, labor-intensive industries.

This strategic focus on human capital has been reinforced by empirical evidence linking educational attainment and skills development to long-run economic performance (Blanchard and Olney, 2017). Yet despite the evidence on its importance, human capital investment decisions remain shaped by a complex mix of individual incentives, institutional constraints, and policy choices. Understanding the determinants of these decisions is therefore crucial—not

only for explaining micro-level behavior but also for informing the design of effective policies aimed at improving human capital attainment in developing nations.

Importance & Possible Implications

Considering how FDI may impact local labor supply is and has shown to be an important research area with many possible avenues to explore as there may be important spillover effects (Blomström and Kokko, 2003). These effects can have broad policy implications for developing nations interested in attracting increasingly more foreign investments. On the other hand, Alvarado et al. (2017) shows that there are differing effects by region and country income levels. Meaning that FDI may not be the best answer to the growth question in Latin America.

The theory behind this analysis is that individuals are differentially exposed to the presence of firms in their spatial context. Firms they observe can either be domestic or foreign, where I assume the latter are more productive, as shown by Melitz. The motivation for wanting to be employed by a MNC is beyond the scope of this analysis, but it can be explained as a labor market adjustment in the presence of trade shocks (Artuç et al., 2010) or a desire for better employment opportunities (wages, possible migration, etc.) or some form of non-pecuinary utility derived from working for a firm of this type.

Costa Rican Context - Education and Economy

Costa Rica provides a promising context for this analysis for several reasons. First, their strong economy that has been attributed to its education levels, strong democratic institutions, and diversity in industry. Importantly, the country has a dedicated regime toward attracting FDI into the country, called the Free Trade Zone (FTZ) regime. This system operates through fiscal incentive structures for international firms to enter and operate within the country. It also offers land inside FTZ dedicated industrial parks in several locations

across the country for these firms to locate.

Second, their public postsecondary education system offers a compelling context for studying field-of-study choices. The country's flagship public universities, Universidad de Costa Rica (UCR) and Universidad Nacional (UNA), attract students across the nation allowing for confidence in spatial impact analysis. Additionally, the relatively low tuition dispells any selection by affordability concerns that may arise in other nations. And crucially, prospective students apply to a field prior to their admittance which is determined by their entry scores and seat availability. Their use of entrance exams and declaration into field-of-study before students begin their postsecondary education makes it so observed patterns in major selection more reflective of true preferences, possible constraints, and perceived labor market outcomes.

Own Work & Results Preview

This paper seeks to provide empirical evidence to whether the presence of MNCs impact demand for specific field of studies at the university level. Rather than a macroeconomic approach where education levels can be observed to increase or decrease as trade volume or trade integration increases, I examine the extent to which MNCs can influence field-of-study specialization decisions. By using individual-level application data of public universities in Costa Rica and MNCs operating in the country, I show there is heterogeneity by industry and field-of-study in specialization decisions. I estimate a simple Multinomial Regression model in which the choice made by the applicant is the field of study and the regressor of interest is an index of MNC presence at the time of their application.

Field-of-study are aggregated into 3 categories: Arts, Writing, and Tourism; STEM and Applied Sciences; Social Sciences and Professional Studies. Results show that the influence of MNCs varies in both economic and statistical significance across field-of-studies. Overall, the effects are stronger for primarily service industries over manufacturing industries. This is likely due to the observed population being conditioned on individuals applying into

university, where manufacturing employment may not be attractive. When taking a more detailed look within field-of-study categories, results suggest that MNC presence results in sorting based on the skills that MNCs will demand on the labor market.

The paper is structured as follows. Section 2 describes relevant literature and contextualizes the present project's contributions. Section 3 describes the institutional details and context of the project. Section 4 presents the data. Section 5 describes the empirical approach. Section 6 presents the reduced form results and Section 7 concludes.

2 Literature Review

My paper relates to several strands of literature. First,there exists a large literature studying why and how individuals choose which field-of-study to specialize in. This can be split into 2 broad categories of potential determinants of college major choice: Expected earnings of the field and non-pecuniary returns and sorting on individual abilities and ex-post learning.

Although not the exclusive motive for education specialization, a large proportion of the existing work has focused on the impact of expected earnings on major choice. Either through observational studies (Altonji, 1993; Carneiro et al., 2011; Beffy et al., 2012; Kirkeboen et al., 2016) or eliciting beliefs of expected earnings in a laboratory setting (Arcidiacono et al., 2012, 2020), results suggest that both expected earnings and non-pecuniary returns are an important determinant in college major choices (Altonji et al., 2012; Beffy et al., 2012). There is a heterogenity in returns to field-of-study, supply-side selectivity of fields Hastings et al. (2013) which shows large, positive returns to highly selective degrees in Chile. Likewise, Bleemer and Mehta (2022); Carroll et al. (2014) find that studying Economics comes with a wage premium.

Given that completion of a university degree will take 4-years on average, while the expectation of earnings is important, there may be more immediate effects that appear more salient to the individual. Ex-ante information on returns seems important to educational attainment levels. Jensen (2010) shows that eight-grade boys in the Dominican Republic completed 0.20 - 0.35 more years of school on average after receiving information on the higher measured returns to education. In this project I model the choice of individuals based off the presence of MNCs around them at the time of their application.

Individuals may also choose a major based on their endogenous abilities. This leads to choosing a major based on ability sorting. Arcidiacono (2004) confirm earning premiums for certain majors, but this does little to explain the ability sorting across majors. They state that ability sorting is primarily due to individual preferences for field-of-study. Kinsler and Pavan (2015) derive a structural model which provides evidence that selection into fields

plays a role in generating the observed wage gap across fields. However, this does not fully explain why individuals choose majors that would give them lesser monetary returns.

The literature above does a good job at providing evidence on the returns of choosing a major and to a lesser extent how people choose majors based on their abilities. The present analysis expands the current literature on major choice by focusing on how the individuals surrounding economic market may influence their decisions. In particular, I give greater attention to the effects of MNCs on university major choice in a developing economy setting. This is important due to the increasingly important role they play in developing economies as globalization has expanded to all corners of the world.

3 Institutional Details

The Costa Rican public university system operates under a decentralized admissions process. There are a total of four universities: Universidad de Costa Rica (UCR), Universidad Nacional (UNA), Instituto Tecnológico Costarricense (TEC), Universidad Estatal a Distancia (UNED), Universidad Técnica Nacional (UTN). In the present analysis I only observe applications into UCR and UNA, which comprise about 80% of all public university students during the sample period. These universities offer a wide selection of fields for students to specialize in. These range from social sciences and education to traditional STEM fields. Obtaining a tertiary degree (I only consider bachelor's degrees in this project) usually requires 4 years. Tuition costs are generally low in Costa Rica, with a university credit costing roughly $30 in 2025.[1]

Admissions Process

The admissions process to a public tertiary education is a decentralized process. Individual applications are submitted 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. Having completed the exam each applicant receives an entry score. This score is a weighted average of their individual performance on the entry exam and their performance over the last two years of their high school education.

When applying, each student is asked to rank their two prefered majors.[2] The institution has determined, through budgetary and internal processes, how many seats it will award for each major each year. This is unknown to the student at the time of application. 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

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

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

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 then admitted into their assigned major 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.

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

Free Trade Zone Firms

Costa Rica's Free Trade Zone (FTZ) regime is a collective of benefits and incentives for firms providing FDI for the first time. They must meet certain criteria and local market obligations in order to qualify. Firms that invest through the FTZ regime establish themselves in industrial parks in the nation. These parks are exclusive for firms and are supervised by the governmental institution called Foreign Trade Promoter (PROCOMER, for its initials in Spanish), which is a part of the Ministry of Foreign Trade.

Firms under this regime are by definition Multinational Corporations. I use the entire universe of firms operating within the FTZ regime as of 2023. This data has each firm's name, unique corporate identity number, location at the province-canton-district level, whether they operate inside the industrial park or not, and the economic activities they perform. 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. From this data I select the earliest date possible and assign it to the respective firm.[3]

Each firm has at least one Economic Activity code which describes the primary activities of each firm in the country. These codes are equivalent to the 4-digit International Standard Industrial Classification (ISIC4). For simplicity, I use the first code reported in the data.[4] There are a total of 68 unique 4-digit ISIC4 codes, with the largest share being firms in a sub-category of Manufacturing. The full list can be found in table A3 of the Appendix.

[3]The registry goes as far back as November 22, 2003 which is far before the start of my sample period.

[4]In some cases, I specifically use the second code as otherwise it would seem that a large majority of firms are strictly just administrative, which is untrue.

Education

Data on university applications for both the Universidad Nacional (UNA) and Universidad de Costa Rica (UCR) are sourced directly from the respective 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[5], 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. UCR has 235 unique majors. Table A1 shows these with examples of majors within each category[6]. The data from UNA goes from 2007 to 2020 and contains 379,438 observations. And the data from UCR extends from 2008 to 2020 and contains 156,012 observations.

[5] In the UCR data, the exact entry score was not provided due to privacy concerns. Instead, they provide a range of 50 points. To be conservative when using this data, I use the lower end of the range for each observation.

[6] Only shows examples using UNA data.

5 Methodology

Model

In order to estimate to estimate how MNC presence impacts field-of-study choice, individuals follow the utility function:

$$U_{im} = \alpha_c + \alpha_t + \beta_{mj}\Gamma_{djt} + X_i'\gamma + \varepsilon_{im}, \tag{1}$$

where individual i chooses the field-of-study m that maximizes their utility. This is made up of canton and year fixed effects, and are influenced by the MNE presence index Γ_{djt}. Each individual also has demographic characteristics X_i' and are subject to an idiosyncratic shock ε_{im}. The possible 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:

$$P(Y_i = m) = \frac{\overbrace{exp(\alpha_c + \alpha_t + \beta_{mj}\Gamma_{djt} + X_i'\gamma + \varepsilon_{im})}^{\text{Utility of chosen field-of-study}}}{\underbrace{\sum_{m'} exp(\alpha_c + \alpha_t + \beta_{m'j}\Gamma_{djt} + X_i'\gamma + \varepsilon_{im'}))}_{\text{Utilities across all possible field-of-study choices}}} \tag{2}$$

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. 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.

