ESSAYS ON THE ECONOMICS OF IMMIGRATION AND INTERGENERATIONAL MOBILITY

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ESSAYS ON THE ECONOMICS OF IMMIGRATION AND INTERGENERATIONAL MOBILITY

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Despite a substantial amount of research carried out over the past few decades to understand the economic impact of immigration and the determinants of intergenerational mobility, many important questions remain unanswered. Taking advantage of recently available large-scale administrative, household, and firm data, as well as latest developments in causal inference techniques, this dissertation makes forays into three relatively uncharted research areas on these topics.

On the economic impact of immigration, the first chapter examines demand-side effects on local labor markets and firms—effects that arise not from an increase in immigration-induced local labor supply, which has hitherto been a focal point in the immigration literature, but from an increase in consumption-induced demand for local goods and services. To isolate these effects, the empirical analysis focuses on the growing presence of international students in the United States, most of whom are not able to undertake paid employment throughout their courses of study but have been generating a substantial amount of spending in local economies surrounding universities and colleges. Using a shift-share instrumental variable estimation approach and, in particular, quasi-experimental variation drawn from fluctuations in the outflows of students across countries of origin to other English-speaking destinations, I show that international students lead to substantial increases in local jobs and earnings: one additional student per thousand residents increases the employment-to-population ratio by 0.31 percentage points and average wages by

0.69 percent. These effects are concentrated in non-tradable industries, particularly in construction, retail, and services. Furthermore, local demand shocks induced by an increase in international student enrollment result in significant within-industry labor reallocations as more efficient firms are created and expand while the least efficient ones contract and exit. These results are consistent with general equilibrium models with heterogeneous firms and highlight important economic benefits from international students in the form of increases in local income and aggregate productivity.

On intergenerational mobility, the second chapter studies the importance of intra-household bargaining in mediating how family resources determine children's participation in higher education. Using labor force and household survey data from Indonesia, this chapter shows evidence consistent with Nash-bargaining models of household decision making, whereby changes in women's outside options relative to men's result in more decisions made within the household by women, especially those related to expenditures on children. Accordingly, relative improvements in women's bargaining power when children graduate from high school significantly increase their likelihood of university enrollment, holding household resources and children's ability indicators constant. This effect is quantitatively similar for both boys and girls.

The third and final chapter further examines risk aversion as one of the sources of within-household differences in parental demand for children's higher education. Consistent with the documented evidence of a non-unitary model of household decision-making, I find that both fathers' and mothers' risk aversion significantly decrease children's tendency to enroll in higher education, although the effects depend critically on the distribution of intra-household bargaining power. Furthermore, parental risk aversion also affects children's labor market entry upon

high school graduation. Overall, these findings highlight the roles of parental risk preferences and intra-household bargaining dynamics as important mechanisms that contribute to intergenerational persistence in economic outcomes.

BIOGRAPHICAL SKETCH

Tung Dang is a Ph.D. candidate at the Charles H. Dyson School of Economics and Management at Cornell University. He was born and raised in Hanoi, Vietnam.

Prior to his doctoral training at Cornell, Tung attended Green Mountain College, a small liberal arts college in Vermont, where he self-designed his major in mathematics and economics.

He enjoys playing classical guitar and translating books. He is the translator behind the Vietnamese editions of Alvin E. Roth's *Who Gets What and Why* (Tri Thuc Publishing House, 2017) and David S. Evans and Richard L. Schmalensee's *Matchmakers: The New Economics of Multisided Platforms* (joint with Chi Tran; The Gioi Publishers, 2019).

To my family.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

THE LOCAL ECONOMIC IMPACT OF INTERNATIONAL STUDENTS: EVIDENCE FROM US COMMUTING ZONES

1.1 Introduction

Despite the rising costs of higher education, enrollment of international students in the United States has increased substantially over the past few decades. Rapid economic growth, particularly in China and many other emerging economies, has led to a remarkable surge in the number of students who can afford an education overseas (Bound et al. 2020; Bound et al. 2021; Khanna et al. 2020). Indeed, as Figure 1.1 demonstrates, the rise in the number of self-funded students accounted for almost all of the growth in international student enrollment in US higher education in recent years. Besides generating more tuition and fee revenue for the higher education sector, such changes in both the number and composition of students from abroad could fuel demand for local goods and services and result in potentially substantial economic impacts on local economies.[1]

In this chapter, I examine the short-run effects of international students on local labor markets and firms. My empirical analysis is motivated by the predictions of general equilibrium models with heterogeneous firms, whereby demand shocks induced by international students result in not only a net increase in local labor demand but also within-industry reallocations of resources towards high-productivity firms (Melitz 2003; Melitz and Ottaviano 2008; Bernard, Redding, and

[1] Foreign students generated $47.3 billion in higher education revenue alone in 2018, almost equivalent to US export of passenger cars in the same period (Bureau of Economic Analysis 2020).

Schott 2007).[2] Specifically, increases in local demand and profitability will likely stimulate entry as well as expansion among the more efficient incumbents, which increase the demand for labor. Since US visa policy prevents foreign students from working throughout their courses of study, the surge in labor demand may not be compensated by an increase in local labor supply, which then bids up real wages.[3] Higher labor costs, together with a potentially greater number of competitors in the product market, force the least efficient firms to contract or exit. Thus, an increase in international student enrollment could potentially improve local aggregate productivity through a reshuffling of labor and market share towards firms that are more capable of taking advantage of the induced local demand shocks.

Using several sources of data and the concept of commuting zones to approximate local labor markets, I find evidence consistent with these theoretical predictions. At the heart of my analysis is a large set of administrative data covering the universe of international students enrolled in US higher education between 2001 and 2015. The richness of the data allows me to overcome two empirical challenges. First, because I observe detailed information on each student's program of study, including school location, program level, start and end dates, I can measure precise enrollment in an area in a year and utilize the spatial variation in the distribution of international students across geographic locations to study their local impact. Second, I take advantage of available information on students' countries of origin to implement a shift-share instrumental variable estimation approach. As with other studies in the immigration and trade literature, a major concern with the spatial correlation approach is the existence of unobserved pull factors that may influence

[2] For recent reviews of models of trade that incorporate firm heterogeneity, see Bernard et al. (2007) and Redding (2011).

[3] There are a few exceptions. International students can engage in on-campus work study and some forms of off-campus training opportunities that are related to their areas of study.

both foreign enrollment and local labor market outcomes. Bound et al. (2020), for example, show that declines in state support for higher education forced public research universities to adjust by increasing the enrollment of international students. If foreign enrollment responds positively to an economic recession due to such local pull factors, OLS estimates of the effects of international students on local labor markets and firms could be severely biased downward.

To overcome identification challenges, I take advantage of fluctuations in the outflows of international students across countries of origin into other top English-speaking destinations, including Australia, Canada, and the United Kingdom, to isolate the supply-push components of changes in US enrollment. I combine these shocks with the tendency of students to apply to programs where others from the same countries of origin have attended to generate quasi-experimental variation across commuting zones. Through a series of balancing tests, as examined in section 1.3, I empirically show that the variation in international student enrollment predicted by my instrument is uncorrelated with underlying changes in local economic conditions.

In section 1.4, I combine administrative data on international students with data from the American Community Survey to examine the impact of an increase in enrollment on local labor demand. My results suggest that the presence of international students between 2005 and 2015 led to substantial increases in local employment and earnings: at the commuting zone level an increase in enrollment by one student per thousand residents raises the employment-to-population ratio by 0.31 percentage points and average hourly wages by 0.69%. These effects are economically large, and indicate that the growth in the number of foreign students in the US over this period has led to the creation of over 1.9 million jobs, an increase in employment equivalent in magnitude to more than 80% of the rise in import

competition from China (Acemoglu et al. 2016; Abraham and Kearney 2020). In line with expectations, I find that increases in local labor demand are concentrated entirely in the non-tradable sector, particularly in construction, transportation, retail, and services. Improved labor market opportunities are observed across different types of workers, with slightly larger effects among college-educated individuals.

In section 1.5, I use additional longitudinal establishment-level employment and sales data from the Your-Economy Time Series database, which covers the universe of establishments in the US between 2004 and 2017, to study the effects of international students on local firm dynamics. I show that the net local employment responses conceal significant gross job creation as well as job destruction across all margins. While there is a modest reallocation of labor away from agriculture, mining, and manufacturing, most of the observed turnover takes place within retail and services. In addition, I use the average annual sales growth rate as a measure of establishment performance and show evidence consistent with the predictions of a general equilibrium model with heterogeneous firms, whereby job creation is driven by entries as well expansions among the most efficient establishments and job destruction by exits and contractions among the least productive ones. These results suggest that the recent growth in the export of US educational services might also have led to local aggregate productivity gains through an increase in product and labor market competition.

My findings contribute to three strands of literature. First, on the economic impacts of international students, this chapter takes a first step towards systematically assessing the broader effects of foreign enrollment on local labor markets and firms. I examine both overall effects and distributional consequences of an increase in enrollment through the lens of a general equilibrium model with heterogeneous firms. I take advantage of large-scale administrative data and an

instrumental variable estimation approach that together address several identification challenges that arise due to the endogenous spatial distribution of foreign students. By contrast, existing studies in this literature have typically focused on the higher education sector, where the examined outcomes include school finance (e.g., Bound et al. 2020), domestic enrollment (e.g., Shih 2017; Zhu 2021), and academic innovation (e.g., Chellaraj, Maskus, and Mattoo 2008; Stuen, Mobarak, and Maskus 2012).

Second, this chapter contributes to the broader debate on the economic consequences of immigration by providing direct evidence on the positive effects of immigrant consumption on natives' labor market outcomes. Much of the discussion in this area has focused exclusively on the potentially negative impact of an immigration-induced labor supply shock and neglected the fact that, through spending on non-tradable goods and services, immigrants could also stimulate local labor demand.[4] I document these demand-side effects by studying a large and growing group of foreign-born individuals in the US that cannot participate in the labor market in the short term due to visa restrictions. To the extent that these effects can compensate for an increase in local labor supply, the results presented in this chapter provide a short-run explanation as to why a large number of empirical studies have found relatively small overall effects of immigrants on natives' employment and wages.[5]

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[4] Some exceptions exist. Bodvarsson, Van den Berg, and Lewer (2008) examine the 1980 "Mariel boatlift" and find strong increases in spending and labor demand in Miami's retail sector following the massive, sudden influx of Cuban immigrants. Dustmann, Schönberg, and Stuhler (2017) suggest that when the demand channel is suppressed, such as in the case of Czech workers who commuted across the Germany-Czech border to work and did not live and consume in affected areas, an immigration-induced increase local labor supply could lead to significant negative effects on natives' employment and wages in the short-run.

[5] For a recent, comprehensive review of this literature, see Blau and Kahn (2015), Dustmann, Schönberg, and Stuhler (2016), and Blau and Mackie (2017).

Third, my findings also contribute to current understanding of how demand shocks affect firm dynamics. Such inquires have been a major focus of the recent empirical literature in international trade, which seeks to incorporate heterogeneity in firm productivity and firm-level decisions. For example, Pavcnik (2002) and McCaig and Pavcnik (2018) document substantial increases in aggregate manufacturing productivity in Chile and labor reallocation from informal household businesses to formal manufacturing firms in Vietnam, respectively, following trade liberalization. In the contexts of developed countries such as Canada and the US, Trefler (2004) and Bernard, Jensen, and Schott (2006) similarly document evidence of market and resource reallocations favoring high-productivity plants in response to tariff or trade costs reductions. By utilizing detailed firm-level panel data and focusing on a relatively clean source of demand shocks, I am able to directly test the theoretical predictions generated by Melitz-type models. My results suggest that these theoretical predictions, interestingly, also apply to the non-tradable sector in the presence of immigration-induced local demand shocks.

1.2 Data

This chapter draws on numerous sources of data to measure international student enrollment and characteristics, as well as individual and firm outcomes at the local labor market level. I use the concept of commuting zones developed by Tolbert and Sizer (1996) to approximate local labor markets. These geographic units represent clusters of US counties that are characterized by strong commuting ties within each cluster and have been employed to study spatial differences in local labor market outcomes at both the individual and firm levels (e.g., Smith 2012; David, Dorn, and Hanson 2013; Autor et al. 2014; Asquith et al. 2019; Acemoglu and Restrepo 2020). My

analysis focuses on 722 commuting zones that cover the entire US continental territory. In this section, I discuss data sources as well as features of each data set that are most relevant to my analysis.

1.2.1 International students

Data pertaining to international students come from administrative records and were provided by US Department of Homeland Security (DHS) via a Freedom of Information Act (FOIA) request. These records cover the universe of students on F-1 visas who ever enrolled in a higher education institution in the US between 2001 and 2015. Obtained data contain biographic information of students, including country and city of origin, as well as detailed information regarding their study program, such as school name and address, program level, and program start and end dates.[6]

I use these data to measure the size of the international student population in each commuting zone in each year. Specifically, based on program start and end dates, I construct international enrollment in a commuting zone-year to be the total number of international students enrolled in a postsecondary institution within that commuting zone for any portion of the year. Although the obtained administrative data cover the universe of the international student population of interest, there are some limitations that could lead to concerns about measurement error. For example, there's no information regarding students' residential addresses. To the extent that some students traveled long distance to schools and did not reside within the same commuting zones as their programs, my measure could understate the size of the

[6] As part the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, the DHS were mandated by US Congress to collect and maintain current information on all international students throughout their courses of study. Schools have the legal responsibility to submit necessary documentation to a US government electronic database called SEVIS (Student and Exchange Visitor Information System) upon admitting a student and before he or she can apply for a visa and gain entry into the US.

international student population in some locations while overstate in some others. Some students may additionally have terminated their study before the reported program end dates, either to transfer to a new program or leave the US altogether. Thus, OLS estimates of the economic impacts of international students could be biased due to measurement error.

As discussed in more details in the next section, I use a shift-share instrumental variable estimation strategy to address measurement error and other endogeneity issues related to the distribution of international student enrollment across commuting zones and time. This approach involves isolating plausibly exogenous variation in the inflows of students from different countries of origin into the US using postsecondary enrollment patterns observed in Australia, Canada, and the United Kingdom. Data used to measure international student enrollment in these three countries come from Australian Department of Home Affairs (DHA), Immigration, Refugees and Citizenship Canada (IRCC), and UK Higher Education Statistics Agency (HESA).

1.2.2 Natives' employment, wages, and educational attainment

I use 2005-2015 American Community Survey (ACS) data extracted from the Integrated Public Use Microsamples (IPUMS) database to construct local labor market outcomes (Ruggles et al. 2021). In each survey year, I restrict my sample to non-institutionalized natives not living in group quarters. In some robustness checks, I also further restrict my sample to individuals living in their state of birth in order to minimize concerns about natives' migratory responses (Blanchard et al. 1992; Bound and Holzer 2000; Cadena and Kovak 2016; Monras 2020; Notowidigdo 2020). To construct outcomes, I assign individuals to commuting zones using information on

county of residence, which exists for over half of the sample extracted from IPUMS. To assign commuting zones to the rest of the sample, for whom county identifiers are not available, I rely on Public Use Microdata Area (PUMA) information and a statistical procedure implemented by Smith (2012) and David and Dorn (2013). This procedure, which results in consistent estimates of outcomes, involves duplicating observations whose PUMAs are overlapped with multiple commuting zones and re-weighting each of these observations by the respective fraction of a PUMA population that lives within each commuting zone.

I focus on the employment-to-population ratio and average hourly wages of the working-age population (16-64) as the main labor market outcomes. Hourly wages are computed by dividing total wage and salary earnings in the previous year by the product of weeks worked and the usual number of hours per week. As in David and Dorn (2013), hourly wages are set not to exceed top-coded yearly earnings divided by 50 weeks times 35 hours, while hourly wages below the first percentile of the sample's distribution are set to the value of the first percentile. All wages are deflated to the year 2005 using the Bureau of Labor Statistics's Consumer Price Index.

In addition to employment and wages, I also examine whether changes in labor market opportunities induced by international students may affect natives' incentives to invest in education, particularly the decisions to attend college by young adults (Charles, Hurst, and Notowidigdo 2018). For this analysis, I use administrative survey data from the Integrated Postsecondary Education System (IPEDS). For each commuting zone, I calculate the total number of first-time, first-year, degree-seeking domestic students enrolled in the fall, looking separately at the two-year and four-year levels.[7] I then divide these numbers by the size of the local 18-25 adult population in each year to get a measure of enrollment per capita.

[7] Following the literature, I define four-year institutions to be any college or university that offers a four-year degree, while two-year institutions are those that offer two-year degrees but not higher.

Data to estimate commuting zones' population in each year come from the Survey of Epidemiology and End Results (SEER). As discussed in section 1.3, I also use data from the ACS to construct a large set of control variables at the commuting zone level.

1.2.3 Firm dynamics

I use annual establishment-level data from Your-Economy Time Series (YTS) database to construct measures of job flows. Maintained by the Business Dynamics Research Consortium (BDRC) at the University of Wisconsin, the database tracks all in-business establishments at their unique locations across the US between 1997 and 2018. This sample includes all establishments that are conducting or intent on conducting commercial activities, including for-profit, non-profits, and government establishments.[8] Detailed information, including an establishment's name, location (e.g., zip-code), industry affiliation, number of employees, and sales, is collected from each location in each year and linked longitudinally to assemble time series.

For the purpose of my analysis, I restrict my sample to all for-profit establishments that were in operation at some point between 2004 and 2016. Following Asquith et al. (2019), I further exclude all establishments that had less than two employees throughout this period to avoid non-employer businesses. Based on this sample, I construct different job-flow components, i.e. changes in job creation due to firm entry and expansion and job destruction due to firm exit and contraction, at the commuting zone level. In addition, I also use information on industry affiliation and sales to conduct heterogeneity analysis by industry and establishment-

[8] Entities that do not conduct commercial activities and therefore excluded from the YTS database include those created for tax purposes and holding companies. For more description of the database, see https://wisconsinbdrc.org/data/

level productivity. Further details behind variable construction are discussed in section 1.5.

Before moving on to the next section, I briefly discuss the reliability of YTS data. Appendix Figure A1 presents a scatterplot of the relationship between YTS and the ACS in terms of total commuting zone employment over the 2005-2016 period. The correlation coefficient between the two sources is 0.996, indicating a high level of reporting accuracy of the YTS data. As further discussed in section 5, both data sources yield almost identical estimates on the effects of international student enrollment on net changes in employment at the commuting zone as well as commuting zone-industry level. Nonetheless, my results on firm dynamics should be viewed as a first step towards dissecting the effects of international students on US local labor markets in the context of a general equilibrium model with heterogeneous firms, and would likely benefit from future validations using other sources of data, such as Census's Longitudinal Business Database.

1.3 Empirical methodology

Although the number of international students in the US has been steadily rising, there is considerable variation in the distribution of students across commuting zones over the 2005-2015 period. Table 1.1 tabulates top ten commuting zones with the largest number of international in 2005 and 2015. Consistent with the findings of Ruiz (2014), these cross-sectional patterns indicate that international students tend to have a stronger presence in metropolitan areas with high concentrations of universities and colleges. Table 1.2 provides additional summary statistics on enrollment at various points along the distribution of international students across commuting zones. As shown, areas that were popular to students in

2005 were also more likely to experience strong growths in enrollment throughout the period. My empirical analysis exploits this spatial variation to examine the effects of international students on local labor markets and firms. In this section, I first describe the estimation equation and discuss challenges to identification. I then introduce an instrumental variable estimation approach that aims at addressing these issues and provide evidence that supports the validity of this approach before presenting results and discussing their implications in the next sections.