Introduce Presence Index

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

$$\Gamma_{djt} = \sum_{d'} \frac{\mathrm{S}_{d'jt}}{exp(\tau_{dd'})}, \tag{5}$$

where the numerator $S_{d'jt}$ is the stock of firms in district d' operating under economic activity code j in year t. The existing stock of firms at the time of application captures the most updated roster of firms that are operating in the country. Each year applicants are exposed to a different stock of firms, given that any industry may grow in size year to year. The denominator 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.[7] This index is non-negative and ranges from 0 to 17 in the data.

Given how the MNC presence index is constructed, an increase of one unit in the index can theoretically be generated through two 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. This shuts down migration as a mechanism of change which leaves new firms entering as the only possibility. Given that the index weighs the quantity of firms by spatial distance, one new firm does not necessarily equal one unit increase in the index. **Author's note: I acknowledge this is a concern at the time. I am currently working on a better way to standardize this unit increase across industries so that a 1 unit increase is better understood.**

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

6 Estimation Results

Table 1 presents the Average Marginal Effects (AMEs) of MNC presence, measured at the district level for all ISIC4 categories, on the probability of choosing one of three aggregate field-of-study categories: *Arts, Writing & Culture, STEM & Applied Sciences;* and *Social Sciences & Professional Studies*. Each column reflects how increased presence in a given industry shifts the likelihood of applicants choosing that category, conditional on individual characteristics (age, sex, entry score, and high school type) and fixed effects for canton and year.

Effects of MNC Presence on Broad Field of Study Choice

A few high-level patterns emerge. First, certain industries – particularly those tied to knowledge-intensive or technical work – are associated with meaningful shifts in study preference. For example, an increased presence of firms in **Architectural and Engineering Services** is associated with a decline in the probability of choosing a major in Social Sciences and a corresponding increase in both STEM and Arts fields. This may reflect how applicants internalize demand for not just engineers, but also designers and visual communication specialists. **Administrative Services** also shows an expected shift as their presence increases. There is an increase demand for majors within the Social Sciences and Professional Studies. Here we can find Business Administration-type jobs which would align quite directly with this industry. Ultimately, applicants are likely making a decision on skills attained in a field-of-study, over the name of the specialization.

Second, some industries appear to show minimal influence on field-of-study choices. The **Computer Consultation and Management** sector, despite its growth, does not significantly alter field-of-study preferences. This is likely due to the majors offered rather than the field itself. UNA does not have a strong offering of fields that you would usually associate with this industry. The only tangentially related major is Information Systems, which falls

under the STEM category. This thought is reinforced by the estimates from the **Computer Programming** industry, which are also minimal.

More surprisingly, **Medical Instrument Manufacturing**, Costa Rica's largest export sector in recent years, shows no significant effect on demand for STEM fields. Instead, it is linked with an increase in probability of choosing a field-of-study in Social Science & Professional Studies. There is a similar trend in the **Materials Recovery** industry: STEM fields appear to be less desireable for applicants. This overall trend can potentially be explained through a service versus non-service industry composition.[8] Where the production of Medical Instruments and recovery of materials industries may be less desireable in the observed population.

Alternatively, there could also be an occupational mismatch: although classified as manufacturing, local employment opportunities may rather cluster in managerial or administrative roles rather than technical production. At the very least, I can say that conditioning on individuals seeking a university education this popular exporting industry does not affect their decision-making strongly. There are likely effects for non-university applicants seeking employment here, much like the maquiladora story in Atkin (2016), but that is beyond the scope of this research.

To give a more intuitive sense of the magnitude of these effects, Table 2 translates the AMEs into predicted changes in application counts. These numbers suggest that even modest percentage point shifts can imply large re-allocations in student flows over the sample time period.

[8]Empirical analysis on this is pending. I can use the firm classification within the FTZ as some form of categorization.

Table 1: Aggregated Categories Marginal Effects (All Control Vars + All Industries)

	Grouping of Broad Fields		
	Arts, Writing & Culture	STEM & Applied Sciences	Social Science & Prof. Studies
Admin. Services	-0.404***	0.092	0.312**
	(0.094)	(0.143)	(0.150)
CPU Programming	-0.114	-0.226	0.340*
	(0.123)	(0.188)	(0.196)
Call Centers	0.473**	-0.039	-0.434
	(0.192)	(0.291)	(0.305)
CPU Consultation & Mgmt.	0.039	-0.175	0.135
	(0.127)	(0.244)	(0.258)
Manu. Medical Insts.	0.170	-0.090	-0.081
	(0.187)	(0.277)	(0.290)
Architect & Engineering	1.286***	0.127	-1.414**
	(0.058)	(0.557)	(0.593)
Materials Recovery	0.737***	-1.293**	0.555
	(0.043)	(0.513)	(0.549)
Data Processing	3.376***	0.438	-3.814***
	(0.046)	(0.399)	(0.424)
Controls	✓	✓	✓
Canton FE	✓	✓	✓
Year FE	✓	✓	✓
Obersvations	379,316	379,316	379,316
Pseudo-R2	0.041	0.041	0.041

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.
Coefficients are in **percentage points** for easier reading

Table 2: Aggregated Categories Changes in Field of Study

	Arts, Writing & Culture	STEM & Applied Sciences	Social Science & Prof. Studies
Admin. Services	-1,533	349	1184
CPU Programming	-433	-858	1290
Call Centers	1,795	-148	-1,647
CPU Consultation & Mgmt.	148	-664	512
Manu. Medical Insts.	645	-341	-307
Architect & Engineering	4,880	482	-5,365
Materials Recovery	2,796	-4,906	2,106
Data Processing	12,810	1,662	-14,472
Total	21,108	-4,424	-16,699

To get a better understanding of more detailed fluctuations in field-of-study choices in the data, I explore more narrow major groupings within each of the 3 aggregated categories below.

Arts, Writing & Culture

To better understand this category, I disaggreagate into four subfields: *Arts, Humanities, Languages* and *Tourism*.[9] As in the main analysis, the shown coefficients are the AMEs of the regression which represent the percentage point change in the probability of selecting a specific sub-field-of-study. There is an added condition that these results are limited to an applicant choosing a major within the *Arts, Writing & Culture* category.

Among the top 10 ISIC4 industries analyzed, **Architectural and Engineering Activities** stand out. As shown in Table A5 in the Appendix, increased MNC presence in this sector significantly increases the probability of choosing *Arts*-related majors, while simultaneously decreasing demand for the other sub-fields.

This is noteworthy because the *Arts* sub-category is dominated by the *Art and Visual Communication* major, which accounts for ∼39% of all applications in the broader category. The estimated increase in its demand, alongside with 3.5 p.p. decrease in *Languages* suggests a reorientation toward majors with more direct visual-deisgn labor market applications.

[9]As noted in table A2, tourism is not an official ISCED category but I change the name because all majors within this category fall under some sort of tourism activity.

Without going into what the skills this major may offer to the student and their labor market profile, it is important to highlight that potential employment opportunities in this industry may seek someone with this profile over someone that had specialized in a language, for example.

The fact that there are no predictable trends in any of the sub-categories speaks to the heterogenous effects across industry and field-of-study.

STEM and Applied Sciences

I next analyze the sub-fields within *STEM & Applied Sciences*, dissaggregating into ten categories: *Agriculture, Architectural, Well-Being, Biology, Physics, Engineering, Environmental, Health, Information Systems, Veterinary Medicine*. The results, presented in Table A6 in the Appendix, show clear heterogeneity in response to different MNC sectors.

There is heterogeneity across all other sub-fields in a manner consistent to the other sub-fields. Without diving into exact movements in probability of choosing a specific subfield, the results suggest that the STEM subfield estimates reinforce the view that students respond not only to industry presence but also to the specific skills and knowledge those industries are perceived to reward.

For this sub-category, the most interesting trend is not in one single industry, but rather in the *Agriculture* sub-field. *Agriculture* shows a consistently negative trend, with the exceptions of **Administrative Services** and **Computer Programming Activities**. This is of particular interest given the nature of MNCs in this context. They either concentrate in service industries or production industries. The fact that most industries increasing their presence has a negative association with *Agriculture* seems to suggest that university applicants are no longer seeking employment in Agricultural industries, which tend to be domestic. Instead, they are substituting into sub-field-of-studies that are more likely than not to have an association with MNC employment, such as Engineering, Biology, or Physical sciences.

Social Sciences & Professional Studies

Lastly, the sub-fields within *Social Sciences & Professional Studies*. These dissaggregate into *Social Sciences, Education, Administration & Commerce,* and *Journalism & Information*. Results are presented in Table A7 in the Appendix. The effects of MNC presence on this sub-field are equally heterogenous, with some industries reinforcing conventional expectations while other challenge them.

The *Social Sciences* subfield, whose most popular majors include International Relations, Psychology, and Economics, shows a consistent and meaningful downward trend across all ISIC categories. This trend is reinforcing evidence of the trend seen in the narrow categories where potential attained skills do not necessarily align with the industries under scrutiny. These majors may also be subject to occupational mismatch, where attained skills do not directly line up with what industries may be demanding.

Highlighting the **Architectural & Engineering** industry, there is a significant shift of applicants toward choosing the *Administration & Commerce* sub-field-of-study. This is focused around Business Administration and International Commerce majors, and they seemingly crowd-out demand for the other sub-fields. These results suggests that this specific industry may have a significant concentration in Administrative occupations, although I cannot confirm this in the present analysis.

The complete opposite of this occurs in the **Data Processing** industry. Here, applicants experiencing a higher presence of this industry seemingly shift their field-of-study preferences toward *Social Sciences* and away from *Administration & Commerce*.

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 entering a nation will influence the labor market composition and the countries educational attainment. Beyond the extensive margin of educational attainment, field-specialization is also an important aspect to consider. It can be influenced by many factors, such as expected wages or endogenous abilities. Local labor market conditions may influence these decisions through the presence of MNCs at the time of making a decision.

I specifically look at how the presence of MNCs influence the field-of-study chosen by university applicants. Using data of applicants from Costa Rican public universities and MNCs operating under the Free Trade Zone regime in the country, I estimate a Multinomial Logit model in where individuals are choosing which major to apply to. Results show that industries affect field-of-studies differently. When looking at the 8 largest MNC industries in the country, results suggest that service industries are more relevant for university applicants than manufacturing/production industries. Results vary in significance by industry, likely due to occupational composition of firms within the country, which is not observed in the data. Looking at more narrow definitions of field-of-studies, results suggest that individuals seek majors that develop transferable skills within the industry.

Overall, these results suggest that higher levels of FDI does influence human capital specialization decisions. 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.

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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	19.76	(3.06)
Application Score	480.02	(238.36)
Female	0.57	
STEM[a]	0.36	
GAM[b]	0.55	
Public High School	0.78	
Geographical Information		
Province	(%) of Applications	No. of Cantons
San José	0.31	17
Alajuela	0.19	15
Heredia	0.17	10
Cartago	0.08	8
Puntarenas	0.09	11
Guanacaste	0.10	11
Limón	0.06	6
Observations	379,438	

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

Table A5: Arts, Writing, & Culture Sub-Categories

4-Digit ISIC Cat.	Arts	Humanities	Languages	Tourism
Admin. Services	-0.429	0.179	0.057	0.192
	(0.003)	(0.002)	(0.006)	(0.006)
Comp. Programming	0.259	-0.302	0.232	-0.189
	(0.004)	(0.003)	(0.007)	(0.008)
Call Centers	-1.480**	-0.408	-0.265	2.154*
	(0.007)	(0.005)	(0.011)	(0.012)
Comp. Consultancy & Mgmt.	-0.455	-0.303	0.396	0.362
	(0.005)	(0.003)	(0.008)	(0.008)
Manu. of Medical Instruments	0.576	-0.121	-0.528	0.072
	(0.007)	(0.005)	(0.012)	(0.014)
Architectural & Engineering	5.593***	-1.063**	-3.546**	-0.984
	(0.006)	(0.004)	(0.018)	(0.009)
Materials Recovery	-0.174	-0.203	1.085	-0.708
	(0.008)	(0.006)	(0.016)	(0.013)
Data Processing	-3.927***	2.360***	3.535**	-1.968**
	(0.006)	(0.005)	(0.014)	(0.009)
Controls	✓	✓	✓	✓
Canton FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	44,429	44,429	44,429	44,429

Table A6: STEM & Applied Sciences

4-Digit ISIC Cat.	Ag.	Architect.	Well-Being	Bio	Physics	Engineering	Enviro.	Health	Info. Systems	Vet.
Admin. Services	0.193*	-0.031	0.189**	-0.028	-0.222	-1.106***	-0.054	-0.084***	2.129***	-0.986***
	(0.108)	(0.107)	(0.078)	(0.158)	(0.158)	(0.193)	(0.062)	(0.025)	(0.203)	(0.229)
Comp. Programming	0.159	0.454***	0.034	-0.262	-0.261	-0.538**	-0.341***	0.007	-0.123	0.871***
	(0.126)	(0.129)	(0.109)	(0.214)	(0.205)	(0.239)	(0.062)	(0.025)	(0.269)	(0.273)
Call Centers	-0.364*	0.226	0.260	-0.266	0.762***	-0.636	0.363***	0.156***	0.397	-0.899*
	(0.063)	(0.207)	(0.170)	(0.321)	(0.762)	(0.394)	(0.030)	(0.012)	(0.011)	(0.467)
Comp. Consultancy & Mgmt.	-0.616***	-0.125	-0.156	-0.270	1.087***	0.695**	-0.196**	-0.040	-0.879**	0.501
	(0.112)	(0.165)	(0.115)	(0.252)	(0.245)	(0.286)	(0.098)	(0.042)	(0.397)	(0.333)
Manu. of Medical Instruments	-0.121*	-0.470*	-0.367*	-0.224	-0.888**	2.742***	-0.513***	-0.230***	0.106	-0.036
	(0.070)	(0.260)	(0.192)	(0.335)	(0.350)	(0.311)	(0.021)	(0.019)	(0.404)	(0.461)
Architectural & Engineering	-0.305***	0.580***	0.450***	0.157	-1.075*	-1.183*	0.368***	0.043***	1.918**	-1.000
	(0.080)	(0.104)	(0.056)	(0.544)	(0.570)	(0.681)	(0.031)	(0.016)	(0.885)	(0.752)
Materials Recovery	-1.191***	-1.454***	-0.486***	1.030**	0.292	0.902	-0.505***	-0.135***	-0.298	1.847***
	(0.074)	(0.079)	(0.041)	(0.498)	(0.639)	(0.693)	(0.020)	(0.009)	(0.974)	(0.697)
Data Processing	-0.500***	-1.444***	0.842***	-2.360***	-0.2455	1.637***	-0.467***	0.172***	0.481	1.884***
	(0.108)	(0.228)	(0.175)	(0.432)	(0.439)	(0.509)	(0.043)	(0.015)	(0.705)	(0.593)
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Canton FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	140,062	140,062	140,062	140,062	140,062	140,062	140,062	140,062	140,062	140,062

Table A7: Social Sciences & Professional Studies

4-Digit ISIC Cat.	Social Sci.	Education	Admin. & Commerce	Journalism & Info.
Admin. Services	0.402**	0.120	-0.593***	0.070***
	(0.175)	(0.187)	(0.203)	(0.022)
Comp. Programming	-0.026	-0.270	0.402	-0.107***
	(0.233)	(0.248)	(0.266)	(0.033)
Call Centers	-0.430	0.771**	-0.323	-0.019
	(0.367)	(0.387)	(0.417)	(0.015)
Comp. Consultancy & Mgmt.	-1.035***	0.733**	0.398	-0.966**
	(0.313)	(0.326)	(0.362)	(0.044)
Manu. of Medical Instruments	-0.123	0.696**	-0.594	0.021
	(0.343)	(0.350)	(0.395)	(0.024)
Architectural & Engineering	-1.956***	-2.023***	4.058***	-0.080***
	(0.693)	(0.776)	(0.865)	(0.026)
Materials Recovery	-1.375**	-0.428	1.865**	-0.062***
	(0.629)	(0.676)	(0.019)	(0.023)
Data Processing	3.472***	0.493	-3.550***	-0.415***
	(0.532)	(0.538)	(0.594)	(0.021)
Controls	✓	✓	✓	✓
Canton FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Observations	194,947	194,947	194,947	194,947

Table A8: Education Summary Statistics

Full Sample		
Field-of-Study	Yearly Mean	Std. Dev.
Arts, Writing, and Culture	3,172	610
STEM & Applied Sciences	10,001	2,118
Social Sciences and Professional Studies	13,921	3,318

Table A9: MNC Presence Index Summary Statistics

Econ. Activity	Mean	Std. Dev.
Admin. Services	0.1744	1.0275
CPU Programming	0.1134	0.6676
Call Centers	0.0618	0.3863
CPU Consultation & Mgmt.	0.0697	0.4266
Manu. Medical Insts.	0.0311	0.2920
Architect & Engineering	0.0259	0.1755
Materials Recovery	0.0102	0.1454
Data Processing	0.0188	0.1838