1.3.1 Estimation equation

To examine local labor market and firm responses to international student enrollment, I estimate specifications of the following stacked first-difference model:

$$\Delta y_{c,t+1} = \gamma_t + \beta \frac{\Delta \mathrm{IS}_{c,t}}{\mathrm{Pop}_{c,t-1}} + \Delta X'_{c,t}\Gamma + \Delta \epsilon_{c,t} \quad (1)$$

where $t \in [2006,2015]$, $\Delta z_t = z_t - z_{t-1}$, and γ_t denotes a vector of year fixed effects. The main explanatory variable of interest, $\Delta \mathrm{IS}_{c,t}/\mathrm{Pop}_{c,t-1}$, is the period change in the number of international students enrolled in a postsecondary institution in commuting zone c normalized by the size of the commuting zone's population at the beginning of the period. This specification thus allows the effects of changes in international student enrollment to vary by the size of the local economy while avoids the potential pitfalls that arise when there are changes in the local population

due to migratory responses by natives.[9] Furthermore, the lag structure of the independent variables accommodates a short delay before the effects of international students on workers and firms can be captured in survey data.

Since I estimate my econometric model in stacked first differences, any unobserved time-invariant heterogeneity across commuting zones will be removed without imposing more restrictive assumptions on the error structure.[10] To further account for potentially confounding changes in underlying local economic conditions, I include a large set of covariates, X_{ct}, that control for changes in the local population composition. These include changes in log population; the share of females; the shares of the population by age (16-34, 35-49, 50-64, and over 65), and education (no college, some college, college or professional degree, and advanced degrees); the share of employed adults that are foreign born; and the share of the population employed in manufacturing. All regressions are weighted by commuting zone population in 2005.

1.3.2 Identification challenges

The main difficulty in estimating β, which captures the short-term effects of international students on local labor markets and firms, is to account for bias associated with the potentially endogenous distribution of international students across commuting zones and time. For example, enrollment by international students could be driven by negative local economic shocks. Recent studies have identified

[9] In particular, an alternative specification that has been employed in the immigration literature is to regress changes in the outcome to changes in the population share of immigrants (or international students in this case), though results will be mechanically biased if there is in-migration or out-migration by natives in response to immigrant inflows (Card and Peri 2016).

[10] A fixed-effect specification assumes no serial correlation in the error term while first-difference estimators are more efficient if the errors follow a random walk (Wooldridge 2010). In practice, I cluster standard errors on commuting zones to obtain estimates that are robust to either structure.

economic recessions and the resultant declines in state support for higher education as strong drivers of international enrollment (Bound et al. 2020; Bound et al. 2021). Bound et al. (2020) finds a 10 percent decrease in state appropriations results in a 16 percent increase in the enrollment of students from overseas at public research universities and a 22 percent increase at the more resource-intensive AAU institutions. To the extent that areas hardest hit by a recession also experienced the sharpest declines in state support for higher education, OLS estimates of the effects of international students on local economies will be downward biased.

On the other hand, the arrivals of students from abroad can also be driven by positive local labor demand shocks. A primary concern that has often plagued the immigration literature is that areas that experience stronger growth in labor demand tend to also attract more foreign-born workers. If international students are aware of these positive shocks and account for the increases in local training and employment opportunities after graduation when making enrollment decisions, OLS estimates of their effects on local economies can also be upwardly biased.

In addition to the endogenous sorting of foreign students across commuting zones, measurement error in the size of the foreign student population may further complicate identification. As mentioned in the previous section, the obtained administrative data, despite being the best data source available that tracks international students in the US, does not contain information on the actual termination date of a student's course of study. The estimated number of students that are present in a commuting zone in a year, which I construct using students' anticipated program end dates, might overstate the actual number if some students decide to leave their programs early and lead to a downward bias.

1.3.3 Instrumental variable estimation approach

To address biases resulting from the endogenous distribution of international students, I use a shift-share instrumental variable approach that isolates the plausibly exogenous, supply-driven variation in international student enrollment. I predict enrollment in the US by using the total number of students from each country of origin that enrolled in a higher education institution in three other leading English-speaking destinations—namely, Australia, Canada, and the United Kingdom—which collectively host an almost equal number of international students as does the US. The average pairwise correlation coefficient between the flows of students into the US and in these three destinations over the 2005-2015 period across different countries of origin is about 0.7, which suggests the existence of a common set of factors that exert strong influences on the total supply of students who wanted to study abroad from each source country. These could be underlying changes in demographics, family income, and institutional background within each source country. Indeed, Khanna et al. (2020) shows that the rise in the number of international students from China, which accounted for much of the global increase in international student enrollment, was largely driven by growth in family income and therefore students' ability to afford an education abroad. Hence, fluctuations in the number of international students studying in Australia, Canada, and the U.K are strong predictors of the realized changes in international student enrollment in the US from each country of origin, but are arguably not related to pull factors that arise from changes in local economic conditions in the US. Furthermore, students from each country of origin tend to apply to the same programs that previous cohorts have attended (Beine, Noël, and Ragot 2014; Shih 2017). Accordingly, this network tendency causes supply shocks from each source country to have differential effects across US commuting zones that vary with the strength of the network.

To implement these ideas, I construct my instrument by interacting the distribution of international students by country of origin across commuting zones at the beginning of the century with period changes in total enrollment from each country of origin in Australia, Canada, and the UK. Let k denote a country of origin, the predicted change in enrollment in commuting zone c from $t-1$ to t is taken as

$$\widehat{\Delta \text{IS}}_{ct} = \sum_{k} \frac{\text{IS}_{c,k,2001-2002}}{\text{IS}_{k,2001-2002}} \times \Delta \text{IS}_{t}^{\text{Australia, Canada, UK}} \tag{2}$$

where $\Delta \text{IS}_{t}^{\text{Australia, Canada, UK}}$ is the period change in enrollment of international students from country k in the three mentioned destinations. The share component, $\frac{\text{IS}_{c,k,2001-2002}}{\text{IS}_{k,2001-2002}}$, is the fraction of students from country k that ever enrolled in a US higher education institution in commuting zone c within the 2001-2002 period.[11] This instrumental variable estimation approach is thus very similar in spirit to a growing number of studies in the immigration and trade literature that utilize supply-push factors as shift components (Card 2001; Stuen, Mobarak, and Maskus 2012; David, Dorn, and Hanson 2013; Peri, Shih, and Sparber 2015; Shih 2017; Monras 2020; and Derenoncourt 2022).

1.3.4 Validity of the instrument

In order for the instrumental variable estimation approach to work, the constructed shift-share instrument must satisfy the relevance and exclusion restrictions. Here, I

[11] I pool data from 2001 and 2002 to increase the sample size and the precision of the share estimates, though my results remain quantitatively similar if I only use enrollment patterns in 2001.

address these two criteria before briefly discussing issues related to statistical inference.

Relevance Restriction.—As mentioned in the previous subsection, there is a strong correlation between changes in international student enrollment across countries of origin between the US and the other three English-speaking destinations. In a simple regression, yearly changes in combined total enrollment in Australia, Canada, and the UK explain about two thirds of the variation in the changes in enrollment in the US across all countries of origin between 2005 and 2015. Figure 1.2 depicts the first-stage relationship between the predicted and actual changes in international student enrollment, both adjusted by start-of-period commuting zone population, via a binned scatterplot. The obtained F-statistic is 54.02, suggesting that my instrument provides an adequate source of identifying variation.

Exclusion restriction.—Recent work by Borusyak, Hull, and Jaravel (2022) shows how identification can be achieved in this setting. In particular, with many periods as well as a large number of shocks per period, the shift-share IV estimates are shown to be numerically equivalent to those obtained by fitting transformed, shock-level regressions in which both outcomes and treatments are weighted by the shares while the shifts serve directly as instruments for the weighted treatment variable. Consequently, a shift-share strategy will result in consistent estimates if the shocks are idiosyncratic with regards to a share-weighted average of unobserved factors that determine the outcomes, a condition that would hold in this setting if shocks to enrollment of international students observed in Australia, Canada, and the UK are indeed unrelated to changes in local economic conditions in the US, regardless of whether variation in the share component is endogenous.

To assess the validity of the identification assumption, I conduct a series of balancing tests that regress past changes in local economic conditions on the actual

and predicted contemporaneous changes in international student enrollment. The results of these exercises are presented in Table 1.3. In columns 1 and 2, I look at commuting zone level changes in state appropriations per public full-time equivalent domestic student. As shown, there is a negative and strongly significant correlation between state support for higher education and enrollment of students from abroad. This is consistent with recent studies that documented strong increases in foreign student enrollment at public research institutions in response to declines in state funding after a recession (Bound et al. 2020; Bound et al. 2021). On the other hand, the obtained IV estimate is much smaller in magnitude and not statistically significant. Since declines in state funding for higher education are one of the major "pull factors" of international student enrollment, these results suggest that the supply-driven variation in international student enrollment being isolated by the instrument is indeed not correlated with changes in local economic conditions.

Although international students are not allowed to work in the short-run, those who have graduated may try to stay and look for work in the same local areas as their colleges and universities, and thereby change the composition of the local workforce. Ruiz (2014) documents that about 45 percent of foreign students who engaged in temporary post-graduation employment through Optional Practical Training (OPT) between 2008 and 2012 remained in the same metropolitan area as their study programs. To address this concern, I look at past changes in the share of employed adults that are foreign-born and have some college education in columns 3 and 4. The obtained OLS estimate is positive, though weakly significant, suggesting that areas that experienced strong increases in international student enrollment also tended to have a larger supply of college-educated foreign workers. On the other hand, IV estimate is close to zero and not statistically significant.

In columns 5-8, I examine past changes in commuting zone employment and wages as the outcomes. OLS estimates are positive and significant for employment (column 5) but negative and significant for wages (column 7), which suggest that that direction of bias can be ambiguous. Nevertheless, these estimates make intuitive sense in light of the previous results, as changes in international student enrollment could be driven by negative economic shows while simultaneously increase the share of college-educated foreign workers in the local labor force. Reassuringly, IV estimates in columns 6 and 8 are close to zero and statistically insignificant. Taken together, these results reinforce the notion that the constructed shift-share instrument is isolating short-run supply-induced variation in enrollment of international students that is not confounded by underlying changes in local economic conditions.

Statistical inference.—Recent work by Adao, Kolesar, and Morales (2019) suggests that a shift-share instrumental variable approach, such as the one used in this setting, may yield standard errors that are too conservative if regression residuals are correlated across commuting zones with similar shares. To explore the robustness of my standard errors, I use a randomization inference method developed by Borusyak and Hull (2020). The method consists of a series of tests where I permute observed changes in international students enrollment outside the US and re-estimate equation 1 using these permuted shocks to construct the instrument. I repeat this procedure 1,000 times and obtain a two-sided p-value of 0.062 for employment and 0.004 for wages, indicating that conventional clustered standard errors are unlikely to suffer from over-rejection in this setting.

1.4 Effects of international students on local employment and wages

In this section, I quantify the impacts of international student enrollment on local labor markets. I first focus on overall employment and wage effects, then examine heterogeneity across industry and types of workers to shed light on the nature of labor demand shocks that may take place due to potential surges in local consumption generated by international students. To conserve space, I only report OLS and IV estimates on the main outcomes. While OLS estimates generally have the same signs as their IV counterparts, only the latter are economically and statistically significant across specifications. This is in line with recent studies as well as the evidence discussed in the previous section, which suggest that international enrollment tends to be countercyclical: declines in local economic conditions and particularly state funding for higher education increase local reliance on tuition revenue from abroad and, consequently, enrollment of international students (Bound et al. 2020; Bound et al. 2021).

1.4.1 Overall employment and wage effects

Table 1.4 reports regressions of changes in the employment-to-population ratio and (log) average wages on changes in international student enrollment per capita. Panel A presents overall results, while panel B and C look at outcomes of men and women, respectively. Columns 1 and 2 show that increases in foreign enrollment have a positive and statistically significant impact on local employment. OLS estimates suggest that an increase in enrollment of one student per thousand residents would lead to a 0.8 percentage point increase in the overall employment-to-population ratio on average, with similar effects on both men and women (increases of 1.1 and 0.5 percentage points, respective). The corresponding IV estimates are 3.1, 3.3, and 2.8 percentage points and are all significant at the 1 percent level. To contextualize the

economic impact of international students on local employment, I multiply the obtained IV coefficient with observed period changes in enrollment, then add up the results over the 2005-2015 period. Accordingly, the overall increase in international student enrollment during this period may have resulted in the creation of 1.3 million jobs in total. This effect is equivalent in magnitude to about 59% of the displacement effect of the increase in import competition from China over the 1999-2018 period, and is thus economically substantial (Acemoglu et al. 2016).

Columns 3 and 4 examine the local labor demand effects of international students in terms of changes in average wages. As before, both OLS and IV results are positive and strongly significant, though the IV estimates are much larger in magnitude. The preferred IV specifications suggest that one additional international student per thousand residents would increase average wages by 6.9 percent overall, and 6.2 and 7.9 percent for men and women, respectively.

Given the large effect of international students on local employment, some portion of the observed increase in average wages may reflect changes in the composition of local workers rather than the increased returns from working. To address this issue, I consider alternative measures of wages that have been used recently in the literature. These include wages adjusted by the probability of employment (Charles, Hurst, and Notowidigdo 2018; Notowidigdo 2020), residualized wages (Notowidigdo 2020), and wages computed at the commuting zone-demographic level (Acemoglu and Restrepo 2020). Column 5 and 6 present results using the changes in average wages adjusted by the probability of employment. Both OLS and IV estimates are economically large and statistically significant at the 1 percent level, suggesting that most of the observed effect on local wages due to increases in international enrollment does reflect increases in local labor

market opportunities. Estimates using the rest of the alternative measures of wages also support this conclusion and are tabulated separately in the appendix.

1.4.2 Effects by industry

Which industries are most likely to benefit from the increases in local demand generated by international students? Construction is a natural candidate, given the increase in housing needs that would stimulate the construction and renovation of rental apartments. Furthermore, spending on personal items, groceries, entertainment, and social gatherings, on top of education and healthcare, should also contribute to labor demand in retail, transportation, and local services.

Figure 1.3 shows the effects of international students on local employment, both overall and separately for men and women, in different industries. I provide estimates and confidence intervals for IV specifications that are similar to column 2 of Table 1.4, with the outcomes in this case being changes in the industry-specific employment share of the population. Consistent with my hypotheses, construction accounts for a major portion of the impact of international students on local employment. The IV estimate suggests that an increase of one additional international student per thousand residents leads to a 0.13 percentage point increase in the share of population employed in construction. The remaining portion of the employment effect can be attributed to retail and personal services (0.13 points), education and healthcare (0.11 points), professional and technical services (0.08 points), and transportation and warehousing (0.04 points). Note that the combined increase in employment share in these sectors exceeds the net overall effect of international students on local employment. This is because increases in international student enrollment appear to result in some inter-industry reallocation of labor,

particularly from agriculture and manufacturing.[12] Overall, these results are consistent with the existence of positive local labor demand shocks, especially among non-tradable industries, induced by increases in international student enrollment and, consequently, local consumption.

1.4.3 Effects by education and age

Figure 1.4 summarizes the effects of international students on local employment by workers' education. The observed patterns of labor demand shocks across industries suggest that both college- and non-college-educated workers would experience increases in labor market conditions. In particular, positive labor demand shocks in education, healthcare, professional, and business services, which collectively employ almost half of workers with a college degree, should lead to substantial increases in employment and wages among college-educated workers. Likewise, changes in labor demand in construction, retail, and personal services should also result in improved opportunities for non-college workers, though the net increase in employment and wages among this group could be smaller due to the a slight contraction in agriculture and manufacturing.

Consistent with these expectations, IV estimates indicate positive and statistically significant effects of international students on employment and wages of both non-college and college-educated workers, with slightly larger effects among the latter group. In addition to some reallocation of labor across industries, particularly from agriculture, mining, and manufacturing to services, several mechanisms could explain the slightly smaller net effects of international students on employment and wages of non-college natives. In section 5, I show that increases in

[12] I discuss the effects of international students on between-industry and within-industry labor reallocations in detail in section 1.5.

international student enrollment raise the rate of creative destruction in the service sector and lead to substantial within-industry labor reallocations towards the most productive firms. To the extent that these firms employ a relatively higher share of skilled workers (Engbom and Moser 2017) or that more educated workers face substantially lower adjustment costs (Dix-Carneiro 2014), such reallocations could contribute to the higher labor demand increase among college-educated natives. Furthermore, in a companion working paper, I show that increases in international student enrollment also result in labor supply adjustments among young natives, whereby improvements in local labor market opportunities reduce first-time, full-time enrollment of natives at public, two-year colleges. A summary of these results is provided in Appendix Table A1. Accordingly, the endogenous labor supply adjustments of natives towards labor force participation and away from college training could also offset the initial effects of international students on non-college workers' employment and earnings.

Figure 1.5 presents the employment and wages impacts across different age groups. I consider young (16-34), middle-age (35-49), and older workers (above 50). These results indicate that increases in international student enrollment have uniform effects on employment and wage outcomes across these three groups of workers.

Overall, the broad pattern of results discussed in this section provides strong evidence for the existence of positive local labor demand shocks induced by increases in the enrollment of international students. These shocks are concentrated in the non-tradable sector, but are substantial across different types of workers. Given these strong boosts in local jobs and income, one might be tempted to conclude that most workers and firms are "winners" following a surge in local enrollment of students from overseas. Do international student inflows result in distributional consequences, if any? To answer this question, I analyze the impact of international students on

local job flows in the context of a Melitz-type general equilibrium model with heterogeneous firms. Before moving on to the next section, I briefly discuss the robustness of the main results presented in this section to alternative samples and model specifications.

1.4.4 Robustness checks

Alternative wage outcomes.—As mentioned, my baseline measure of average wages is constructed using a sample of full-year, full-time employed natives. In Appendix Table A2, I consider a less "restrictive" measure of wages based on both part-time and full-time employed workers. The corresponding IV estimate, presented in column 2, is strongly significant and slightly larger than the baseline estimate. This makes intuitive sense, as part of the labor demand shocks in construction as well as retail and personal services can be attributed to part-time workers. In addition, I also follow recent studies and consider two alternative measures of wages that are robust to compositional changes in the labor force (Acemoglu and Restrepo 2020; Notowidigdo 2020). These include average wages constructed at the commuting zone × demographic cell level, where demographic cells are defined by gender, education (non-college, college), and age (16-34, 35-49, and over 50), and average residualized wages obtained from regressing log wages on education, a quadratic in potential experience, gender, and race. Both IV estimates, presented in columns 3 and 4, are positive and statistically significant. Overall, these results suggest that the documented wage effect of international students are likely to reflect changes in the underlying returns to employment rather than changes in the composition of employed workers.

Alternative sample restrictions.— In Appendix Table A3, I assess the robustness of my baseline estimates to several alternative sample restrictions. One concern with the main results on the employment and wage effects of international students is that natives' migratory responses may counteract the initial effects of the labor demand shocks, in which case the baseline estimates may represent lower bounds of the true effects. Following Charles, Hurst, and Notowidigdo (2018), I address this concern by constructing employment and wage outcomes using a sample of natives living in their state of birth: those who are less likely to have moved across labor markets for employment reasons. Panel A presents IV estimates for this sample, which are quantitatively similar to the baseline estimates. This suggests that endogenous migration is not an overly important concern in this setting, consistent with the recently documented evidence on the low and declining mobility rates at the state as well as commuting zone level among US citizens (Basso and Peri 2020). In panels B and C, I repeat the baseline analysis but exclude either the top 10% of commuting zones with the highest number of international students or those without any international students in 2005. The corresponding IV estimates of the employment and wage effects of international students remain similarly positive and statistically significant, suggesting it's unlikely that any particular commuting zone is driving the observed results.

Alternative specifications.—Lastly, in Appendix Table A4, I consider the robustness of my baseline results to alternative specifications. In panel B, I exclude international graduate students from my constructed measure of international enrollment. The obtained IV estimates are larger than the baseline, suggesting that it is local demand shocks instead of unobserved high-skilled migration that is driving the results. In panels C and D, I drop Chinese and Indian students, respectively. Corresponding point estimates are positive and statistically significant in each case,

which indicate that my baseline results are not just capturing the local labor market effects of these two major groups of international students in the US.

1.5 Effects of international students on local job flows

In this section, I examine the effects of international students on local job flows and discuss their distributional implications. As mentioned, because of US student visa policy, international students are generally not permitted to engage in off-campus employment throughout their courses of study. An increase in enrollment would only directly affect the product market in local economies surrounding universities and colleges through demand shocks, much like an increase in "export" exposure. Following these demand shocks, trade theory with heterogeneous firms predicts an increase in firm entry as well as expansion among the most efficient incumbents. These would raise competition in potentially both the product market and the labor market, which increase residual demand price elasticities and labor costs, respectively, and subsequently force the least efficient firms to shrink or exit altogether due to a reduction in profitability (Melitz 2003; Melitz and Ottaviano 2008). Hence, to the extent that an increase in enrollment mirrors a positive export shock, albeit in the non-tradable sector, international students could lead to within-industry resource reallocations and aggregate productivity gains, though these effects cannot be observed by looking at the overall changes in local employment and wages as discussed in the previous section.

To carry out this analysis, I rely on annual establishment-level time-series data between 2004 and 2017 from the Your-Economy Time Series (YTS) database, which is compiled by the Business Dynamics Research Consortium (BDRC) within the University of Wisconsin System. As discussed in section 2, YTS attempts to track all

establishments in the US, including for-profit, non-profit, and government establishments, and provides annual establishment-level information on jobs, sales, industry affiliations, and geographic locations. Based on these data, I first calculate period net growth in employment, adjusted by the mid-point working age population, at the commuting zone level, then decompose net growth into job-flow components along both the extensive and intensive margins as follows,

$$(3) \qquad \frac{\Delta \mathrm{E}_{c,t}}{\bar{P}_{c,t}} = \underbrace{\frac{\mathrm{E}_{c,t}^{\text{entry}}}{\bar{P}_{c,t}} - \frac{\mathrm{E}_{c,t}^{\text{exit}}}{\bar{P}_{c,t}}}_{\text{Extensive margin}} + \underbrace{\frac{\mathrm{E}_{c,t}^{\text{expansion}}}{\bar{P}_{c,t}} - \frac{\mathrm{E}_{c,t}^{\text{contraction}}}{\bar{P}_{c,t}}}_{\text{Intensive margin}}$$

where $E_{c,t}^{\text{entry}}$ and $E_{c,t}^{\text{exit}}$ are gross job creation and destruction along the extensive margin due to establishment entry and exit, respectively, and $E_{c,t}^{\text{expansion}}$ and $E_{c,t}^{\text{contraction}}$ analogously defined along the intensive margin due to establishment expansion and contraction. Following Asquith et al. (2019), I define each of these four dynamics at the establishment level (e.g., the opening of a new branch by a national chain is counted towards entry) and exclude changes in commuting zone employment due to establishment relocation. Figure 1.6 shows the contribution of each job-flow component to gross job creation and destruction between 2005 and 2016. Consistent with findings from the literature, job flows along the extensive margin, i.e. due to firm establishment entry and exit, account for a major portion of the job creation and destruction processes.

Similar to my analysis in section 4, I first regress net employment growth and each of the four job-flow components in equation 3 on previous period change in international student enrollment. Later in the section, I also explore heterogeneity by

sector (tradable and non-tradable), industry, and a measure of establishment performance.

1.5.1 Overall effects on local job flows

Table 1.5 presents baseline estimates of the effects of international student enrollment on local job flows. Each reported coefficient comes from a regression where the outcome variable is either net employment growth or a job flow component. I present OLS and IV estimates of the overall effect as well as separately for non-tradable and tradable industries.

The first two coefficients of the first row of Table 1.5 reports the effects of international on overall net employment growth adjusted by the midpoint between the current period's and the previous period' size of a commuting zone population. While this outcome is different from changes in the employment-to-population ratio, which were examined in Table 1.4, both OLS and IV estimates are reassuringly very similar in magnitude to the corresponding employment effects of international students obtained in the previous analysis using ACS data (Table 1.4, columns 1-2). The preferred IV estimate is significant at the 5 percent level and suggests that an increase of one additional international student per thousand residents increases employment by 0.36 percentage points. In columns 3-6, I examine employment effects by sector. As before, the local labor market response to an increase in international student enrollment is concentrated entirely in the non-tradable sector.

Moving beyond net employment changes, the job flow regressions show that an increase in international enrollment increases the rates of job creation and destruction across all margins. In particular, international students lead to not only greater job creation through firm entry and expansion, but also greater job

destruction through firm exit and contraction. These effects are concentrated in the non-tradable sector, and are consistent with a theory of trade with heterogeneous firms that predicts substantial within-industry labor reallocation as a consequence of the opening up of the economy (Melitz 2003; Bernard, Redding, and Schott 2007; Melitz and Ottaviano 2008). To ascertain the existence of such reallocations, I next examine the effects of international students on local job flows within each industry.

1.5.2 Effects by industry

By what mechanism does a growth in international student enrollment lead to an increase in not only local job creation through firm entry and expansion but also job destruction through firm contraction and exit within a sector? As mentioned, a theory of trade with heterogeneous firms predicts that an increase in demand in an industry would raise its profitability, which, in turn, stimulates firm entry as well as firm expansion among top performers at the expense of less productive firms. Accordingly, the extent of within industry resource reallocation would likely depend on the magnitude of the demand shock as well as the cost of entry in each industry.

The results presented in section 4 using ACS data suggest that most of the effect of international students on local employment is concentrated in a small number of non-tradable industries such as services, retail, and construction. In Figure 1.6, I show that this pattern also holds for the YTS sample despite the fact that the outcome examined in this case, net employment growth, is slightly different from changes in industry employment-to-population ratio. As shown, both point estimates and the ordering of industries according to effect size closely match their counterparts in Figure 3. The robustness of these results suggests the demand shocks generated by international students indeed disproportionately benefit local retail and

services. Due to their relatively low entry costs, one would expect most of the observed increase in within-sector labor reallocation to take place in these industries as well.

Results presented in Figure 1.7 confirm these expectations: an increase in international student enrollment leads to significant increases in the rate of job creation and destruction across all margins, particularly in industries that have relative low entry costs and are most impacted by the demand shocks such as services, retail, and finance, real estate, and insurance (FIRE). To the extent that the observed increases in firm entry and expansion raise the level of competition in either the labor or product market, and subsequently force the least productive firms to shrink or exit, enrollment of international students may also lead to an increase in aggregate productivity in the short run among industries that experience increased job turnover (Melitz 2003; Melitz and Ottaviano 2008). On the other hand, international students seem to increase net employment but not turnover in construction or transportation and warehousing, potentially due to the relatively higher entry costs in these industries.

It's also interesting to note that an increase in international student enrollment seems to also lead to a slight decrease in net employment in manufacturing, as observed by both ACS and YTS estimates (figures 3 and 7, respectively). This reduction in manufacturing employment is consistent with a documented industry switching phenomenon whereby some manufacturing establishments change their industry code from manufacturing to service in response to the increase in demand in the service sector (Bloom et al. 2019). Furthermore, manufacturers facing increasing market pressure may also outsource a portion of their economic activities and thereby contribute to the reallocation of labor from manufacturing to the service sector (Berlingieri 2013). To the extent that service establishments, especially those

with higher productivity, tend to employ a higher share of skilled workers, the observed labor reallocations from other parts of the economy to the service sector as well as reallocations from less productive to more productive establishments within the sector itself may explain the larger employment responses among college educated workers, as documented in section 4.3, as a result of an increase in international student enrollment. Overall, these results paint a much more nuanced picture of the local labor market impact of international student enrollment and highlight distributional consequences that cannot be readily discerned from examining net changes in local employment.

1.5.3 Effects by firm performance

What determines the differences in firms' responses to a demand shock induced by international students? Product differentiation, in terms of location and quality, may decide how much an establishment can take advantage of increase in market size. In contrast, those with high marginal costs of production might be forced to shrink or exit as a result of increases in the number of competitors and labor costs. To the extent that such differences in firm characteristics can be summarized by a measure of performance, Melitz-type models suggest that an increase in international student enrollment would lead to expansions among the most efficient firms, and exits and contractions among the least productive. To shed light on this matter, I sort establishments within each industry in each commuting zone into four performance terciles, then examine the short-run effects of an increase in international student enrollment on aggregate job flows in each tercile.

Earlier studies in the trade literature have shown that firms that self-select into the export market tend to outperform their non-exporting counterparts along many

dimensions, including faster growth in sales and employment, years before they start exporting (e.g., Bernard and Jensen 1999). Accordingly, in the absence of data necessary to construct a measure of establishment-level productivity such as total factor productivity or value-added per worker, I rely on establishment-level growth in total sale volume, which is available for an establishment in each year it appears in the YTS data, to proxy for performance.[13] To allow comparability across establishments in each industry, I define performance of each establishment in a year to be the average annual growth rate in total sales volume, calculated using all the years in which an establishment exists in the database.[14] Specifically, the performance of establishment i is constructed as

$$\text{Performance}_i = \frac{1}{\bar{t} - \underline{t}} \sum_{j=\underline{t}}^{\bar{t}} \frac{\text{sales}_{i,j} - \text{sales}_{i,j-1}}{\text{sales}_{i,j-1}} \tag{4}$$

where $\underline{t}$ and $\bar{t}$ denote the earliest and latest year in which establishment i exists in the database, respectively. Using this measure of performance, I sort establishments within an industry in each commuting zone in each year into three terciles, and aggregate job flows in each tercile to the commuting zone-year level.

Table 1.6 reports IV estimates obtained from regressing job flows in each performance tercile on changes in international student enrollment. Column 1 first presents the overall effects of international students on job flows in the private sector, which are only slightly different from those provided in Table 1.5. By construction, the sum of the three tercile coefficients from columns 2-4 is identical to the overall effect for each job flow outcome.

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[13] This analysis excludes establishments in the public sector for which a sale-based measure of performance is not applicable.

[14] This measure of performance thus assumes it takes time for establishments to realize their productivity (Asquith et al. 2019).

The effects of international students on job creation due to firm entry indicate no clear pattern across the three performance terciles. This is consistent with the notion that firms do not observe their productivity until after entry decisions have been made, which explains the disproportionately high likelihood of exit among young firms that has been observed in the firm dynamic literature (e.g., Haltiwanger, Jarmin, and Miranda 2013). On the other hand, job creation due to expansions is driven entirely by high-performance incumbents. The obtained IV estimate suggests that one additional student per thousand residents results in a 0.55 percentage point increase in the rate of job creation due to expansion among the most productive establishments. This effect is strongly significant and explains 82% (0.55/0.67) of the overall effect.

In stark contrast, the impact of an increase in international student enrollment on job destruction is driven mostly by deaths and contractions among low-performance establishments. The IV estimates for deaths and contractions in the first performance tercile are 0.050 and 0.015, which explain 61% (0.050/0.082) and 62.5% (0.015/0.024) of the overall effects, respectively.

Taken together, the various results discussed in this section demonstrate that the growing presence of international students in local US economies may also have led to Melitz-type local aggregate productivity gains in the non-tradable sector. In particular, only a selective set of potentially the most efficient firms seemed able to reap the benefits from the enrollment-induced positive demand shocks, whereas increases in competition in possibly both the product market and the labor market forced the least productive firms to shrink or exit altogether. The local labor market effects of an increase in international student enrollment are therefore not without distributional consequences. For example, to the extent that more educated, highly skilled workers are more likely to be employed at or reallocated to the most

productive firms (Engbom and Moser 2017; Gilje, Taillard, and Zeng 2021) or face lower adjustment costs (Dix-Carneiro 2014) the overall positive impact of international students on local jobs and earnings may have accentuated the recent rise in wage inequality across workers.[15]

1.6 Concluding remarks

Rapid growth in income per capita and the concurrent surge in demand for quality education in many emerging economies have led to a staggering increase in the global number of students pursuing higher education outside their home countries, from 2.1 million students in 2000 to 6 million students in 2019 (UNESCO Institute for Statistics 2021). As the leading destination, the US has absorbed a significant portion of this shock, currently receiving over a million students and more than 40 billion dollars in higher education revenue alone from abroad each year. These trends have attracted a considerable amount of attention from both economists and policy makers, though little research has been done to systematically assess the broad impacts of foreign students on US local economies.

Using large-scale administrative and survey data, this chapter seeks to narrow this gap by investigating the short-run effects of international students on local labor markets and firms via increases in local consumption. I implement an instrumental variable estimation approach that takes advantage of the supply-push components of changes in US enrollment, proxied by fluctuations in the outflows of international students across countries of origin to other top English-speaking host countries. As shown by a series of balancing tests, this strategy allows me to purge US international enrollment of confounding changes in local economic conditions. My

[15] For recent reviews on the topic of wage inequality, see Katz et al. (1999), Lemieux (2008), Autor, Katz, and Kearney (2008), and Card et al. (2018).

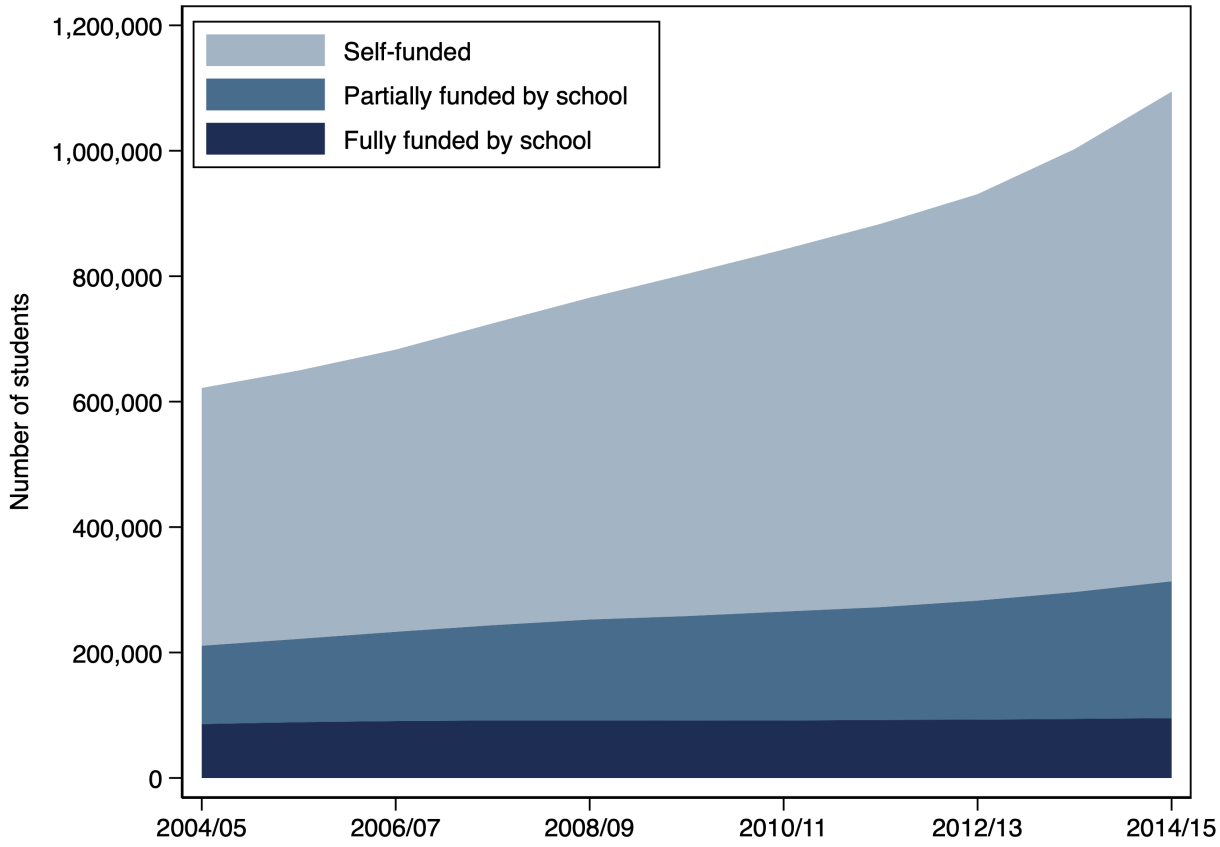
results suggest that an increase in international student enrollment leads to substantial increases in local employment and wages: one additional student per thousand residents raises the employment-to-population ratio by 0.31 percentage points and average wages by 0.69%. These increases are concentrated in the non-tradable sector, most notably in construction, retail, and services. More importantly, surges in local demand stimulate firm entry and expansion, potentially increasing competition in both the product market and the labor market. Accordingly, international students also cause significant job destruction due to firm contractions and exits, particularly among less efficient firms. Hence, in addition to net positive effects on local jobs and earnings, an increase in enrollment of students from abroad also results in within-industry labor reallocations and, therefore, improvements in local aggregate productivity.

Overall, this chapter suggests that future discussions and deliberation of US student visa policy should take into account these short-run local economic benefits of international students. A policy that restricts enrollment would hurt not only US universities and colleges, by curtailing tuition revenue and academic innovation, as prior research has shown, but also surrounding local economies through a reduction in employment, earnings, and business dynamism.