Measured over entire sample period at national level

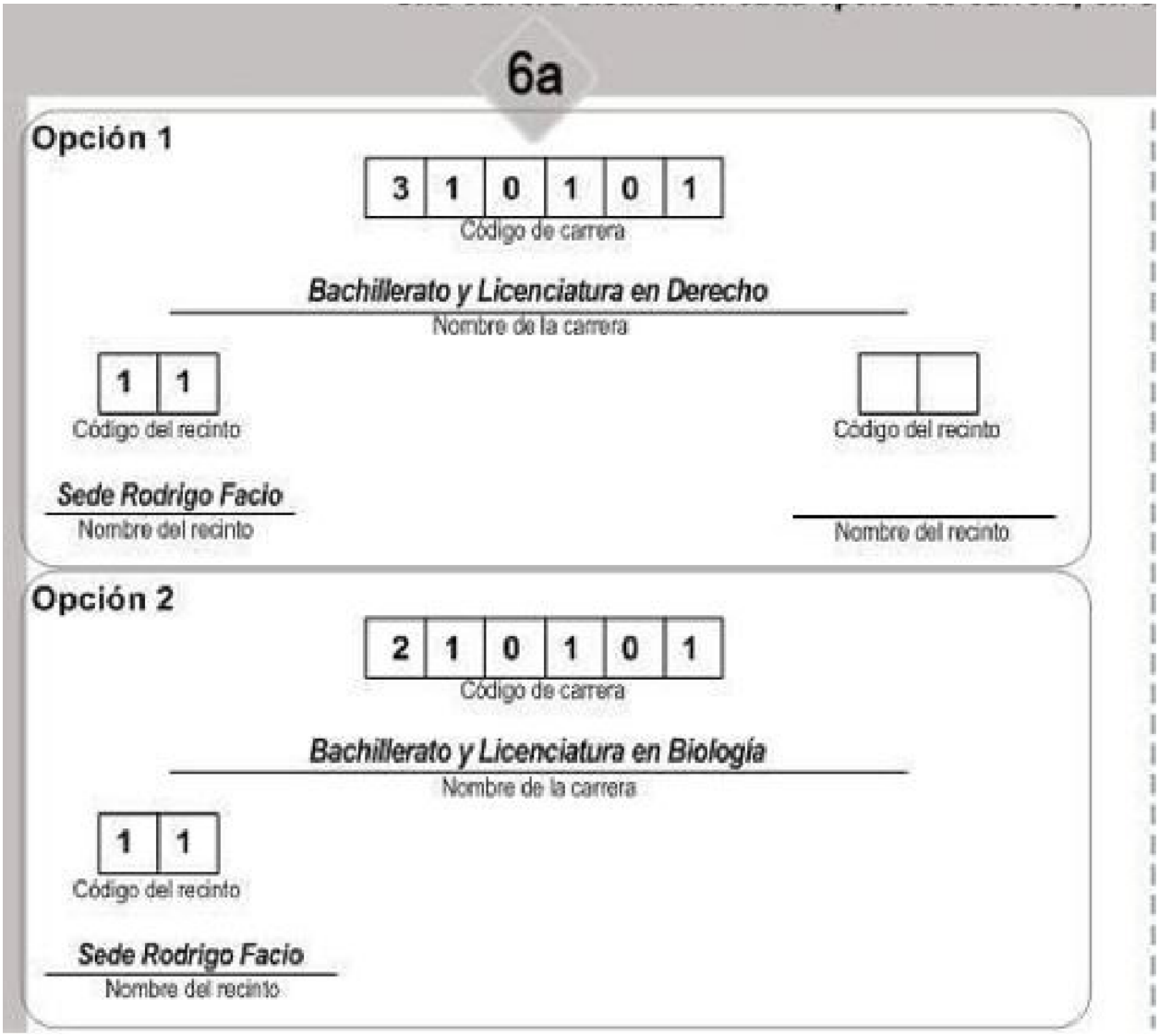


Figure A1: Example of Rank Order of Majors into UCR

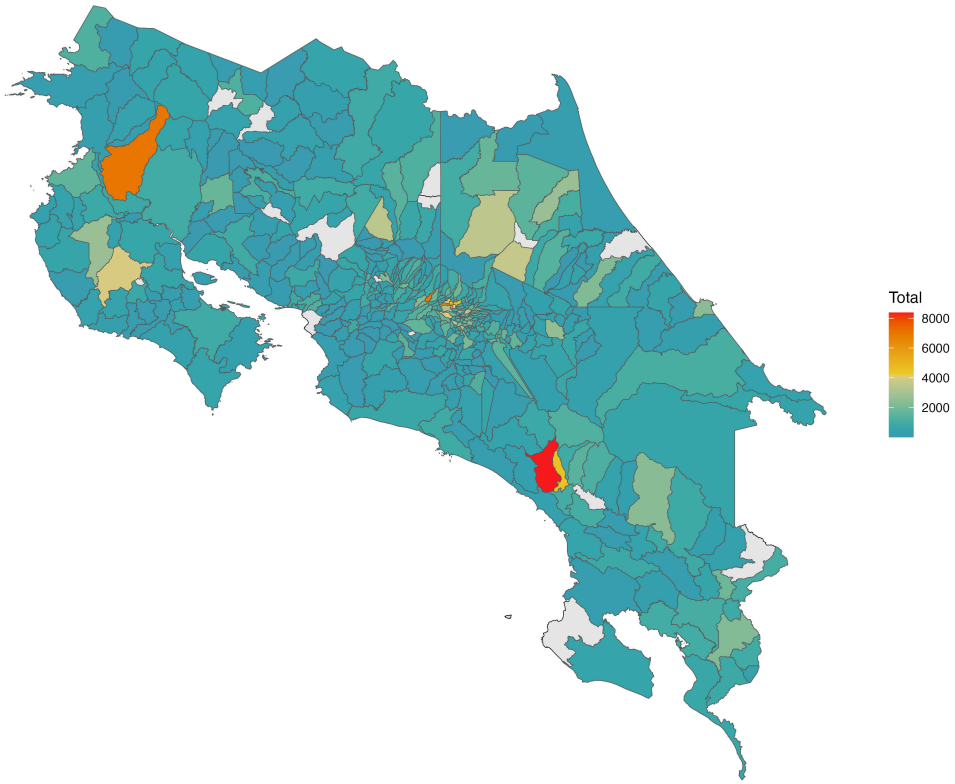


Figure A2: Applications Heatmap (All Years)

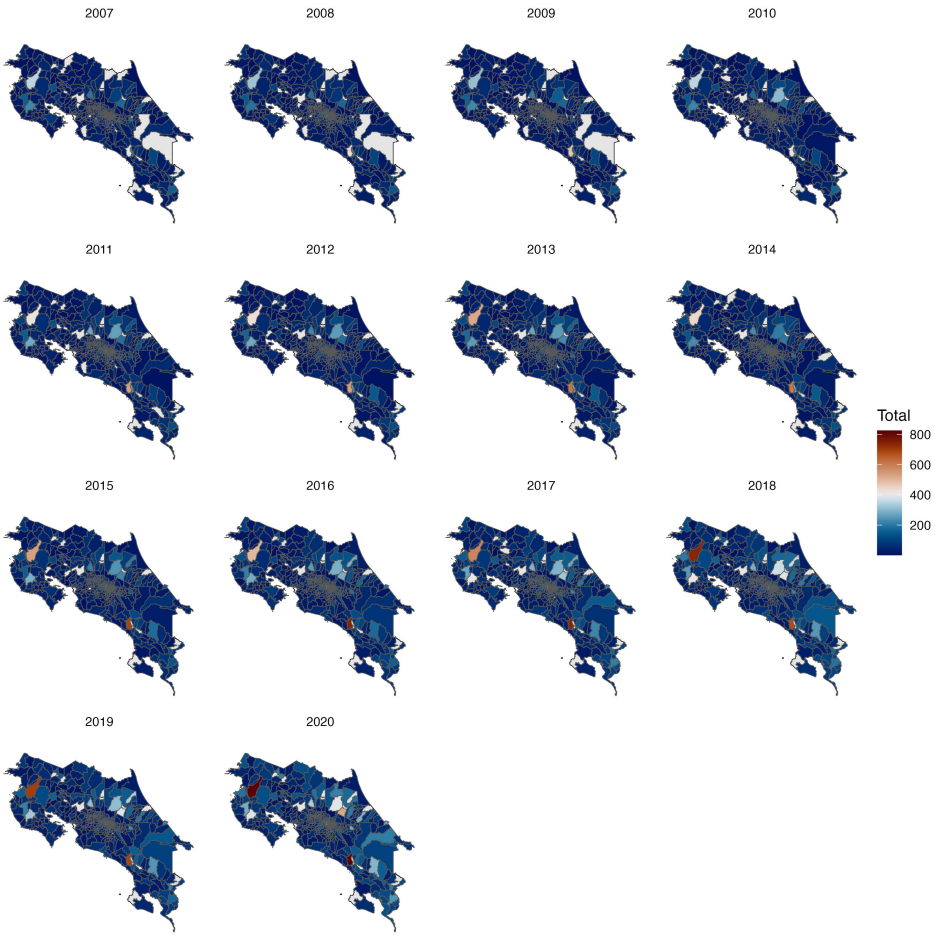


Figure A3: Applications Heatmap (By Year)

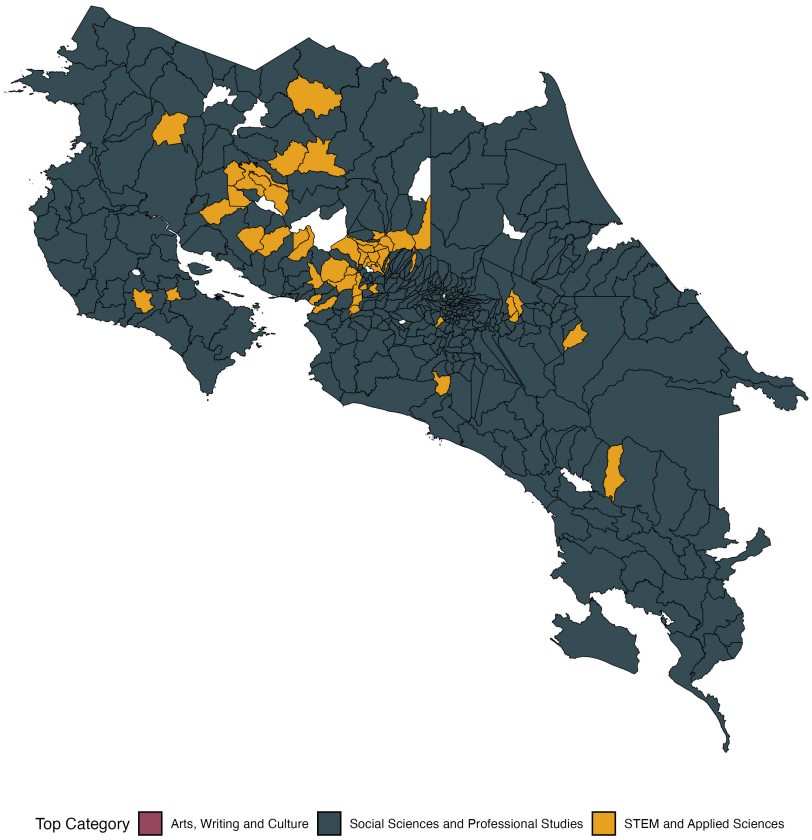


Figure A4: Field-of-Study Majority Applications by District (All Years)

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

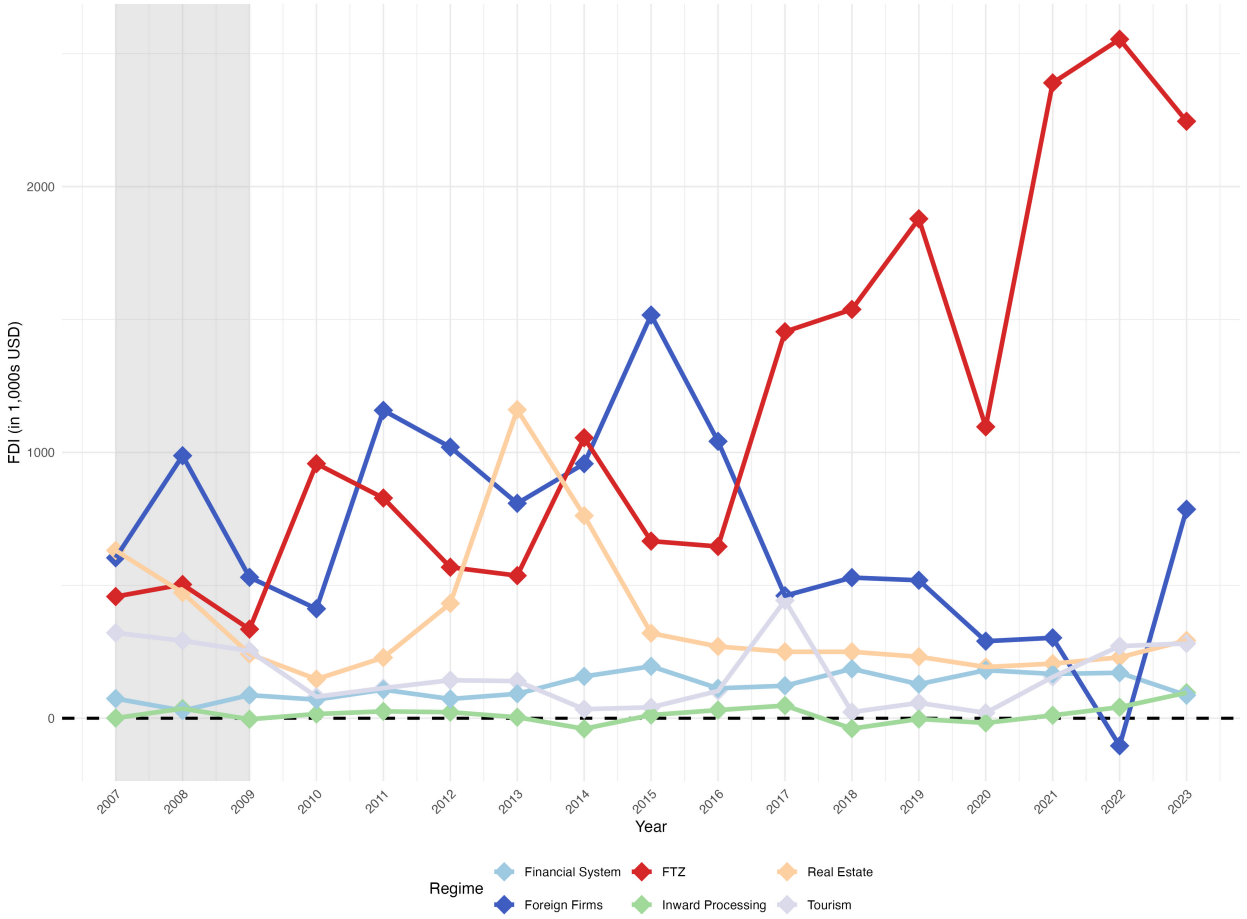


Figure A6: FDI Flows by Regime into Costa Rica

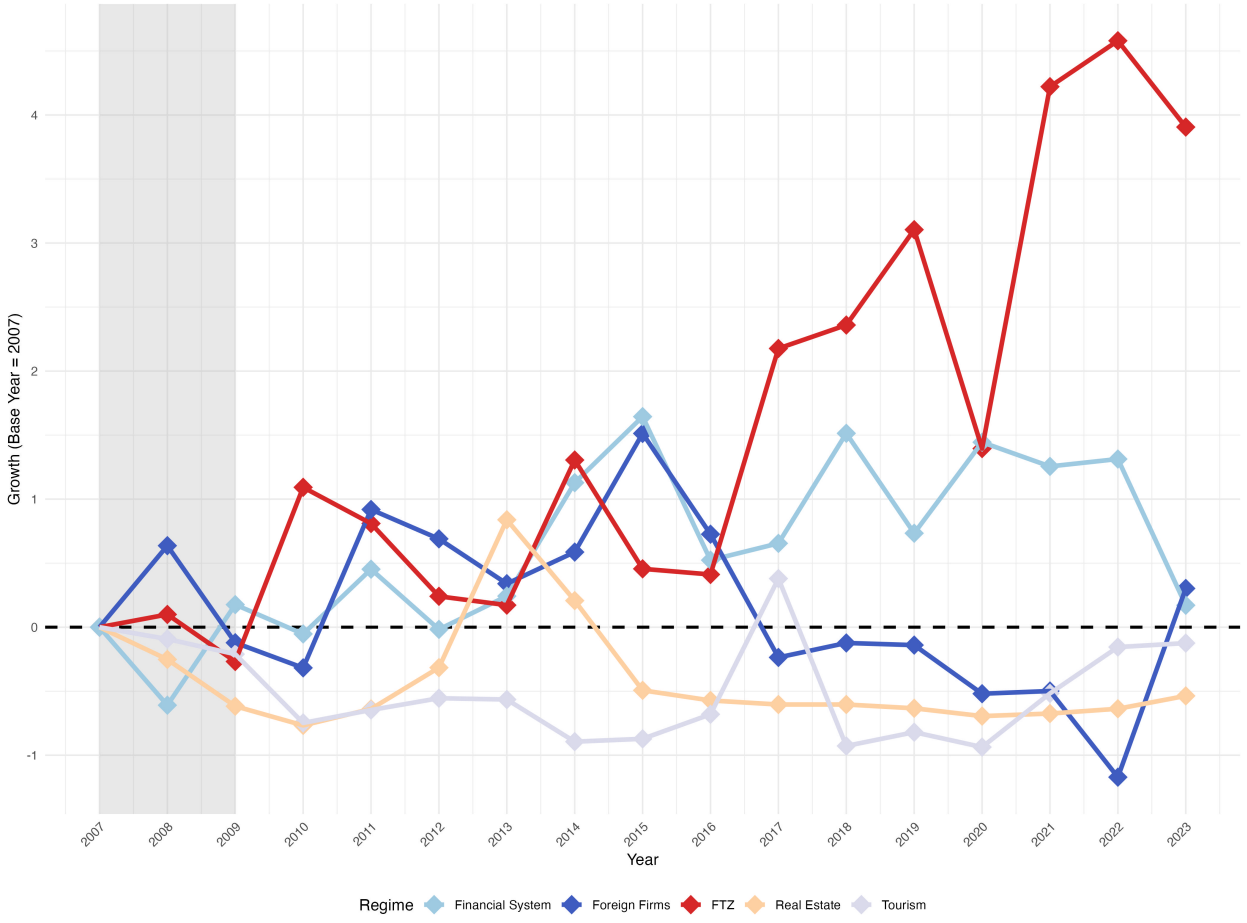


Figure A7: FDI Growth (Base Year = 2007)

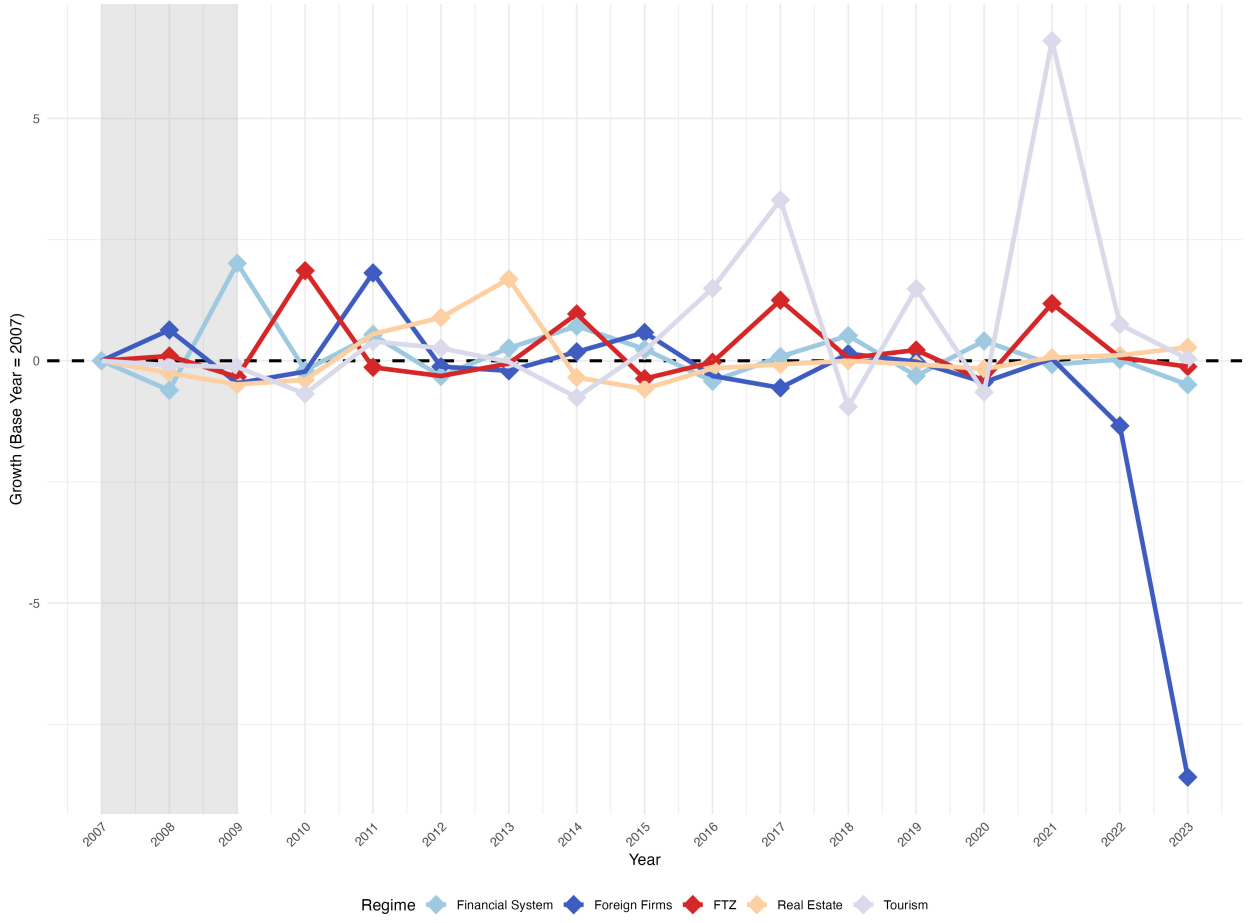


Figure A8: FDI Growth (By Year)