Given the overwhelming representation of international students in the fields of science, technology, engineering, and mathematics, what are the long-run effects of an increase in foreign enrollment and participation in the labor force after graduation on technological growth and innovation? Would both the short- and long-run effects differ if students were allowed to work while still enrolled in schools? Interestingly, the results discussed in this chapter suggest that immigrants in general can also increase labor demand for natives by affecting local consumption. How much does this channel counter the potentially negative effects of an immigration-induced labor

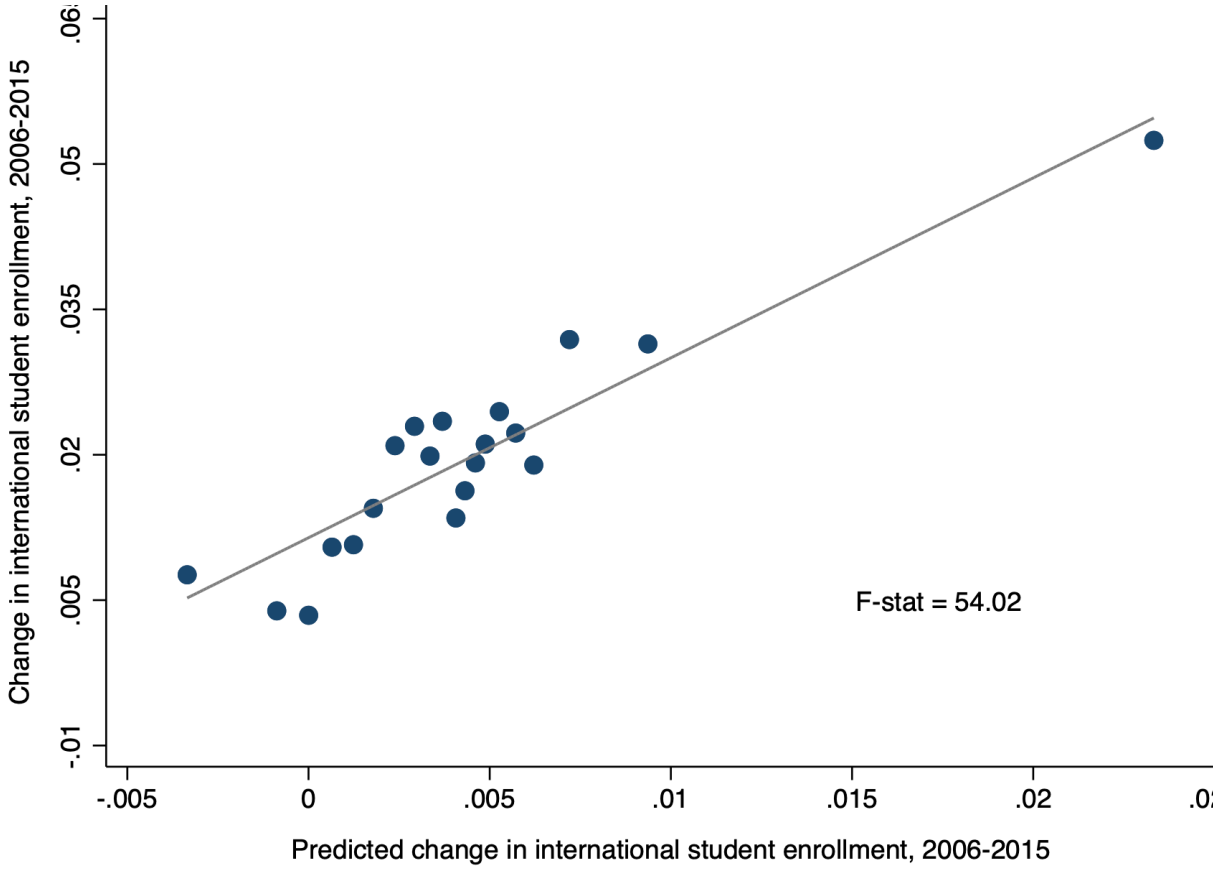
supply shock? These are important topics that should be investigated by future research.

Figure 1.1: Trends in International Student Enrollment in US Higher Education by Funding Status



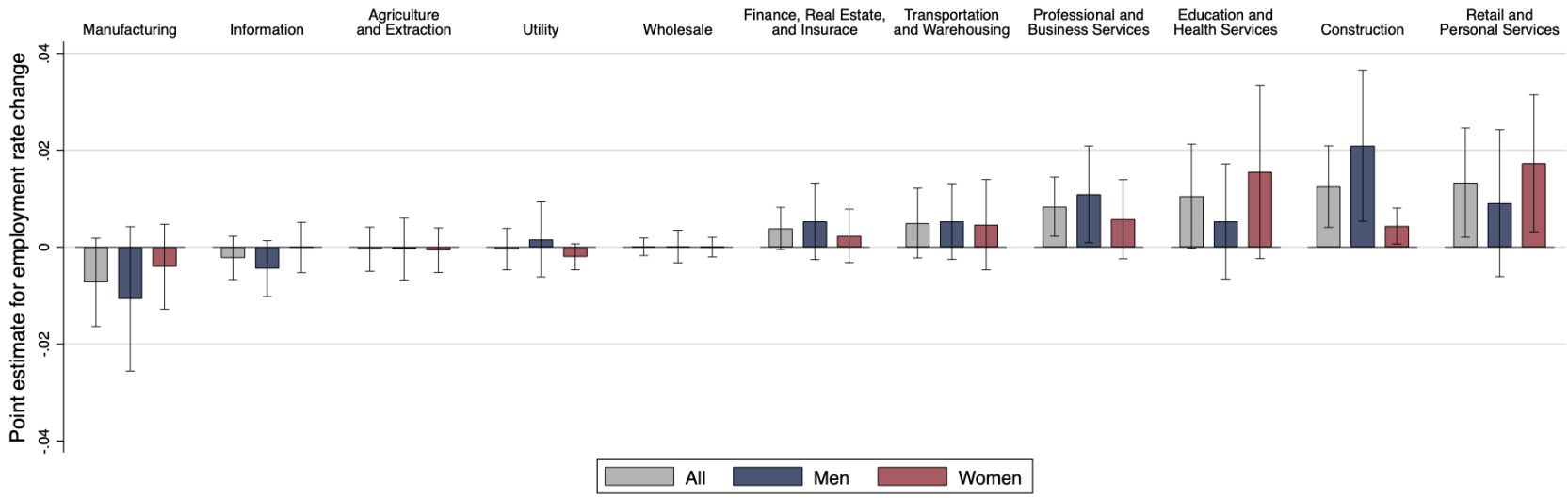
Source: Author's calculations based on administrative data from US Department of Homeland Security (2004-2014).

Figure 1.2: 2SLS First Stage



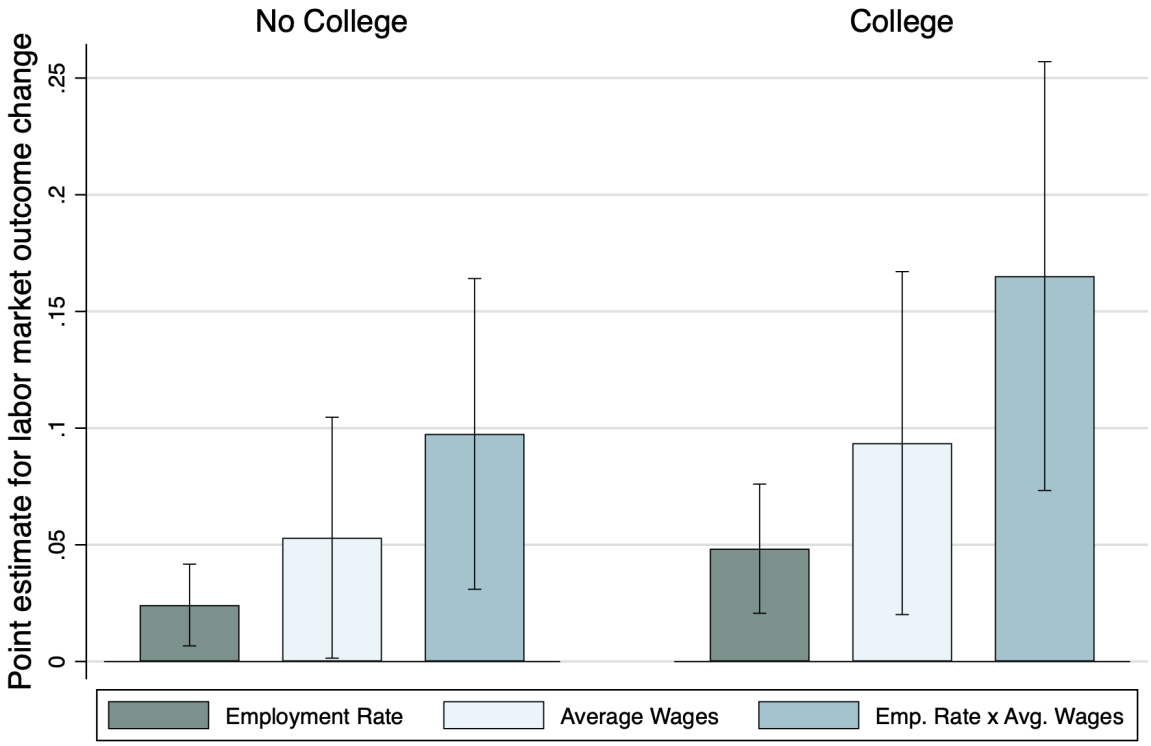
Notes—This binned scatterplot shows the first-stage relationship between predicted and actual period change in international student enrollment between 2006 and 2015. The right hand side variable is grouped into 20 bins. Both left- and right-hand-side variables have been residualized on a set of covariates that include changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), and education (no college, some college, college or professional degree, and advanced degrees), the share of employed adults that are foreign born, and the share of the population employed in manufacturing. Regression is weighted by commuting zone population in 2005.

Figure 1.3: Effects of International Students on Industries, ACS Estimates



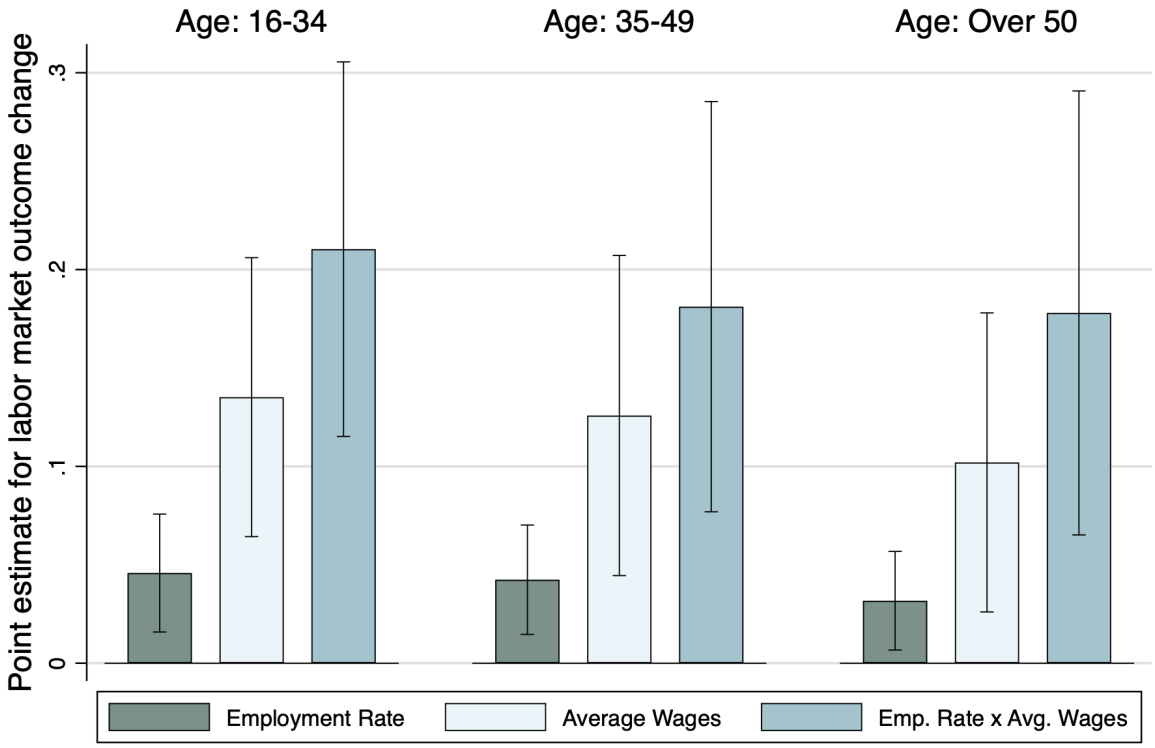
Notes—This figure presents estimates of the effects of a change in international student enrollment on changes in industry employment-to-population ratio. The capped lines provide 95% confidence intervals. Estimates are obtained from stacked-differences IV specifications as in column 2 of table 4.

Figure 1.4: Effects of International Students on Employment and Wages by Education, ACS Estimates



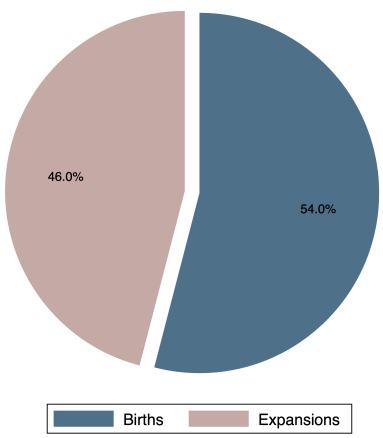
Notes—This figure presents estimates of the effects of a change in international student enrollment on changes in employment and wage outcomes of natives with different education levels (no college, college degree). The capped lines provide 95% confidence intervals. Estimates are obtained from stacked-differences IV specifications as in columns 2, 4, and 6 of table 4.

Figure 1.5. Effects of International Students on Employment and Wages by Age, ACS Estimates

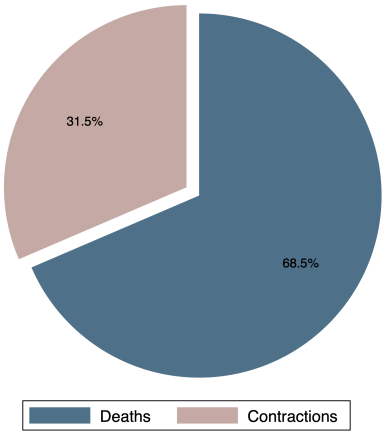


Notes—This figure presents estimates of the effects of a change in international student enrollment on changes in employment and wage outcomes of natives in different age groups (16-34, 35-49, 50+). The capped lines provide 95% confidence intervals. Estimates are obtained from stacked-differences IV specifications as in columns 2, 4, and 6 of table 4.

Figure 1.6: Job Creation and Destruction between 2005 and 2016, YTS Estimates

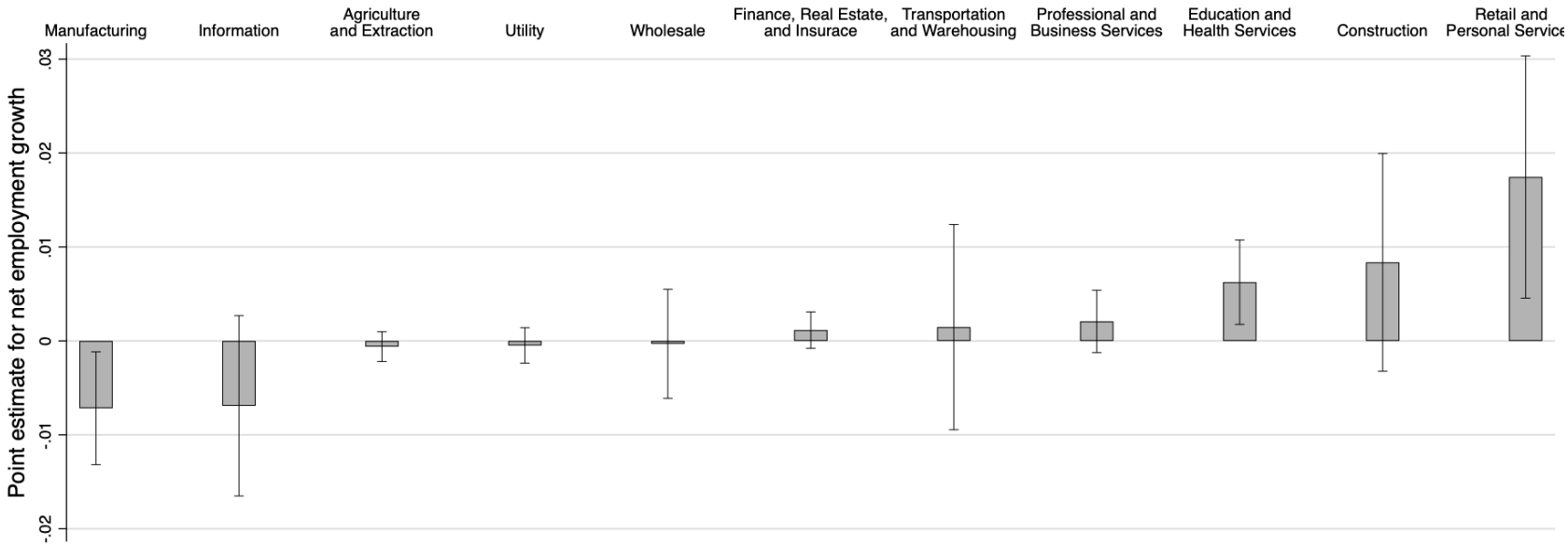


(a) Job creation shares (average)



(b) Job destruction shares (average)

Figure 1.7: Effects of International Students On Industries, YTS estimates



Notes.—This figure presents estimates of the effects of a change in international student enrollment on changes in industry net employment growth adjusted by commuting zone population (see equation 3 in the main text). The capped lines provide 95% confidence intervals. Estimates are obtained from stacked-differences IV specifications as in column 2 of table 5.