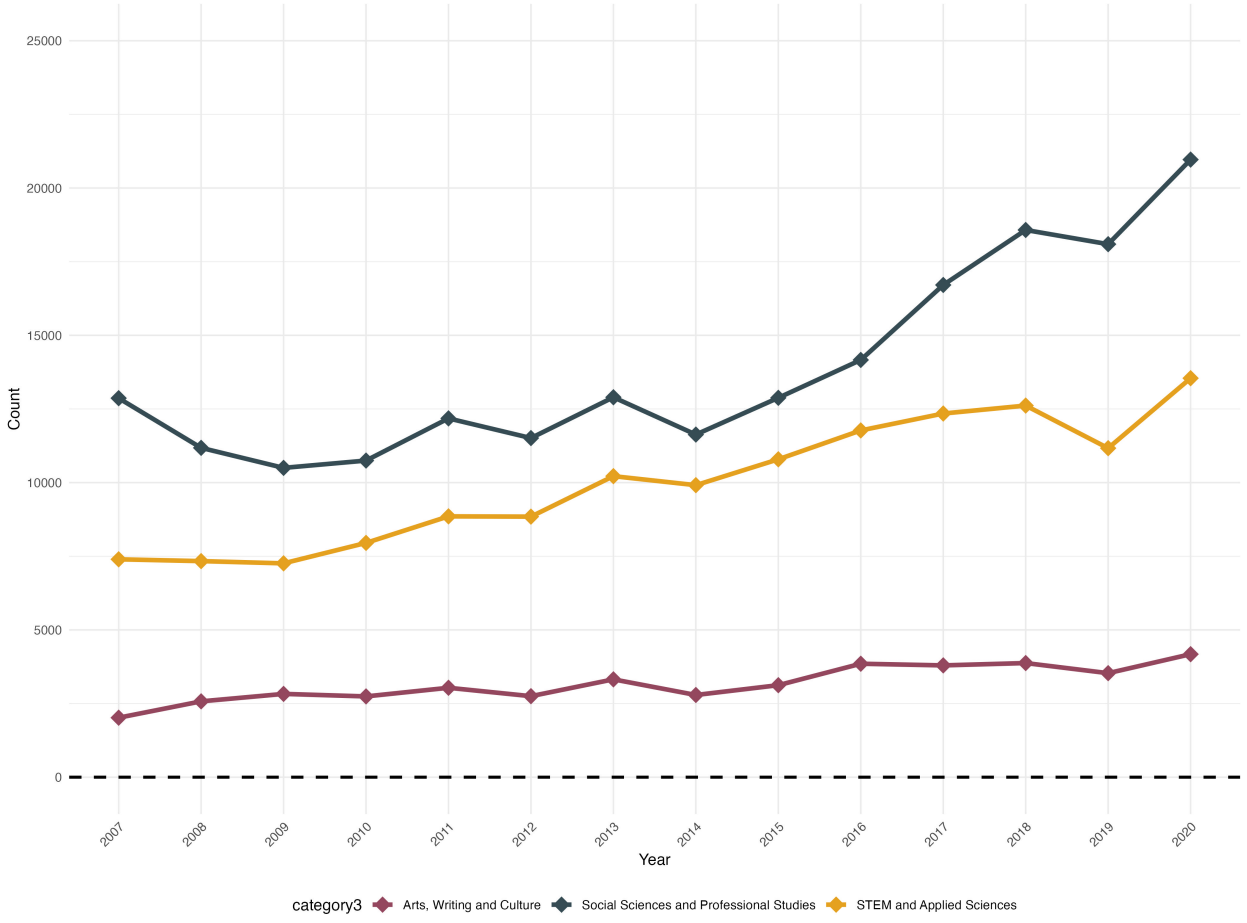


Figure A9: Applications by Field-of-Study by Year

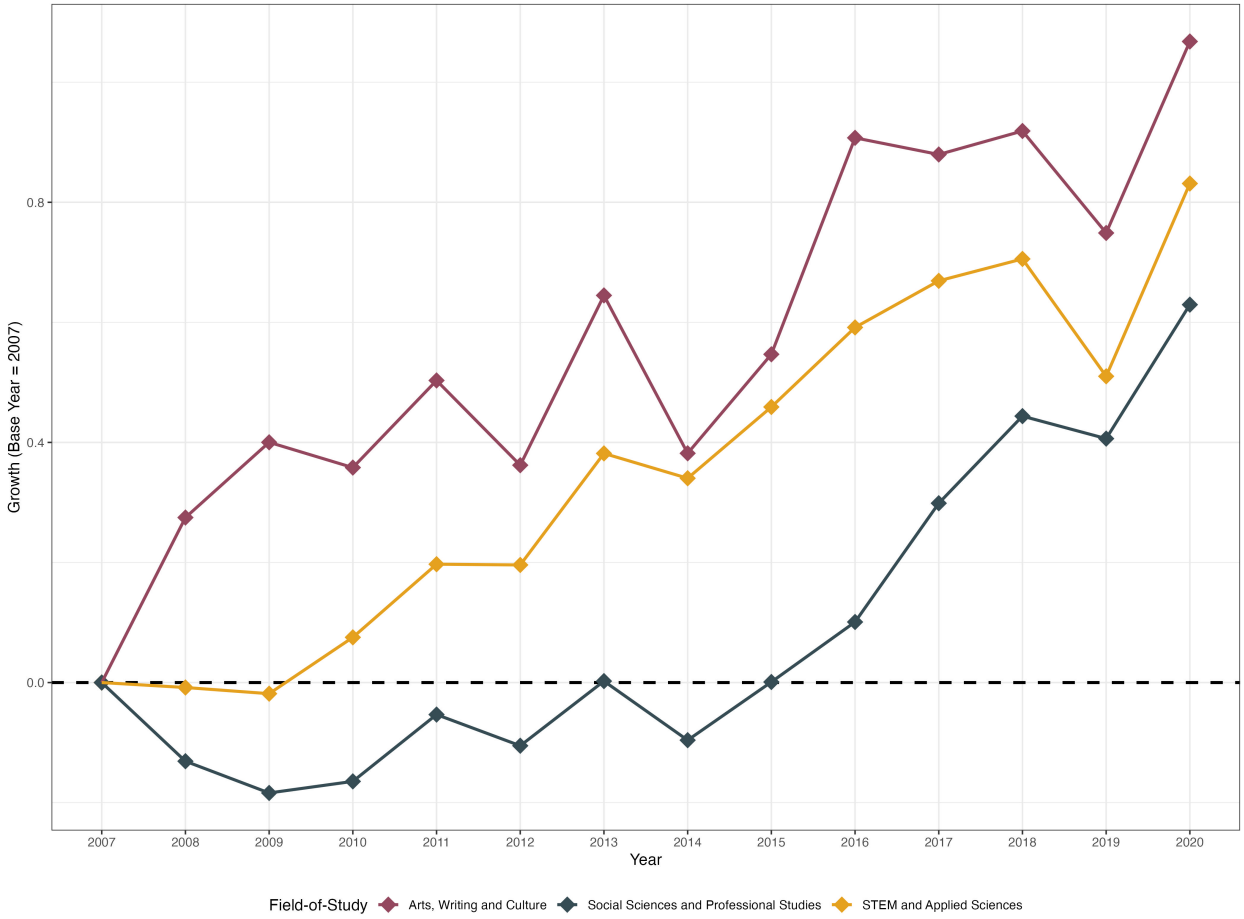


Figure A10: Growth in Applications by Field-of-Study (Base Year = 2007)