Table 1.1: Top 10 Commuting Zones With Largest Number of International Students

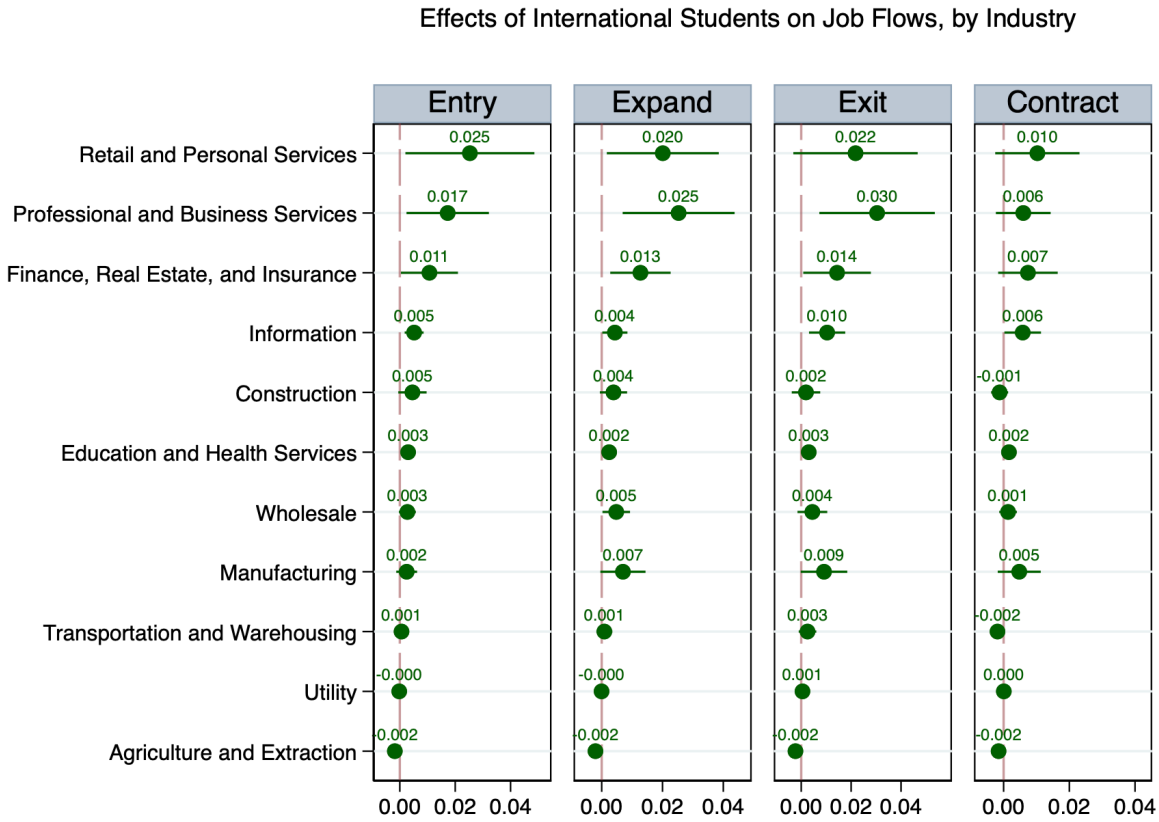
2015		
Commuting zones	Largest counties (by 2010 Census population)	International students (% of pop)
38300	Los Angeles—Orange—Riverside (CA)	109,739 (0.59)
19400	Kings—Queens—New York (NY)	87,890 (0.71)
20500	Middlesex—Worcester—Essex (MA)	63,917 (1.19)
37800	Alameda—Contra Costa—San Francisco (CA)	46,595 (0.89)
39400	Pierce—Snohomish—Thurston (WA)	37,384 (0.81)
11304	Fairfax (VA)—Montgomery (MD)—D.C.	34,728 (0.60)
24300	Cook—DuPage—Lake (IL)	32,146 (0.37)
32000	Harris—Fort Bend—Montgomery (TX)	24,000 (0.38)
19600	Bergen—Middlesex—Essex (NJ)	23,983 (0.89)
37500	Santa Clara—Monterey—Santa Cruz (CA)	23,174 (0.38)

2005		
Commuting zones	Largest counties (by 2010 Census population)	International students (% of pop)
38300	Los Angeles—Orange—Riverside (CA)	53,528 (0.31)
19400	Kings—Queens—New York (NY)	48,218 (0.41)
20500	Middlesex—Worcester—Essex (MA)	29,960 (0.60)
11304	Fairfax (VA)—Montgomery (MD)—D.C.	19,722 (0.39)
37800	Alameda—Contra Costa—San Francisco (CA)	18,614 (0.40)
24300	Cook—DuPage—Lake (IL)	18,578 (0.22)
19600	Bergen—Middlesex—Essex (NJ)	15,790 (0.27)
32000	Harris—Fort Bend—Montgomery (TX)	14,942 (0.28)
11600	Wayne—Oakland—Macomb (MI)	14,590 (0.29)
39400	Pierce—Snohomish—Thurston (WA)	13,507 (0.34)

Table 1.2: Growth in International Student Enrollment Across Commuting Zones, 2005-2015

	Mean	p10	p25	p50	p75	p90	p95	p99
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Number of international students								
2005	1,254	5	30	181	777	2,817	5,427	18,578
2015	2,279	5	51	276	1,473	4,668	10,440	34,729
Δ	+1,125	+0	+21	+95	+696	1,851	5,013	16,151
Panel B. Population share of international students (%)								
2005	0.209	0.007	0.034	0.098	0.252	0.517	0.798	1.680
2015	0.342	0.007	0.048	0.155	0.391	0.827	1.188	3.520
Δ	+0.08	+<0.001	+0.014	+0.057	+0.140	+0.310	+0.390	+1.840

Figure 1.7: Effects of International Students on Job Flows by Industry, YTS Estimates



Notes—This figure presents estimates of the effects of a change in international student enrollment on changes in commuting zone job-flow components in each industry. The capped lines provide 95% confidence intervals. Estimates are obtained from stacked-differences IV specifications as in columns 2 of table 5.

Table 1.3: Balancing Tests: Effects of International Students on Pre-Determined Changes in Commuting Zone

	State Appropriations per Public FTE		Share of Foreign-Born College Graduates in the Labor Force		Employment Rate		Average Wages	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	-0.116***	-0.012	0.006***	-0.002	0.013***	0.009	-0.032***	-0.006
	(0.028)	(0.069)	(0.002)	(0.004)	(0.004)	(0.010)	(0.011)	(0.026)
First-stage *F*-statistic		50.4		55.3		55.3		55.3
Observations	5,160	5,160	6,498	6,498	6,498	6,498	6,498	6,498

Notes—Outcomes are period changes from *t-2* to *t-1*. All specifications include year fixed effects and current period changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), education (no college, some college, college or professional degree, and advanced degrees), and the share of foreign born. Regressions are weighted by commuting zone population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level, ** significant at the 5 percent level, *** significant at the 1 percent level

Table 1.4: Effects of International Students on Local Employment and Wages, ACS Estimates, Stacked First Differences 2006-2015

	Employment Rate		Average Wages		Emp. Rate x Average Wages	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. All workers						
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	0.008***	0.031***	0.039***	0.069***	0.055***	0.142***
	(0.004)	(0.009)	(0.011)	(0.023)	(0.017)	(0.034)
Panel B. Men						
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	0.011*	0.033***	0.041***	0.062**	0.069***	0.150***
	(0.006)	(0.012)	(0.013)	(0.029)	(0.024)	(0.045)
Panel C. Women						
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	0.005	0.028***	0.032***	0.079***	0.038***	0.132***
	(0.004)	(0.011)	(0.012)	(0.026)	(0.016)	(0.037)
First-stage *F*-statistic		54.02		54.02		54.02
Observations	7,220	7,220	7,220	7,220	7,220	7,220

Notes—Outcomes are period changes from *t* to *t+1*. All specifications include time fixed effects, changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), and education (no college, some college, college or professional degree, and advanced degrees), the share of employed adults that are foreign born, and the share of the population employed in manufacturing. Regressions are weighted by commuting zone population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level

** significant at the 5 percent level

*** significant at the 1 percent level

Table 1.5: Effects of International Students on Local Job Flows, YTS Estimates, Stacked First Differences 2006-2015

Independent variable: $\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	All		Nontradable Sector		Tradable Sector	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Net employment growth	0.005	0.036**	0.009*	0.029**	-0.004	0.007
	(0.008)	(0.016)	(0.005)	(0.011)	(0.004)	(0.008)
Job flows						
Entry	0.022**	0.073**	0.014**	0.052**	0.008**	0.016
	(0.009)	(0.033)	(0.006)	(0.022)	(0.003)	(0.010)
Expand	0.016**	0.079**	0.011***	0.048**	0.006**	0.026**
	(0.007)	(0.033)	(0.004)	(0.019)	(0.003)	(0.013)
Exit	0.021**	0.091**	0.011***	0.057**	0.012***	0.030*
	(0.010)	(0.044)	(0.006)	(0.026)	(0.004)	(0.017)
Contract	0.015***	0.037*	0.008***	0.019*	0.007***	0.010
	(0.004)	(0.020)	(0.003)	(0.010)	(0.002)	(0.008)
First-stage *F*-statistic		54.02		54.02		54.02
Observations	7,220	7,220	7,220	7,220	7,220	7,220

Notes—Outcomes are period changes from *t to t+1*. All specifications include time fixed effects, changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), and education (no college, some college, college or professional degree, and advanced degrees), and the share of foreign born. Regressions are weighted by commuting zone population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level ** significant at the 5 percent level *** significant at the 1 percent level

Table 1.6: Effects of International Students on Local Job Flows by Establishment Performance Tercile, YTS Estimates, Stacked First Differences 2006-2015

Independent Variable: $\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	Overall	Lowest Tercile	Middle Tercile	Highest Tercile
	(1)	(2)	(3)	(4)
Entry	0.063**	0.029***	0.012*	0.022***
	(0.028)	(0.014)	(0.007)	(0.008)
Expand	0.067**	0.003*	0.009**	0.055**
	(0.027)	(0.002)	(0.003)	(0.023)
Exit	0.082**	0.050***	0.037***	-0.005
	(0.039)	(0.018)	(0.013)	(0.010)
Contract	0.024*	0.015***	0.004	0.005
	(0.014)	(0.007)	(0.003)	(0.007)
First-stage *F*-statistic	54.2	54.2	54.2	54.2
Observations	7,220	7,220	7,220	7,220

Notes—Outcomes are period changes from *t* to *t+1*. All specifications include time fixed effects, changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), and education (no college, some college, college or professional degree, and advanced degrees), the share of employed adults that are foreign born, and the share of the population employed in manufacturing. Regressions are weighted by commuting zone population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level

** significant at the 5 percent level

*** significant at the 1 percent level

CHAPTER 2

GENDER WAGE GAP, INTRA-HOUSEHOLD BARGAINING, AND INTERGENERATIONAL MOBILITY

2.1 Introduction

Across many cultural and economic settings, children from wealthier families are more likely to pursue higher education (Shavit and Blossfeld 1993; Carneiro and Heckman 2002; Björklund, Lindahl, and Plug 2006; Bulman et al. 2021). Given the usually sizable wage premium and myriads of other non-pecuniary benefits associated with investments in higher education (Oreopoulos and Salvanes 2011), understanding the pathways through which family resources affect participation in higher education is of great policy importance. On one hand, investments in higher education can be prohibitively costly, and if credit markets are missing or imperfect, families facing short-term resource constraints may be unable to realize the productive potential of their children (Belley and Lochner 2007; Coelli 2011; Lovenheim 2011; Bastian and Michelmore 2018; Manoli and Turner 2018). Alternatively, a positive wealth-schooling or income-schooling gradient could reflect other factors that determine higher education preparation—such as innate ability, family environment, attitudes, and school and peer quality—long-term factors that are correlated with more family resources (Carneiro and Heckman 2002; Cameron and Taber 2004; Bleakley and Ferrie 2016). Effective policy aimed at promoting access to higher education and upward mobility could therefore be dramatically different depending on the underlying mechanisms.

In this chapter, I study an aspect that has often been overlooked in this literature: the role of intra-household decision making. Because investments in higher education are often costly and may entail uncertain labor market outcomes, parents may disagree on whether and how much to invest in a child's higher education. The possibility of a disagreement suggests that the causal relationship of household resources on educational investments depends critically on the extent to which disagreement in preferences exists and, as well, on who controls household resources and decision making. Even if a household faces resource constraints, additional income or wealth may not translate into more educational investments if there is a lack of demand for children's education by the household decision maker. On the contrary, an increase in decision-making power by the more altruistic parent could result in a reallocation of household resources towards additional investments in children's higher education even if household resources remain the same.

To test these hypotheses, I examine how positive shocks to labor market opportunities for women relative to men affect the propensity of children enrolling in a university in the context Indonesia, where the gender wage gap has been shrinking remarkably over the past few decades. As figure 2.1 demonstrates, women were earning about 70% what men were earning on average in 1990. This figure rose steadily, reaching 90% in 2014. Standard Nash-bargaining models of household decision making predict that an improvement in women's outside options increase their intra-household bargaining power (Manser and Brown 1980; McElroy and Horney 1981; Lundberg and Pollak 1993). If mothers are more altruistic or have greater demand for children's higher education, such an increase in decision-making power could result in a higher likelihood of children enrolling in a university, holding household resources and other background characteristics constant. Figure 2.2 provides prima facie evidence for such a relationship. In particular, the share of

young adults aged 21-30 who have earned a bachelor's degree have likewise increased dramatically among both men and women during this period, from about 1% in 1990 to 8% in 2014.

My empirical analysis takes advantage of rich household survey data from the Indonesian Family Life Survey (IFLS) along with annual data from the 1990-2014 Indonesia Labor Force Survey (Sakernas). Using an instrumental variable approach that exploits plausibly exogenous shock in gender-specific labor demand, I first show that an increase in women's share of potential earnings substantially raises the number of decisions made only by women among married couples, especially decisions regarding household expenditures on children. Consistent with the notion that mothers are more altruistic, I find that a rise in mothers' share of potential earnings when children graduate from high school increases their likelihood of enrolling in higher education. This effect is quantitatively similar for both boys and girls, and is more pronounced among households with greater resources. Furthermore, the effect of an increase in mothers' bargaining power on university attendance is only significant when relative potential earnings are measured when children were 16 or 17, and are not distinguishable from zero once they have graduated from high school.

Overall, my results indicate that disagreements over how much to invest in children's higher education among parents likely exist, and that how much household resources translate into investments will depend on the distribution of within-household parental bargaining power. These results thus relate to two broad strands of literature. First, a large empirical literature in labor has been devoted to assessing the various pathways through which household resources determine college enrollment, though little consensus has been reached (e.g., Carneiro and Heckman, 2002; Belley and Lochner, 2007; Løken, 2010; Lovenheim, 2011; Bulman et

al., 2021). The results presented in this chapter suggest that intra-household decision making is a potentially important factor that mediates the wealth or income gradient.

In addition, a broad literature has revealed the shortcomings of the unitary models in explaining household behaviors, including saving, investment, and consumption decisions (e.g., Alderman et al., 1995; Lundberg, Pollak, and Wales, 1997; Duflo, 2003; Ward-Batts, 2008; Addoum, 2017; Schaner 2017). This work is the first, to the best of my knowledge, that accounts for household dynamics in studying investments in higher education. My results indicate that intra-household bargaining dynamics, particularly those influenced by time-varying factors such as changes in parents' labor market conditions, could give rise to differences in educational and labor market outcomes in children with otherwise similar characteristics. Policy aimed at promoting participation in the higher education sector should therefore take into consideration intra-household bargaining, especially when there are conflicts between preferences and decision making (Björkman Nyqvist and Jayachandran, 2017).

2.2 Data and variable definitions

To analyze the effects of changes in parents' decision-making power on household investment in children's postsecondary education, I combine large-scale household survey data from the Indonesian Family Life Survey (IFLS) with labor force survey data from the 1990-2014 Indonesian Labor Force Survey (Sakernas). In this section, I describe the main sample and variables used throughout my empirical analysis. I also discuss the construction of my measures of intra-household bargaining power, and show direct evidence of changes in household decision-making patterns as a result of shocks to gender-specific outside options.

2.2.1 Household outcomes

I construct household-level outcomes using data from the IFLS, a longitudinal household survey first conducted in 1993 by the RAND Corporation. Subsequent waves were carried out in 1997, 2000, 2007, and, most recently, 2014. The original sample in 1993 comprises of over 7,200 households and is designed to represent 13 provinces in Indonesia (83% of the Indonesian population).[16] A key advantage of using the IFLS is that the survey contains a wealth of information on not only the main variables of interests but also a large set of characteristics related to children's ability, tastes for schooling, and household financial background, factors that have been identified as major determinants of enrollment in postsecondary education that may confound the effects of parents' decision-making power.

To study household demand for children's postsecondary education as a function of the distribution of intra-household bargaining power, I focus on university enrollment as the main outcome variable. As noted by Prada and Urzúa (2017), enrollment, instead of completion, is a better indicator of household demand for education, since completion could depend on factors that are beyond the control of individuals and families (Light and Strayer, 2000; Bound, Lovenheim, and Turner, 2010). Consequently, I follow the literature and restrict my main sample to individuals who meet the minimum requirement to enroll in a university in Indonesia: those who are old than18 years old and have at least graduated from high school in the latest round of the IFLS (IFLS-5).

Furthermore, I restrict my sample to individuals for whom I observe important household and parental characteristics, as well as several measures of

[16] For more information on the IFLS, see http://www.rand.org/labor/FLS/IFLS/.

ability and taste for schooling. In particular, I control for both parental age, years of formal education completed, and income. I define parental income as the sum of father's and mother's income taken from all sources, including wage income, farm income, and non-farm business income, measured when children were between 12 and 18 years old. Apart from parental income, recent studies have shown that family wealth has a positive causal effect on children's university enrollment (e.g., Lovenheim 2011). I therefore also control for the total value of assets a family owes during this period. These include houses and lands, savings, farm stocks, vehicles, and household appliances.[17]

I use several proxies to control for individuals' ability. In the context of Indonesia, Newhouse and Beegle (2006) show that school type is an important factor behind academic achievement. Accordingly, I control for whether an individual graduated from a public non-religious, public religious, private non-religious, or private religious high school. Furthermore, I take advantage of a battery of tests in the IFLS that assess respondents' cognitive capacity and fluid intelligence. The Woodcock-Johnson cognitive capacity assessment module is taken from IFLS-5, which asks respondents to name current date, perform delayed word recall, and, most importantly, go through an adaptive number series test adopted from the Health and Retirement Study. The fluid intelligence assessment module, on the other hand, includes an abridged version of Raven's test and is administered to respondents aged 14-24 starting from IFLS-3. Each of the assessment modules results in a single numeric score which I standardize and include in my regression analysis.

Finally, I take into account the province as well as the degree of urbanization of individuals' residence when they were between 12 and 18 years old. These capture the time-invariant differences across local labor markets that may confound the

[17] All monetary figures are in Indonesian rupiah and converted to the base year 2014.

effects of intra-household bargaining on household demand for children's higher education.

2.2.2 Gender-specific outside options

As mentioned in the introduction, there has been a dramatic improvement in the labor market opportunities for women relative to men as well as an increase in participation in higher education among young adults in Indonesia over the past three decades. Standard Nash-bargaining models of household decision making suggests one mechanism through which the two phenomena are related. Greater earning potentials improve women's outside options, either in a divorce (Manser and Brown, 1980; McElroy and Horney, 1981) or a within-marriage non-cooperative outcome (Lundberg and Pollak, 1993), which increase female decision-making power. Accordingly, if women on average are more altruistic or have greater demand for children's higher education than men, improved earnings for women at threat point will result in reallocations of resources within households towards greater educational investments in children.

In this section, I describe in detail my measures of gender-specific potential earnings, and examine the first-order relationship between changes in female share of potential earnings and self-reported patterns of household decision making as observed in the IFLS. Since the outcome of interest in this chapter is children's university attendance, I focus on parents' earning potentials measured when an individual was 17.[18] For each individual in my IFLS sample, I rely on labor force survey data from Sakernas and construct each of his or her parents' potential earnings to be the average hourly wage of formal wage earners in the same province

[18] I also investigate the dynamic effects of shocks to mother's bargaining power on children's university attendance in the next section.

of residence and demographic group (based on the parent's gender, education, and age when the individual was 17).[19] Next, I use each parent's share of potential earnings, defined as his or her potential earnings divided by both parents' total potential earnings, to proxy for his or her bargaining power.