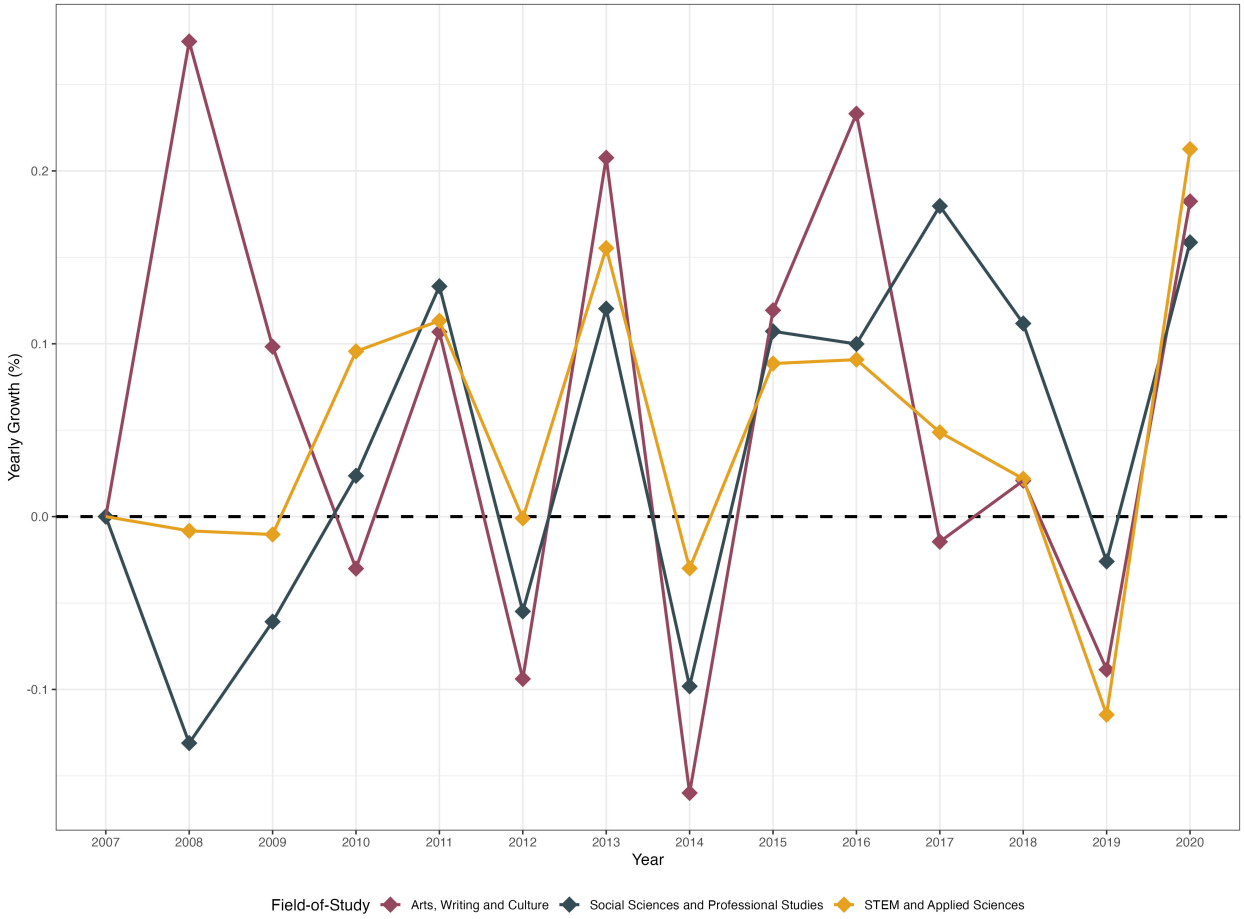


Figure A11: Growth in Applications by Field-of-Study by Year

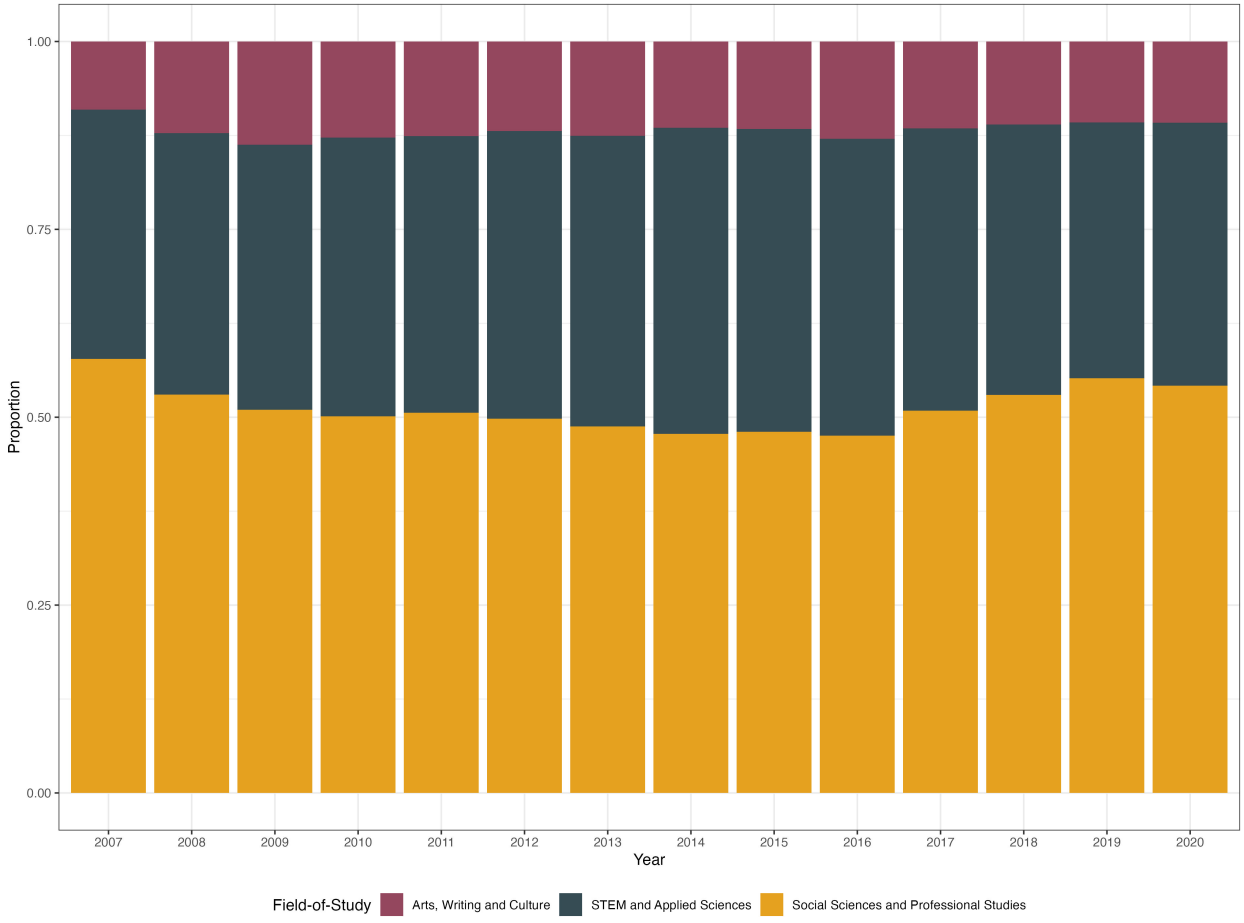
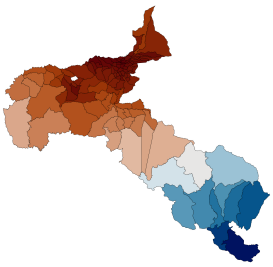
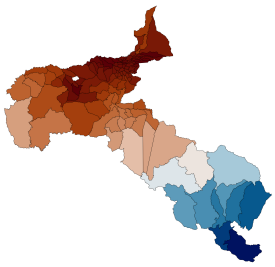


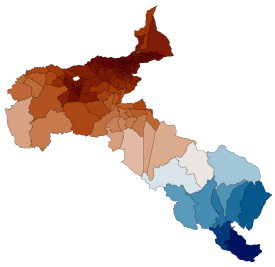
Figure A12: Field-of-Study Categories Proportions



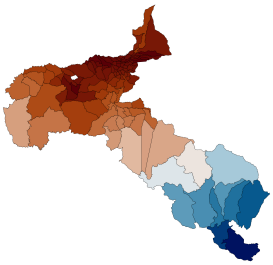
(a) Admin. Services



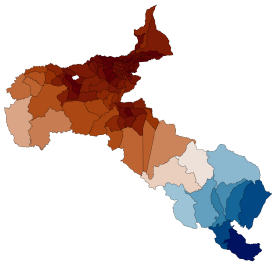
(b) Comp. Programming



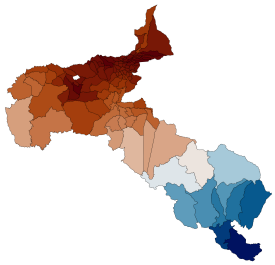
(c) Call Centers



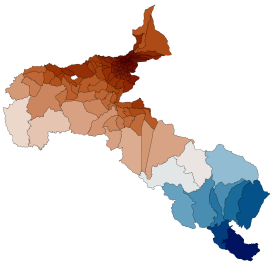
(d) Comp. Consultancy & Mgmt.



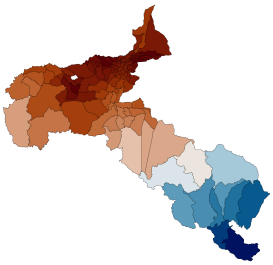
(e) Manu. of Medical Instruments



(f) Architectural & Engineering

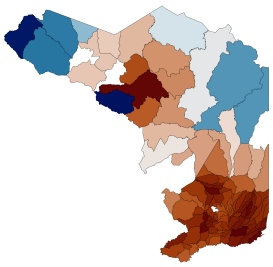


(g) Materials Recovery

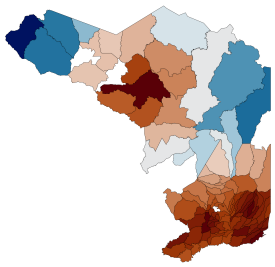


(h) Data Processing

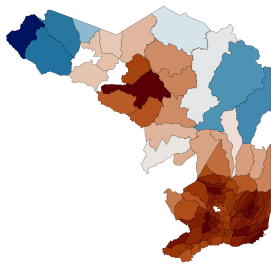
Figure A13: MNC Presence Index (San Jose)



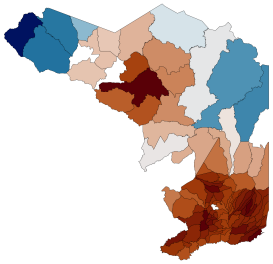
(a) Admin. Services



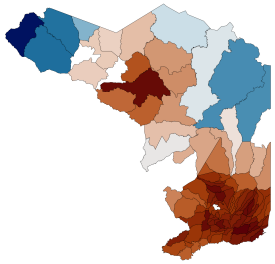
(b) Comp. Programming



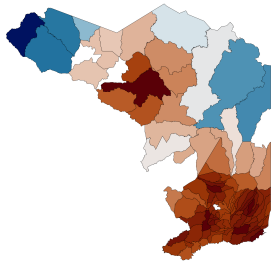
(c) Call Centers



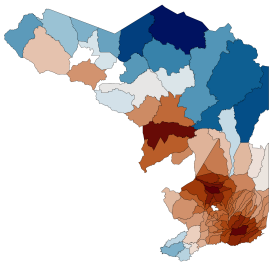
(d) Comp. Consultancy & Mgmt.



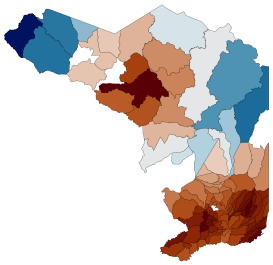
(e) Manu. of Medical Instruments



(f) Architectural & Engineering

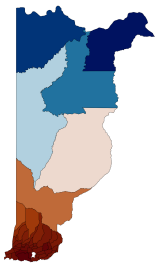


(g) Materials Recovery

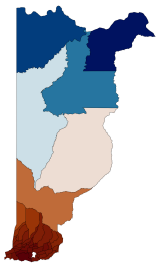


(h) Data Processing

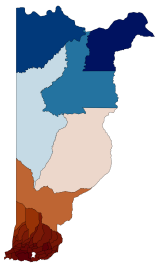
Figure A14: MNC Presence Index (Alajuela)



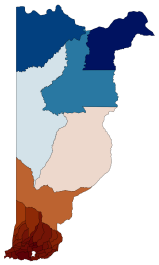
(a) Admin. Services



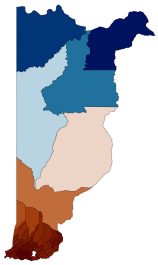
(b) Comp. Programming



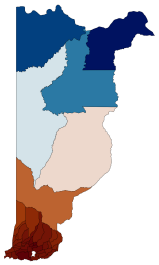
(c) Call Centers



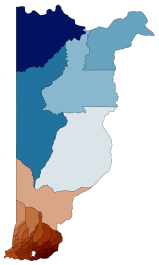
(d) Comp. Consultancy & Mgmt.



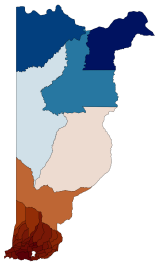
(e) Manu. of Medical Instruments



(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.

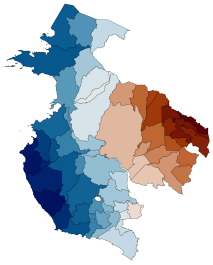
(e) Manu. of Medical Instruments

(f) Architectural & Engineering

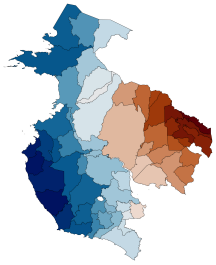
(g) Materials Recovery

(h) Data Processing

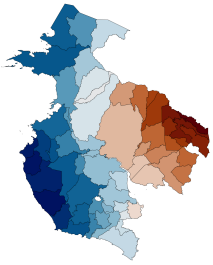
Figure A16: MNC Presence Index (Puntarenas)



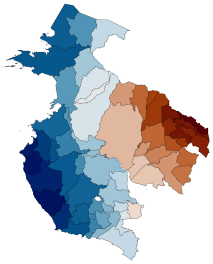
(a) Admin. Services



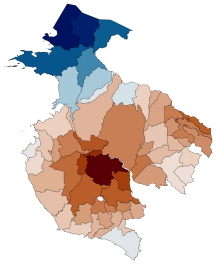
(b) Comp. Programming



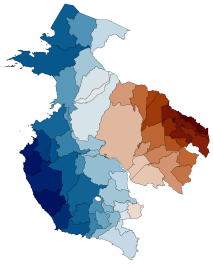
(c) Call Centers



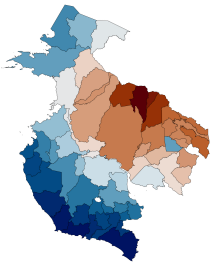
(d) Comp. Consultancy & Mgmt.