As discussed above, one advantage of using potential instead of actual relative earnings is that the former is independent of labor supply decisions and therefore better serve as indicators of earnings at threat points. On the other hand, parent's potential wages and relative earnings are not randomly assigned. For example, if there is assortative mating, parents' potential relative earnings could be endogenous to household characteristics and educational investments in children. Furthermore, parents' local labor market conditions might be correlated with the opportunity costs of or returns to attending higher education facing children. To address these threats to identification, I use Bartik-style instruments to purge parents' potential relative earnings of unobserved household and local labor market characteristics that may also determine household investments in children's higher education. Specifically, I first predict the average hourly wage of each parent's demographic group as follows

$$\hat{w}_t^{a,g,e,p} = \sum_k \gamma_{1990}^{k,g,p} \times w_t^{k,a,g,e,-p} \tag{5}$$

where $w_t^{k,a,g,e,-p}$ is the average hourly wage of wage earners in industry k, age group a, gender group g, education group e, measured in year t at the national level excluding province p. $\gamma_{1990}^{k,g,p}$ is the portion of workers in gender group g and province p who worked in industry k in 1990. I then use the predicted wages for both parents to instrument for potential relative earnings. As shown later, these predicted wages are strong determinants of potential relative earnings, since households residing in a

[19] I consider four educational levels (no schooling, primary school, junior high school, senior high school, bachelor's degree and beyond) and 5-year age intervals ranging from 25 to 55.

province that historically had more women in industries that would later experience stronger national wage growth tend to see shifts in relative income that are more favorable to mothers than to fathers, compared to households in other provinces. With cohort and province fixed effects, however, variation in $\hat{w}_t^{a,g,e,p}$ over time is driven by economy-wide shocks that are arguably not related to household or local labor market characteristics that might influence household investment decisions.

To assess the validity of my measures of intra-household bargaining power, I take advantage of the household decision making module in the IFLS, available starting from IFLS-2, and examine whether changes in women's relative potential earnings affect the self-reported identity of the decision maker(s) across different domains among married couples. There are 17 domains in total, including decisions over food eaten at home, routine purchases, clothes for self, clothes for spouse, clothes for children, children's education, children's health, large purchases, money given to family, money given to spouse's family, gifts for parties or weddings, money for monthly arisan (savings lottery), money for monthly savings, time the husband spends socializing, time the wife spends socializing, labor supply, and use of contraception. I consider two specific outcomes, the fraction of decisions made by the wife only and whether children's education is decided by the wife only, both constructed using information reported by the wife, and estimate the following regression

$$\text{(6)} \quad \text{wife's decision making}_{i,t} = \text{wife's rel. potential earnings}_{i,t} + \Gamma' X_{i,t} + \gamma_i + \theta_i + \epsilon_{i,t}$$

where t denotes survey year (1997, 2000, 2007, 2014), γ_i individual fixed effects, θ_t survey year fixed effects, and $X_{i,t}$ a vector of covariates that includes husband's and wife's age, years of schooling, household earnings, wealth, and number of children.

Table 2.1 reports the results obtained from this analysis, which includes all couples for whom the outcomes are observed in at least two survey rounds. To establish the baseline, I first look at the effects of wife's (actual) relative earnings on decision-making power. The result in column 1 suggests that, holding household resources and other characteristics constant, going from a situation where the wife is not working to one where she's the sole breadwinner increases the fraction of decisions made only by her by 4.4%. Though statistically significant and consistent with a non-unitary model of household decision making, this effect is economically small. In columns 2 and 3, the effects of relative potential earnings are investigated. The obtained point estimates are larger, which suggest that relative potential earnings are much better indicators of intra-household bargaining power. In particular, the IV estimate indicates that an increase in wife's relative potential earnings that results in a potentially total control of household earnings raises the fraction of decisions made only by the wife by 21.8 percentage points. In column 4, I examine the effects of wife's relative potential earnings by her working status in the year before the survey. Nash bargaining models predict that it is changes to earnings at threat points rather than in equilibrium that are driving the observed changes in household decision making. Accordingly, one should expect the positive effects of an improvement in relative labor market opportunities on intra-household bargaining power to apply to both working and non-working women. The obtained result indeed supports this theoretical prediction.

In columns 5-8, I restrict my sample to couples with at least one child younger than 18 and look at decision regarding children's education as the outcome. As expected, the pattern of results remains similar. Remarkably, an increase in wife's relative potential earnings that results in a potentially full control of household earnings raises the probability that children's education is decided solely by the wife

by 71.3 percentage points. This result is consistent with the notion that mothers on average have a much higher demand for children's education than fathers (Dizon-Ross and Jayachandran, 2022). I now turn to my main empirical analysis, which investigates the impact of changes in gender-specific outside options on household investments in children's higher education.

2.3 Intra-Household Bargaining and Household Investments in Children's Higher education

Does gender-specific control over household resources determine household investment in children's higher education? In a common preference model with complete income pooling, investment depends only on total family income: a marginal increase in earnings by the wife would have the same impact on the allocation of household resources as a marginal increase in earnings by the husband through a relaxation of the pooled budget constraint. Indeed, the empirical literature on the determinants of college enrollment has focused exclusively on the roles of total household resources as if households can be represented by a single utility function and budget constraint (e.g., Carneiro and Heckman, 2002; Belley and Lochner, 2007; Lovenheim, 2011; Bulman et al., 2021).

The results discussed in previous section indicate that women gain significant control over educational investment decisions as their outside options improve relative to their husbands' outside options. If mothers have greater demand for children's higher education, increases in female share of potential earnings could increase the likelihood of children enrolling in a university. To test this hypothesis, I estimate specifications of the following regression equation

$$\text{university enrollment}_i = \beta \text{mother's potential share of earnings}_i + \Gamma' X_i + \gamma_p + \theta_c + \epsilon_i \tag{7}$$

where γ_p and θ_c are province and cohort fixed effects, respectively. The dependent variable, university enrollment$_i$, is an indicator for whether individual i has ever enrolled in a university in IFLS-4. Mother's relative potential earnings, as mentioned in the previous section, are measured when individual i was 17. X_i is a large set of controls for background characteristics, household resources, indicators of ability, as well as local labor market conditions when i graduates from high school. Table 2.2 presents summary statistics of the sample analyzed. Of the 4,446 individuals who have graduated from high school in IFLS-5, about 28% went on to enroll in a university. I also split my sample into three terciles based on mother's observed relative earnings. As shown, the fraction of individuals that have attended a university increases in mother's relative earnings, which supports a prima facie case for the role of intra-household bargaining in determining children' participation in postsecondary education.

2.3.1 Main results

Table 2.3 reports the results obtained from estimating equation 7. In column 1, I look at the effect of mother's share of earnings on university attendance. Controlling for gender, number of siblings, urban status, parents' age, local employment rate among middle and high school graduates aged 18-29, the share of working adults with bachelor's degree, the share of women in the labor force, as well as cohort and province fixed effects, an increase in mother's share of household earnings by 100 percentage points increases the likelihood of university enrollment by 6.2 percentage points. This effect is statistically significant at the five percent level, though

economically modest. In column 2, I include controls for parents' earnings, parents' years of education, household wealth, the number of books owned by the household when individuals were 12, the types of high school attended, as well as cognitive and fluid intelligence test scores. As shown, these controls account for a much larger portion of the variation in university enrollment. The obtained coefficient on mother's share of earnings shrinks only slightly to 4.6 percentage points, reinforcing the notion that observed earnings in equilibrium are poor indicators of intra-household bargaining power.

Results presented in columns 3 and 4 show that mother's relative potential earnings has a much larger effects on the allocation of household resources to investments in children's postsecondary education. An increase in mother's potential share of earnings by 100 percentage points increases university enrollment by 24.2 percentage points, holding household resources and background characteristics constant. If there's positive assortative matching in the marriage markets, however, these measures of parents' outside options might still be endogenous to household educational investments and bias OLS estimates downward. On the other hand, unobserved local labor demand shocks may further confound the obtained OLS results. The preferred IV estimates in column 5 and 6 support these intuitions. With a full set of control, the IV coefficient suggests that an increase in mother's potential share of earnings by 100 percentage points (three times the average) increases university enrollment by 47.1 percentage points (less than twice the average).

2.3.2 Effects by gender

I next examine the effect of an increase in mother's bargaining power on household educational investments by gender of the child. Table 2.4 reports the results obtained

from estimating a specification of equation 3 with a full set of interaction terms between each covariate and a gender dummy. The obtained IV coefficients on mother's share of potential earnings are almost identical for boys and girls (0.463 and 0.489, respectively). These results are in line with the findings from Qian (2008) in the context of child survival in China, and suggest that my measures of parents' relative labor market conditions are not just picking up shocks to the costs and benefits of pursuing postsecondary education when children graduate from high school. Since both boys and girls experience an increase in the likelihood of attending a university, the results shown here can be most easily explained by a model of household decision making with bargaining where mothers value higher education more than fathers.

2.3.3 Timing of shocks to outside options

As an extension, I also examine the dynamic effects of changes in mother's earnings potentials relative to father's on university enrollment. If the results presented thus far are driven by changes in the identity of the decision maker within households, one would expect the effect of changes in bargaining power on household investments to be most pronounced when decisions regarding children's university enrollment are being made. If, however, effects are significant even when bargaining power is measured long after high school graduation, one might be concerned that the present empirical approach is being compromised by unobserved household or local labor market characteristics. In figure 2.3, I show the effects of changes in mother's share of potential earnings as measured when individuals were between 14 and 20. As expected, both OLS and IV estimates are only statistically significant when

measured at the ages of 16 and 17, and rapidly shrink towards zero after high school graduation.

2.3.4 Effects by household resources

To conclude my empirical analysis, I examine the heterogeneous effects of changes in mother's bargaining power on children's enrollment in higher education by household income and wealth. If improvements in mothers' outside options lead to within-household increases in expenditures on children's education, one would expect stronger effects of mother's bargaining power among households with more resources. In other words, we would expect the effects of household income and wealth on children's educational attainment to increase in mother's control over household resources. Table 2.5 report the results obtained from estimating specifications of equation 3 with a full set of interaction terms between each covariate and an indicator for whether household income is above median. Consistent with expectation, the effect of mother's bargaining power on university enrollment is concentrated entirely among couples having above median income. I repeat this analysis for household wealth in table 2.6 and obtain similar effects.

2.4 Conclusion

This chapter examines the roles of intra-household bargaining in determining children's participation in higher education in the context of Indonesia. Using plausibly exogenous variation in parents' relative labor market outcomes, I show that improvements in women's outside options relative men's lead to substantial increases in female bargaining power, particularly over decisions regarding

children's education. Accordingly, positive shocks to mother's bargaining power when children graduate from high school significantly increase their likelihood of attending a university. Additional analysis shows that this effect is quantitatively similar for both boys and girls, and is most pronounced among households with greater financial resources.

Consistent with Nash-bargaining models of household decision making, my results indicate that whether parental income and wealth translate into investments in children's higher education critically depends on the distribution of intra-household bargaining power. This highlights a more nuanced view of the roles of short-run budget constraints in determining human capital accumulation, one that has often been overlooked in the labor literature: relaxing the budget constraint can increase household educational investments in children insofar as resources are controlled by altruistic parents. Taken together, the results presented in this chapter highlight important intergenerational effects of improving gender pay parity that can contribute to economic development.

Figure 2.1: Gender Wage Gap in Indonesia (Female/Male Log Hourly Wage)

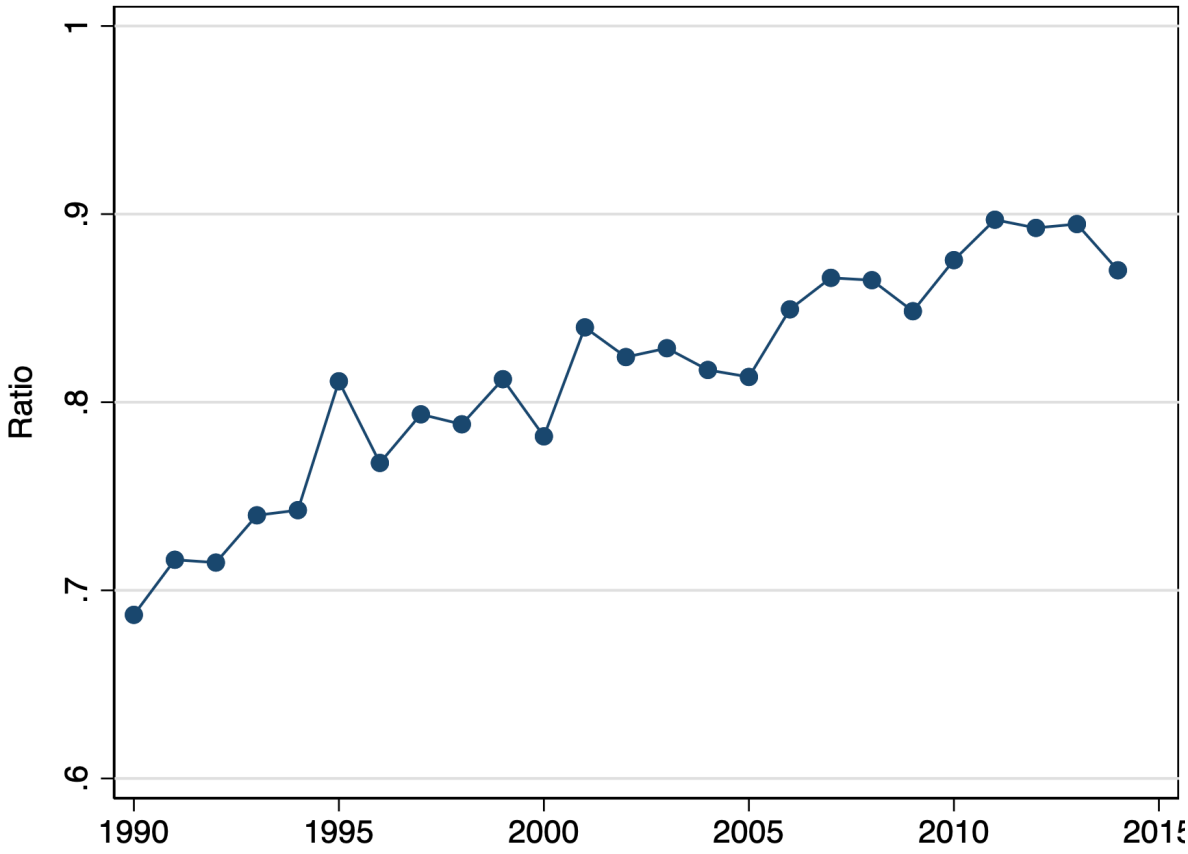


Figure 2.2: Fraction of Young Adults with a Bachelor's Degree or Above, Men and Women

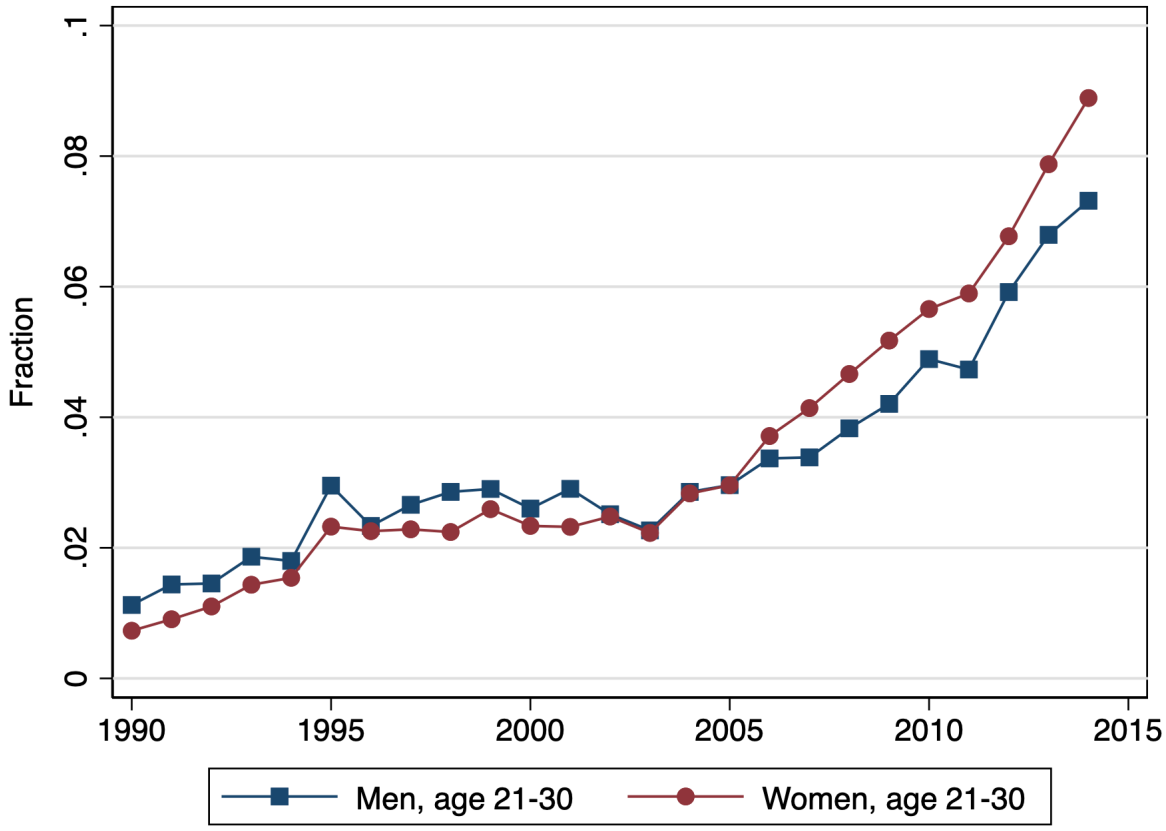
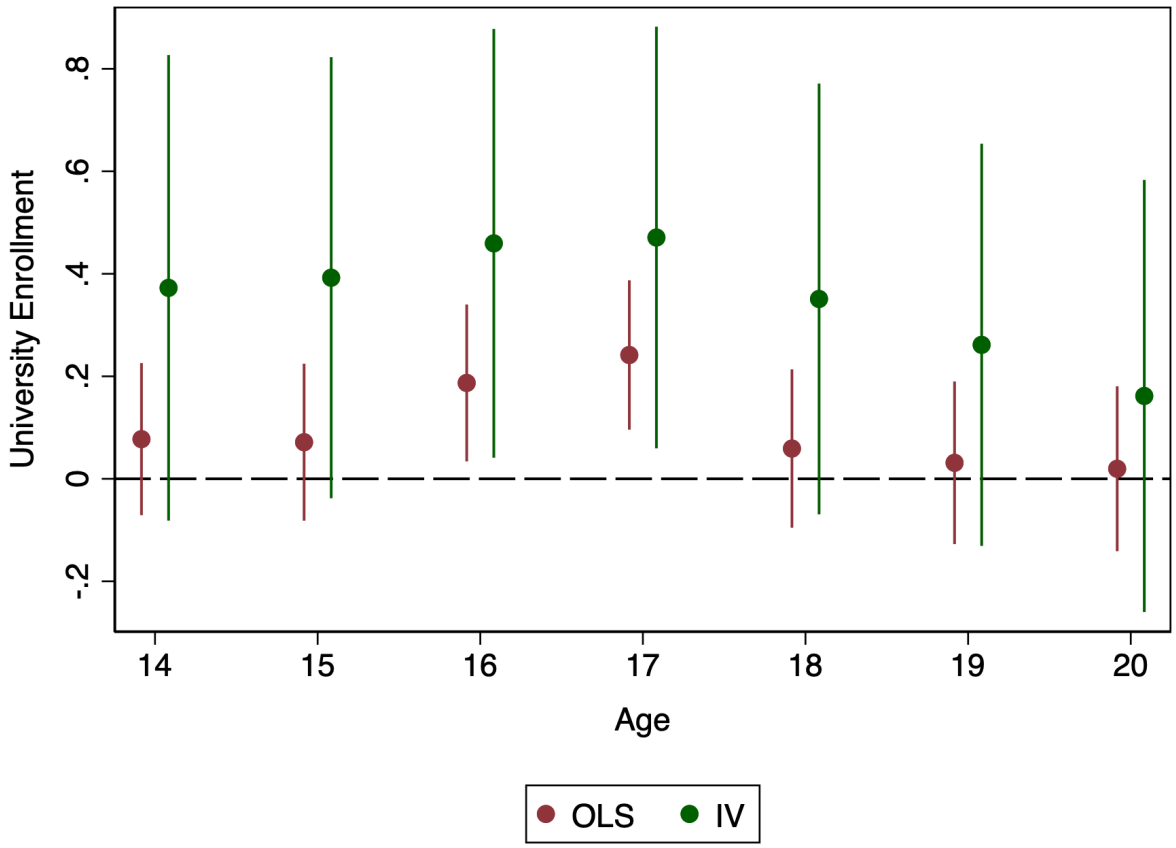


Figure 2.3: Dynamic Effects of Shocks to Mother's Share of Potential Earnings on Children's University Enrollment



Notes—This figure presents estimates of mother's share of potential earnings, measured when individuals were at different ages, on university enrollment with a full set of covariates. Point estimates at age 17 correspond to the results in columns 4 and 6 of table 3.

Table 2.1: Women's Relative Labor Market Opportunities and Intra-Household Decision Making

	Fraction of Household Decisions Made by Wife Only				Decisions Regarding Children's Education Made by Wife Only (1=Yes, 0=No)			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wife's share of earnings	0.044***				0.036**			
	(0.008)				(0.017)			
Wife's potential share of earnings		0.092***	0.218***			0.165***	0.713***	
		(0.027)	(0.103)			(0.059)	(0.210)	
× Wife working $(t-1)$				0.180*				0.776***
				(0.104)				(0.218)
× Wife not working $(t-1)$				0.255**				0.621***
				(0.116)				(0.241)
Household FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R^2	0.182	0.180	0.178	0.179	0.055	0.055	0.044	0.043
Observation	15,061	15,061	15,061	15,061	13,967	13,967	13,967	13,967

Notes—Sample analyzed in columns 1-4 includes all couples for whom the outcomes are observed in at least two survey waves. Sample analyzed in columns 5-8 is additionally restricted to those with at least one child younger than 18. All specifications control for household income, wealth, husband's and wife's age, years of education, and number of children. Standard errors clustered at the household level in parentheses.

Table 2.2: Summary Statistics of the Main Sample

Variables	N	Mean	SD
Ever enrolled in a university	4,446	0.28	0.45
Age	4,446	27.2	6.3
Male	4,446	0.47	0.50
Cognitive test scores (z-score)	4,446	0.51	0.74
Fluid intelligence test score (z-score)	4,446	0.57	0.82
Attended a public, non-religious high school	4,446	0.48	0.50
Parental monthly earnings (million, 2014 Rupiah)	4,446	3.04	18.4
Mother's relative earnings	4,446	0.30	0.28
Mother's potential relative earnings	4,446	0.38	0.12
Father's years of schooling	4,446	8.34	4.25
Father's years of schooling	4,446	7.25	4.05
Father's age	4,446	50.0	4.8
Mother's age	4,446	41.7	4.8
Household assets (million, 2014 Rupiah)	4,446	170	373
Owned more than 25 books at 12 years old	4,446	0.10	0.30
Number of siblings	4,446	2.7	1.6
Urban	4,446	0.58	0.49

Table 2.3: Mother's Bargaining Power and Children's University Enrollment

	University Enrollment					
	OLS	OLS	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Mother's share of earnings	0.062**	0.046**				
	(0.026)	(0.023)				
Mother's potential share of earnings			0.343***	0.242***	0.338***	0.471**
			(0.068)	(0.074)	(0.015)	(0.208)
Cohort FEs	Yes	Yes	Yes	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.053	0.220	0.060	0.331	0.060	0.229
Observation	4,446	4,446	4,446	4,446	4,446	4,446

Notes—Sample includes children aged 18-40 in 2014 who have at least graduated from high school. In addition to reported results, all specifications control for parents' age when individuals were 17, parents' education, income, household wealth, urban status, individuals' gender, number of siblings, cognitive and fluid intelligence test scores, type of high school attended, and number of books in the household when individuals were 12. See main text for additional sample construction and variable definitions. Robust standard errors clustered at household level in parentheses.

* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

Table 2.4: Mother's Bargaining Power and Children's University Enrollment, by Gender

	University Enrollment		
	OLS	OLS	IV
	(1)	(2)	(3)
Mother's share of earnings			
× Male	0.040		
	(0.033)		
× Female	0.063*		
	(0.032)		
Mother's potential share of earnings			
× Male		0.289***	0.463*
		(0.104)	(0.281)
× Female		0.203**	0.489*
		(0.100)	(0.289)
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
p-value (Male = Female)	0.608	0.540	0.948
R^2	0.182	0.178	0.055
Observation	4,446	4,446	4,446

Notes—Sample includes children aged 18-40 in 2014 who have at least graduated from high school. In addition to reported results, all specifications control for parents' age when individuals were 17, parents' education, income, household wealth, urban status, individuals' gender, number of siblings, cognitive and fluid intelligence test scores, type of high school attended, and number of books in the household when

individuals were 12. See main text for additional sample construction and variable definitions. Robust standard errors clustered at household level in parentheses.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

Table 2.5: Mother's Bargaining Power and Children's University Enrollment, by Household Income

	University Enrollment		
	OLS	OLS	IV
	(1)	(2)	(3)
Mother's share of earnings			
× Household income: Below median	0.106***		
	(0.034)		
× Household income: Above median	0.042		
	(0.032)		
Mother's potential share of earnings			
× Household income: Below median		0.155	-0.005
		(0.106)	(0.338)
× Household income: Above median		0.285***	0.707***
		(0.099)	(0.269)
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
p-value (HH. income: Below median = HH. income: Above median)	0.169	0.364	0.107
R^2	0.250	0.250	0.246
Observation	4,446	4,446	4,446

Notes—Sample includes children aged 18-40 in 2014 who have at least graduated from high school. In addition to reported results, all specifications control for parents' age when individuals were 17, parents' education, income, household wealth, urban status, individuals' gender, number of siblings, cognitive and fluid intelligence test scores, type of high school attended, and number of books in the household when

individuals were 12. See main text for additional sample construction and variable definitions. Robust standard errors clustered at household level in parentheses.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

Table 2.6: Mother's Bargaining Power and Children's University Enrollment, by Household Assets

	University Enrollment		
	OLS	OLS	IV
	(1)	(2)	(3)
Mother's share of earnings			
× Household assets: Below median	0.079**		
	(0.034)		
× Household assets: Above median	0.024		
	(0.033)		
Mother's potential share of earnings			
× Household assets: Below median		0.098	-0.307
		(0.105)	(0.295)
× Household assets: Above median		0.317***	0.830***
		(0.099)	(0.276)
Cohort FEs	Yes	Yes	Yes
Province FEs	Yes	Yes	Yes
p-value (HH. assets: Below median = HH. assets: Above median)	0.229	0.119	0.006
R^2	0.243	0.244	0.236
Observation	4,446	4,446	4,446

Notes—Sample includes children aged 18-40 in 2014 who have at least graduated from high school. In addition to reported results, all specifications control for parents' age when individuals were 17, parents' education, income, household wealth, urban status, individuals' gender, number of siblings, cognitive and fluid intelligence test

scores, type of high school attended, and number of books in the household when individuals were 12. See main text for additional sample construction and variable definitions. Robust standard errors clustered at household level in parentheses.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

CHAPTER 3

PARENTAL RISK PREFERENCES, INTRA-HOUSEHOLD BARGAINING, AND INVESTMENTS IN CHILDREN'S HIGHER EDUCATION

3.1 Introduction

Human capital, particularly in the form of educational attainment, is an important input into productivity growth and economic development (Gennaioli et al. 2013; Lagakos et al. 2018). Despite these benefits, investments in education could involve a substantial amount of uncertainty in returns. Recent research on wage inequality suggests that individuals cannot foresee a significant amount of the variability in lifetime earnings at the time they make schooling decisions (Chen 2008; Stange 2012; Cunha and Heckman 2016).[20] Consequently, many studies have emphasized the necessity of accounting for uncertainty about taste, ability, and returns associated with different educational and career trajectories in explaining heterogeneity in choices (Altonji 1993; Charles and Luoh 2003; Heckman, Lochner, and Todd 2006; Altonji, Blom, and Meghir 2012). If additional schooling raises the degree of uncertainty in earnings, more risk-averse individuals and families with otherwise

[20] Most studies in this area have been in the context of the United States. For example, Chen (2008) finds that college entry increases the amount of uncertainty in potential wages of high school graduates by about a quarter, after controlling for selection and unobserved heterogeneity. Stange (2012) suggests that the option value of college attendance, which stems from individuals sequentially learning about their preferences, ability, and labor market prospects, can be substantial, especially for those whose educational outcomes are most uncertain. Cunha and Heckman (2016) study the evolution of earning inequality and also find the variance of the unpredictable component to be larger for college earnings than for high school earnings.

similar characteristics may decide not to obtain more education, especially when credit and insurance markets are imperfect.[21]

While individuals' risk preferences have been shown to be a determinant of educational attainment and occupational choice (Brodaty, Gary-Bobo, and Prieto 2014; Bonin et al. 2007), how parents' risk preferences shape these outcomes is much less understood. Because parents often provide the primary source of funding for children's education, their willingness to take risks may directly determine how much education children can obtain. Alternatively, risk preferences could also be transmitted from one generation to another, in which case parents could indirectly determine outcomes through their influences on children's risk preferences (Charles and Hurst 2003; Dohmen et al. 2012). These two channels can both result in intergenerational persistence in economic prospects if poor and less educated families are less willing to tolerate risks, though their implications for policy aimed at improving intergenerational mobility are not necessarily the same (Heckman and Mosso 2014).

In this chapter, I examine whether parents' risk aversion lowers household investments in children's higher education, as well as provide empirical evidence of a mechanism through which both parents' risk preferences factor into household investment patterns. To this end, I focus on university enrollment in the context of a middle-income country: Indonesia. Compared to other countries with similar levels of economic development in southeast Asia, Indonesia has one of the highest rates of unemployment among tertiary graduates (OECD/ADB 2015; Allen 2016). If additional investments in children's higher education raise their lifetime earning potential on average but entail significant earning risks, including long-term

[21] Navarro and Zhou (2017) show that the elimination of uncertainty and credit constraints would have a huge impact on college enrollment in the U.S., compared to a situation in which only either uncertainty or credit constraints are removed. See also Lochner and Monge-Naranjo (2012).

unemployment due to a limited number of high-paying jobs as well as labor market friction, risk-averse parents may prefer their children entering the labor market and acquiring work experience early to pursuing a university degree.[22] The lack of student access to financial support channels other than private funding in the higher education sector—such as tuition waivers, student loans, or scholarships—thus makes Indonesia a particularly useful setting to study the roles of parental risk preferences.

To motivate my empirical strategies, I begin by presenting a simple model of household investment in child education in which returns depend stochastically on the child's ability and level of educational attainment. This setup extends Checchi, Fiorio, and Leonardi (2014) and Caucutt, Lochner, and Park (2017) to incorporate heterogeneity in parental risk preferences and intra-household decision making through a collective framework (Chiappori 1988; Chiappori 1992; Browning and Chiappori 1998). A key insight from this setting is that the household can be represented by a single utility function whose curvature is jointly determined by both parents' risk preferences as well as their respective decision-making power.

I measure risk preferences by applying the estimation method of Kimball, Sahm, and Shapiro (2009) on the IFLS's income gamble survey questions. This procedure results in a set of estimates of risk aversion that account for measurement error. More importantly, the risk aversion estimates are unique to each member of a household, which allow me to study the separate effect of each parent's risk aversion on household investments in children' education through a theoretically motivated intra-household bargaining framework. In contrast, current studies in the literature

[22] A distinctive feature of the labor market in developing countries is that the large majority of labor market opportunities, especially for young people, are concentrated in the informal sector, and that entry into the formal wage sector is not guaranteed. See Basu et al. (2019) for a recent formal discussion of a multi-sector labor market model for developing countries with overlapping generations of workers and risky job search.

typically assign the role of the decision maker to either fathers or mothers alone, and have not succeeded in identifying a mechanism through which parental risk preferences affect children's educational outcomes.[23]

Using combined data from the Indonesian Family Life Survey (IFLS) and Indonesia Labour Force Survey (Sakernas), I document evidence consistent with the model's key prediction. My findings suggest that both father's and mother's risk aversion significantly dampens household demand for and investments in children's higher education. Furthermore, parents' risk preferences also seem to affect children's entry into the labor market. Children from more risk-averse households are more likely to enter employment immediately upon high school completion. Among high school graduates who decide not to acquire additional schooling, those from more risk-averse households are also more likely to acquire their first job through strong social ties rather than through other costly search channels. These findings reinforce the notion that risk-averse families are more willing to accept a job offer and forgo potential benefits from additional investments in children's schooling, e.g. through setting lower reservation wages (Krueger and Mueller 2016).

This chapter contributes to three active areas of research. First, a growing number of studies have tried to document the roles of parental preferences, including parents' attitudes towards risks, in shaping children's outcomes. Data limitations as well as a lack of opportunity to randomize preferences have largely prevented researchers from reaching conclusive results.[24] This chapter improves upon past research by using rich survey data that provide information on many key variables,

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[23] For example, Wölfel and Heineck (2012) find that more risk-averse mothers are less likely to have children enroll in upper secondary school track in Germany. In the same context, Huebener (2015) finds a negative association between fathers' risk aversion and children's years of completed schooling. Most closely related to this paper are Brown, Ortiz-Nuñez, and Taylor (2012) and Checchi, Fiorio, and Leonardi (2014) who examine the effects of risk preferences of household heads on children's college enrollment in the U.S. and Italy, respectively.

[24] See Black and Devereux (2011) for a review of the literature.

including risk preferences of both fathers and mothers, children's ability and tastes for schooling, and various measures of intra-household bargaining power. More importantly, I provide a conceptual description of how both parents' risk preferences jointly determine a child's education within a household and leverage this framework as an empirical strategy to study their causal effects. The central result of the paper lends strong support to the argument that more risk-averse parents are less willing to finance children's higher education. This finding also highlights the potential roles of social insurance and income tax policies in insuring individuals and families from earning risks and thereby encouraging investments in risky human capital (Da Costa and Maestri 2007; Stantcheva 2017).

Second, research on the determinants of educational attainment has questioned the relative importance of short-run credit constraints in explaining a family income-educational attainment relationship. Recent studies have argued that long-run family and environmental factors, those that are correlated with family income and can be transmitted across generations, play a more prominent role in shaping children's educational attainment (Carneiro and Heckman 2002; Cameron and Taber 2004; Bleakley and Ferrie 2016). This paper contributes to this literature by showing that parental risk preferences could be among such factors if disadvantaged and less-educated families are indeed less willing to take risks from investing in children's human capital. Furthermore, this dynamic could result in a human capital "poverty trap" if children from these families grow up also having less risk tolerance and invest less in future generations.

Finally, a broad literature has revealed the shortcomings of the unitary models in explaining household behaviors, including saving, investment, and consumption decisions (e.g., Alderman et al. 1995; Lundberg, Pollak, and Wales 1997; Duflo 2003; Ward-Batts 2008; Ashraf 2009; Addoum 2017; Schaner 2017). This paper is the first, to

the best of my knowledge, that accounts for intra0household bargaining dynamics in studying investments in higher education. My results indicate that intra0household bargaining dynamics, particularly those influenced by time-varying factors such as changes in parents' labor market conditions, could give rise to differences in educational and labor market outcomes in children with otherwise similar characteristics. Policy aimed at promoting participation in the higher education sector should therefore take into consideration intra0household bargaining, especially when there are conflicts between preferences and decision making (Björkman Nyqvist and Jayachandran 2017).

3.2 A simple model of household investment in children's education

To motivate my empirical analysis, I develop a simple conceptual model that illustrates how parents with heterogeneous risk preferences invest in child education. This framework is similar to those introduced by Checchi, Fiorio, and Leonardi (2014) and Caucutt, Lochner, and Park (2017), in which a household maximizes its utility by allocating resources between consumption and investment in child education. Unlike these and most other studies in the human capital literature, I allow the household utility function to be a weighted combination of each parent's utility function, with the weights reflecting parents' decision-making power. This framework thus follows a standard collective approach that has been frequently used in the labor and development literature to study household allocation of resources and behaviors.[25]

[25] This approach assumes household decisions are always Pareto efficient. Whether this assumption holds is an important issue, though my focus here is to provide a mechanism through which bargaining power influence household-level risk aversion and therefore educational investments. For a recent discussion of alternative models of household decision making, see Chiappori and Mazzocco (2017).

Specifically, consider a two-period model with time index t. In the first period, individuals go to school, acquire human capital, then draw from a distribution of labor market returns and realize their income. In the second period, they match together, pool resources, and give birth to children. They then solve the household problem, i.e., to consume, invest, and pass away.

A household's utility function is assumed to be linear in first-period consumption,

$$u_t(c_t, y_{t+1}) = c_t + \beta V(y_{t+1}) \tag{8}$$

where $\beta \in (0,1)$ is the household time discount rate, and y_{t+1} is the child's next period income. I follow Addoum (2017) and simplify derivations by assuming household utility over y_{t+1} has the following functional form,

$$\begin{aligned} V(y_{t+1}) &= u_F(y_{t+1})^{\pi} u_M(y_{t+1})^{1-\pi} \\ &= \left[\frac{(y_{t+1})^{1-\gamma_F}}{1-\gamma_F}\right]^{\pi} \left[\frac{(y_{t+1})^{1-\gamma_M}}{1-\gamma_M}\right]^{1-\pi} \end{aligned} \tag{9}$$

where $u_F(y_{t+1})$ and $u_M(y_{t+1})$ respectively represent father's and mother's utility over the child's income in the next period, and $\pi \in [0,1]$ captures the level of influence the father has over household decision making. The constant relative risk aversion (CRRA) form of each parent's utility function (with coefficients of relative risk aversion γ_F and γ_M) allows household utility over y_{t+1} to be expressed as a representative investor's utility,

$$
\begin{aligned}
&V(y_{t+1}) = \Theta \frac{(y_{t+1})^{1-\gamma}}{1-\gamma} \text{ , where} \\
&\gamma = \pi \gamma_F + (1-\pi)\gamma_M \text{ , and} \\
&\Theta = \frac{1-\gamma}{(1-\gamma_F)^{\pi}(1-\gamma_M)^{1-\pi}}
\end{aligned} \tag{10}
$$

Future earnings by the child is determined by a Cobb-Douglas human capital production function with a separable, stochastic component of return,

$$y_{t+1} = \tilde{\theta} I_t^{\alpha} A^{1-\alpha} \tag{11}$$

where I_t captures how much the household invests in education in period t, and A determines the innate, time-invariant ability of the child that is known to both parents. To achieve a closed-form analytical solution, I assume $\tilde{\theta}$ follows a log-normal distribution, $\log \tilde{\theta} \sim N(\mu, \sigma^2)$.