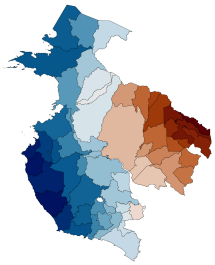
(e) Manu. of Medical Instruments



(f) Architectural & Engineering

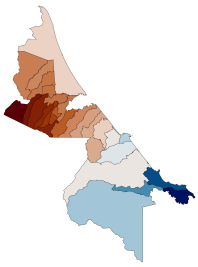


(g) Materials Recovery

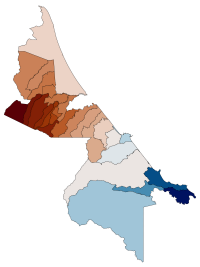


(h) Data Processing

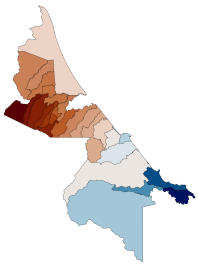
Figure A17: MNC Presence Index (Guanacaste)



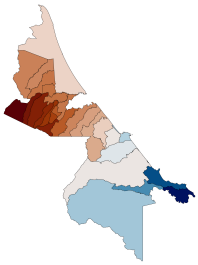
(a) Admin. Services



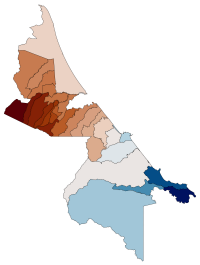
(b) Comp. Programming



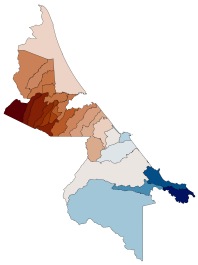
(c) Call Centers



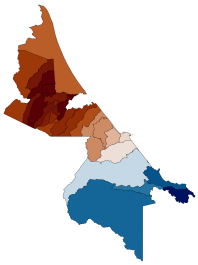
(d) Comp. Consultancy & Mgmt.



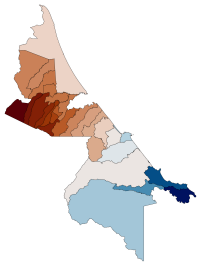
(e) Manu. of Medical Instruments



(f) Architectural & Engineering



(g) Materials Recovery



(h) Data Processing

Figure A18: MNC Presence Index (Limon)

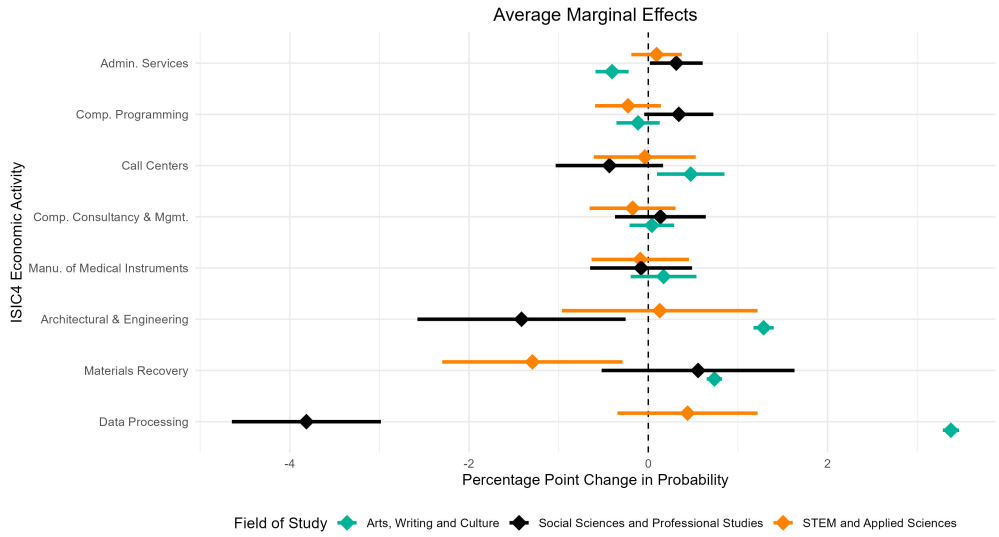


Figure A19: Marginal Effects by Each ISIC4 Economic Activity

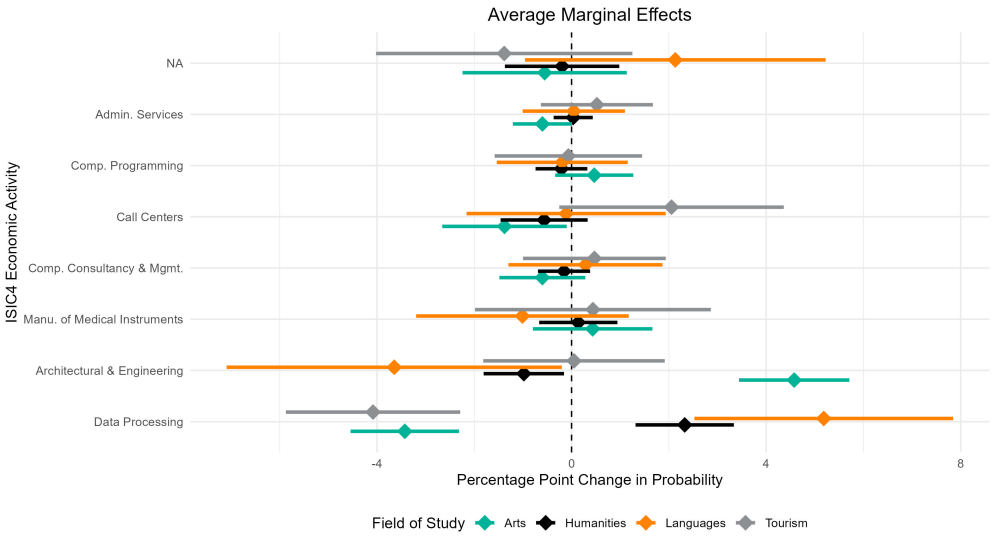


Figure A20: Arts, Writing and Tourism AMEs

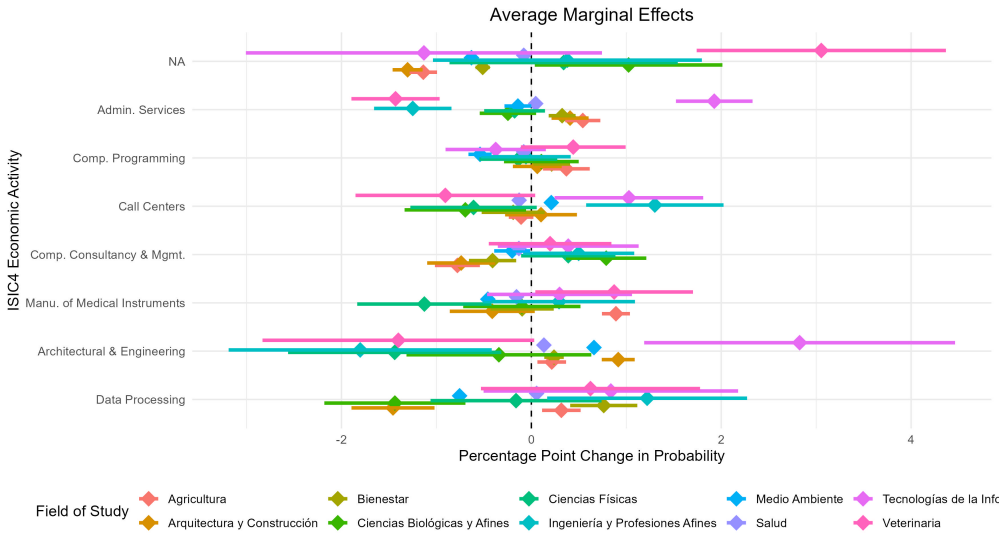


Figure A21: STEM and Applied Sciences AMEs

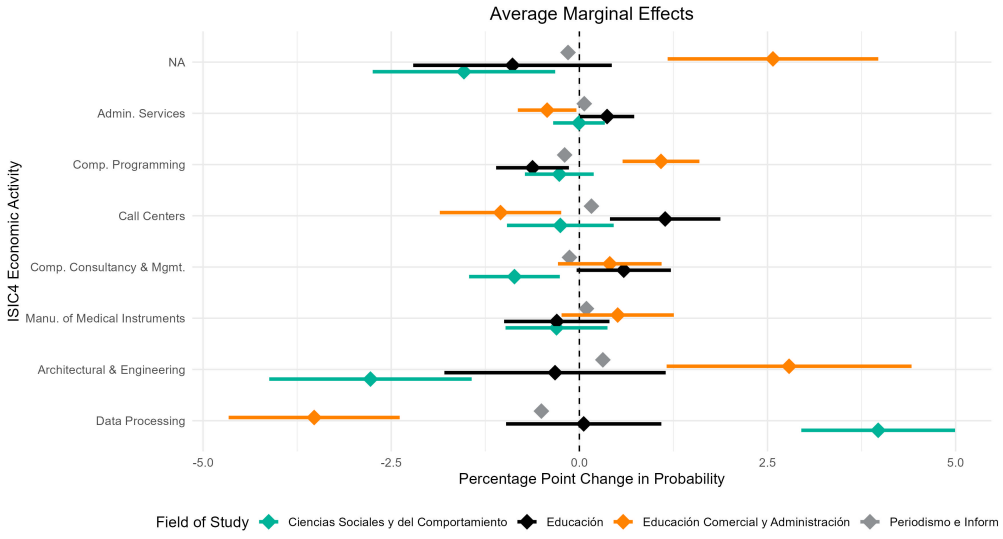


Figure A22: Social Sciences and Professional Studies