Given the budget constraint $y_t = c_t + I_t$, the household problem is

$$\max_{I_t} \quad (y_t - I_t) + \beta \mathrm{E}\left\{\Theta \frac{(\tilde{\theta} I_t^{\alpha} A^{1-\alpha})^{1-\gamma}}{1-\gamma}\right\} \qquad \text{s.t.} \quad I_t \leq y_t \tag{12}$$

Because the human capital production function satisfies the Inada condition, it is always optimal for parents to invest some money in the child's education. Furthermore, the concavity of the production function guarantees the satisfaction of the second-order condition. If the budget constraint does not bind, solving the first-order condition yields the following closed-form, interior solution,

$$I_t^* = \left[\alpha \beta \Theta A^{(1-\gamma)(1-\alpha)} e^{(1-\gamma)\mu + \frac{(1-\gamma)^2}{2}\sigma^2}\right]^{1/(1-\alpha(1-\gamma))} \tag{13}$$

This analytical solution highlights several important results. Higher ability A and the productivity of investment, determined by α, β and the expected value of $\tilde{\theta}$,

increases the optimal level of investment, while the degree of riskiness in return, captured by the variance of $\tilde{\theta}$, has the opposite effect.[26] More importantly, the model yields the following predictions.

Proposition 1. I_t^* decreases in both γ_F and γ_M if $\pi \in (0,1)$, in γ_F but not γ_M if $\pi = 1$, and in γ_M but not γ_F if $\pi = 0$.

If a parent has no bargaining power, household-level risk aversion, γ, is entirely determined by his or her spouse's risk preferences. In this case, household investment is dictated by only one parent, regardless of the other's willingness to take risks. On the other hand, if both parents participate in the decision-making process, household investment decreases in both parents' risk aversion. The strength of the relationship between parental risk aversion and household investment in the child's education thus depends on the distribution of intra-household bargaining power.

Proposition 2. Suppose $\gamma_F > \gamma_M$, then I_t^* decreases in π.

A shock to bargaining power that allows the more risk-averse parent to exert more control over the decision-making process would effectively increase observed household-level risk aversion. Investment in the child's education would thus decline in the event of renegotiation over intra-household allocations.

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[26] Note that if m and v^2 are the mean and variance of the non-logarithmized distribution of $\tilde{\theta}$, then $\mu = \log\left(\frac{m}{\sqrt{1+\frac{v}{m^2}}}\right)$ and $\sigma^2 = \log\left(1+\frac{v}{m^2}\right)$.

An exogenous shock to bargaining power that allows the more risk-averse parent to exert more control over the decision-making process would effectively increase observed household-level risk aversion. Investment in the child's education would thus decline in the event of renegotiation over intra-household allocations.

Overall, the framework presented in this section implies that, if investments in higher education are risky, the likelihood of a child pursuing higher education decreases in household-level risk aversion, which depends on with both parents' risk preferences as well as the distribution of decision-making power.

3.3 Data and variable definitions

This chapter relies on the same data sources used in the previous chapter. Interested readers are referred to section 2.2 for definitions of the main outcome and control variables. Here, I describe the construction of a measure of risk aversion which serves as the key independent variable in my empirical analysis.

The last two rounds of the survey, IFLS-4 and IFLS-5, contain a set of income gamble questions that serve to elicit individuals' risk preferences. In each survey round, respondents were first asked to choose between a guaranteed amount of 800,000 rupiah (about $56) or a lottery with an equal chance of receiving either Rp1.6 million or Rp400,000. Those who preferred the sure amount were asked again to choose between the same safe option and a lottery with a higher expected payoff, an equal chance of receiving either Rp1.6 million or Rp600,000. Those who preferred the risky option in the first question proceeded to answer a different question, choosing between the same safe option and an equal chance of receiving either Rp1.6 million or Rp200,000. Based on these questions, one can create four distinct response categories for each round of survey: those who only chose the safe option, those who

chose both risky options, and two categories of individuals who chose exactly one risky option. Table 3.1 shows the distribution of response categories across the two survey rounds. As shown, the majority of individuals reject both risky options, though there's a substantial fraction of those who are more willing to tolerate risks.

I next apply an estimation method developed by Kimball, Sahm, and Shapiro (2008, 2009) to summarize and transform the sequence of income gamble responses into a cardinal measure of risk aversion that accounts for measurement error. As the next section will show, such a cardinal measure helps facilitate convenient interpretations of the empirical results in light of the theoretical framework presented in section 3.2, while also alleviate concerns about potential attenuation bias caused by measurement error in places where the model predicts that parental preferences have no impact on children's educational attainment.

The basic details behind the estimation procedure are as follows. First, I assume, as before, that individuals have CRRA utility over wealth and locally approximate the implied lower- and upper-bounds of an individual's *risk tolerance*, θ, based on the category that he or she is assigned to.[27] I next estimate Kimball et al. (2008, 2009)'s model of noisy log risk tolerance, $\Sigma = \log\theta + e$, where $\log\theta$ follows $N(\mu, \sigma_\theta^2)$ and e is a classical measurement error component with variance σ_e^2. I allow the mean of the risk tolerance distribution, μ, to depend on gender and age, and the standard deviation of the distribution of the measurement error component, σ_e, to depend on the highest level of completed education as follows

$$\mu = \bar{\mu} + \zeta_1 \text{male} + \zeta_2 \text{age} + \zeta_3 \text{age}^2 \tag{14}$$

[27] For example, if a respondent chooses the safe option of receiving Rp 800,000 at first but switches to the risky option of receiving either Rp1.6 million or Rp600,000 with an equal chance, expected utility theory implies that $0.5\text{u}(\text{w} + 1,600,000) + 0.5\text{u}(\text{w} + 600,000) \geq \text{u}(\text{w} + 800,000) \geq 0.5\text{u}(\text{w} + 1,600,000) + 0.5\text{u}(\text{w} + 400,000)$, where $u(w) = w^{(1-1/\theta)}/(1 - 1/\theta)$. In estimating the bounds, I also follow most studies in the applied literature and ignore income/wealth outside the experiment (Cardenas and Carpenter 2008).

$$\sigma_e = \bar{\sigma}_e + \lambda_1 \text{elementary school} + \lambda_2 \text{junior middle school} + \lambda_3 \text{senior middle school} + \lambda_4 \text{university degree} \tag{15}$$

Based on these assumptions, the probability that an individual is assigned to a category k in a survey round is

$$\begin{aligned} \Pr(c = k) &= \Pr(\log \underline{\theta}_k < \Sigma < \log \bar{\theta}_k) \\ &= \Phi\left(\frac{\log \bar{\theta}_k - \mu}{\sigma_\Sigma}\right) - \Phi\left(\frac{\log \underline{\theta}_k - \mu}{\sigma_\Sigma}\right) \end{aligned} \tag{16}$$

where $\sigma_\Sigma = \sqrt{\sigma_\theta^2 + \sigma_e^2}$, $\Phi(\,.\,)$ is the standard normal cumulative distribution function, and $\log \bar{\theta}_k$ and $\log \underline{\theta}_k$ denote category k's upper- and lower-bounds of log risk tolerance, respectively. For those who answer the income gamble questions in both survey rounds, the classical measurement error is assumed to be transitory and not correlated across the two survey rounds. Accordingly, the probability an individual is assigned to a category j in IFLS-4 and j' in IFLS-5 is

$$\begin{aligned} \Pr(c = j,\, c' = j') = \overrightarrow{\Phi}(U_j, U_{j'}, \rho) + \overrightarrow{\Phi}(L_j, L_{j'}, \rho) \\ - \overrightarrow{\Phi}(U_j, L_{j'}, \rho) - \overrightarrow{\Phi}(L_j, U_{j'}, \rho) \end{aligned} \tag{17}$$

where $\overrightarrow{\Phi}(\,.\,)$ is the bivariate normal CDF, $U_j = (\log \bar{\theta}_j - \mu)/\sigma_\Sigma$, $L_j = (\log \underline{\theta}_j - \mu)/\sigma_\Sigma$, $U_{j'} = (\log \bar{\theta}_{j'} - \mu)/\sigma_\Sigma$, $L_{j'} = (\log \underline{\theta}_{j'} - \mu)/\sigma_\Sigma$, and $\rho = \sigma_\theta/\sigma_\Sigma$.

Table 3.2 reports estimates of the parameters of the model obtained via the maximum likelihood method. The estimated baseline mean and variance of the log tolerance distribution, $\bar{\mu}$ and σ_θ^2, are -0.95 and 0.57, respectively, which are very close to those obtained from the PSID in the US (-1.06 and 0.76; Kimball, Sahm, and Shapiro 2009). Consistent with previous findings from the literature, risk tolerance

tends to be higher among men and increases in age. Based on these parameters, I impute individuals' risk aversion based on the expectation of $1/\theta$ conditional on the observed response category (categories).

The estimated parameters also reveal a significant amount of measurement error in the survey data ($\sigma_e^2 \approx 9$), which is more pronounced among individuals with less formal education. To gauge the validity of the imputed measure of risk aversion, I examine its ability to explain several well-documented risky behaviors. These include (1) the (log) number of cigarettes smoked per day, conditional on smoking, (2) having health insurance, and (3) being self-employed, conditional on working (Falk et al. 2018). Table 3.3 shows the results of this exercise. As expected, risk aversion is associated with a significantly greater tendency to engage in risky behaviors. Notably, the obtained coefficients on risk aversion remain largely unchanged even with the additional controls for education and income, suggesting that the constructed measure of risk aversion indeed captures some of the fundamental underlying preferences.

3.4 Parental risk preferences and children's university enrollment

The theoretical framework introduced in section 3.2 provides an intuitive way of thinking about household investments in children's education: both parents' preferences, potentially divergent if not conflicting, play a contributing role, and children's outcomes thus depend also on the distribution of decision making power within a household. In contrast, existing studies that examine parental risk preferences have either relied on the assumption that outcomes are determined entirely by household heads or failed to identify a collective decision-making mechanism (e.g., Wölfel and Heineck 2012; Brown, Ortiz-Nuñez, and Taylor 2012;

Checchi, Fiorio, and Leonardi 2014; Huebener 2015). To the extent that intra-household bargaining dynamics, and therefore household behaviors, can be influenced by changes in the broader economic environment, within-household heterogeneity in parental preferences could be an important, yet overlooked factor that explains differences in children's human capital.

As a starting point, I use the same sample analyzed in chapter 2, which contains all individuals aged 18-40 in IFLS-5 who have at least graduated from high school, and regress an indicator for university enrollment status on both parents' risk preferences. Specifically, I estimate the following linear probability model

$$\begin{aligned}\text{university enrollment}_i = \beta_1 \text{father's risk aversion}_i + \beta_2 \text{mother's risk aversion}_i \\ + \Gamma' X_i + \epsilon_i\end{aligned} \tag{18}$$

where X_i includes controls for background characteristics, household resources, and indicators of ability. The results in table 3.5 suggest that only father's risk aversion has a negative and statistically significant impact on the likelihood of children enrolling in a university. Mother's risk aversion, on the other hand, has the same sign but are not distinguishable from zero in any of the specifications.

What explains the non-significance of mother's risk preferences? The theoretical framework presented in section 3.2 suggests that the distribution of intra-household bargaining power, which tends to favor fathers, plays a critical role. To explore the relevance of decision-making dynamics, I construct mother's potential share of earnings as in the previous chapter to proxy for mother's bargaining power and re-estimate equation 18 separately for households below and above the median of the distribution.

Table 3.6 reports the results of this exercise. As expected, among households in which mother's potential share of earnings is below the median when children

graduate from high school, the coefficient on father's risk aversion becomes even larger and is statistically significant (column 1). The opposite holds true among households where mother's potential share of earnings is above the median and is expected to be the decision maker (column 2): here, the coefficient on mother's risk aversion is strongly significant and almost of the same magnitude as the effect of father's risk aversion in column 1.

One caveat with these findings is that reverse causality could be driving my results. In particular, since survey on risk preferences was done when children's educational outcomes have been realized, it is possible that households with more educated children could have accumulated more resources, which causes parents to be more willing to take risks at the time the survey was conducted. To address this concern, I examine parents' reported expectation regarding each child's highest level of education to be achieved as the outcome. Studies have shown that parental educational expectations can serve as a proxy for their willingness to invest in higher education.[28] Unlike children's actual educational outcomes, however, parents' willingness to invest should not affect their risk preferences. Furthermore, a parent's stated willingness to invest is not constrained by his or her decision making power, making it useful to investigate how much parents differ in their individual demand for children's education as well as the extent to which the observed differences can be attributed to risk preferences.

To carry out the analysis, I construct sample of households with only children between the age of 7 and 18 who have not enrolled in a university. In addition, I further exclude families in which the wife reports wanting to have more children in order to abstract from issues related to couples' fertility decisions and the potential

[28] For instance, DeBacker and Routon (2017) analyze data from the NLSY97 and find that parents' educational expectations affect children's educational outcomes, but are not shaped by the objective likelihoods of such outcomes being realized.

effects of changes in family composition (Chen, Chen, and Liu 2019). The main outcome variable, which is taken from a survey module in IFLS-5 on parents' educational expectations regarding each individual child and was answered separately by fathers and mothers, is equal to one if a parent expects a university degree or beyond and zero if he or she expects only high school completion.

Table 3.7 presents the results obtained from regressing fathers' and mothers' educational expectations for each child on their risk preferences. The results indicate that more risk-averse fathers are less likely to expect a child to pursue higher education (column 1). On the other hand, mother's risk aversion has no significant effect on father's reported expectation. The reverse is observed with respect to mother's expectation (column 2). In this case, only mother's risk aversion, but not father's, is a significant determinant.

These findings thus rule out reverse causality as the main driver of the results in the previous section, and suggests that parental risk preferences indeed affect the likelihood of children's enrollment in higher education through their willingness to finance such a degree. Without being constrained by decision making power, the effects of fathers' and mothers' risk aversion on their own expectations are strikingly similar in magnitudes and almost identical to the effect of fathers' risk aversion on university enrollment in the previous analysis. The observed significant impacts of parents' risk aversion on their own expectations, coupled with the lack thereof on their spouses' expectations, provides strong justifications for a non-unitary model of household investments in children's education.

3.5 Parental risk preferences and children's early labor market outcomes

Given the established negative association between parental risk aversion and their willingness to invest in children's higher education as well as actual enrollment outcomes, a natural question to ask, then, is what risk-averse parents prefer to continued higher education? I conclude my empirical analysis by investigating the implications of parental risk aversion on children's early labor market outcomes. Since the analysis here only serves as an exploratory basis for future research, I only focus on employment outcomes and also abstract from intra-household bargaining aspects.

If more risk-averse parents derive less (expected) utility from children's future higher education, is it possible that they have lower "reservation wage" levels, i.e. the levels of wage offered to children at which parents are indifferent between investing more in their education and have them participate in the labor market immediately? To investigate this possibility, I construct a sample of high school graduates for whom I observe their employment status between age 18 and 21. The outcome of interest here is an indicator for whether an individual reports working at any point during this period. In columns 1 of table 3.8, I report the results of regressing this outcome variable on parental risk aversion. As expected, the coefficient on father's risk aversion is positive and strongly significant, suggesting children whose fathers are more risk-averse are more likely to work during a time when further investments in human capital could have been made.

As a final check, I also explore the channels through which children acquire their first jobs. In the context of Indonesia, Kuzubas and Szabo (2015) show that individuals are twice more likely to look for a job through family members and friends, compared to other search channels. This is because job search through strong social ties are less expensive, though it comes at the cost of poorer match quality, which results in lower wages (Kuzubas and Szabo 2015). To assess whether lower

reservation wages and a greater desire for children's immediate employment lead risk-averse households to seek out employment opportunities through family and friends, I use information on individuals' first jobs, taken from the IFLS-4 and IFLS-5, and construct an outcome variable indicating whether individuals acquire their first jobs through friends and relatives. Column 2 reports the results of regressing this outcome variable on parental risk aversion, focusing on high school graduates who decided not to obtain higher education. Once again, the coefficient on father's risk aversion is positive and significant at the 5 percent level, whereas the same effect is not observed with respect to mother's risk aversion.

Taken together, the results presented in this section suggest that parental risk aversion is an important determinant of not only children's educational attainment but also their early labor market outcomes. Even though intra-household bargaining was not examined, the overall picture seems consistent with the idea that, on average, fathers tend to have more decision-making power than mothers. Do parental risk preferences and intra-household bargaining dynamics, then, affect how children sort into different occupations and jobs, and, if so, do these factor also affect lifetime earnings and other outcomes? These are important questions that may serve as fruitful venues for future research.

3.6 Conclusion

Given the important contributions of human capital to labor productivity and economic development, a tremendous amount of research in economics has been devoted to understanding the determinants of investments in education, and, in particular, as to why individuals from wealthier families tend to have better educational outcomes. In this paper, I provide empirical evidence showing that

parental willingness to take risks—a fundamental economic preference that has often been linked to wealth—can be a crucial factor that determines children's educational attainment.

Motivated by a collective approach to household decision making, I first incorporate heterogeneity in parental willingness to take risks as well as intra-household bargaining into a standard model of household investments in children's education. I analyze rich household and labor market survey data from Indonesia, and find evidence consistent with the key prediction of the model: Both father's and mother's risk aversion dampen household demand for and ultimately investment in children's higher education, though their effects depend critically on the distribution of intra-household decision making power.

Additional analysis shows that parental risk aversion has a negative impact on not only children's educational attainment but also their early labor market prospects. Children from more risk-averse households are found to be more likely to immediately enter employment after high school graduation and to rely more on friends and relatives instead of potentially more costly channels in acquiring their first jobs. If these outcomes are indicators of poor job matches and therefore lower starting wages, my results underscore the possibility of broader consequences of parental risk aversion and intra-household bargaining dynamics on children's lifetime earnings and intergenerational mobility. Taken together, these findings present a strong case for policy prescriptions that help shield individuals from welfare loss entailed by earning risks and thereby encourage investments in human capital.

Table 3.1: Risk Aversion Response Category

Category	Description	Risk tolerance lower bound	Risk tolerance upper bound	N (%) in IFLS-4	N (%) in IFLS-5
1	Accept all risky choices	3.27	∞	4,432 (26.48%)	6,080 (27.43%)
2	Accept risky choice in Q1, reject risky choice in Q2	1	3.27	2,300 (13.74%)	4,065 (18.34%)
3	Reject risky choice in Q1, accept risky choice in Q2	0.343	1	1,585 (9.47%)	3,711 (16.74)
4	Reject all risky choices	0	0.343	8,432 (50.32%)	8,306 (37.48)

Table 3.2: Distribution of Log Risk Tolerance, Maximum Likelihood Estimates

Parameter	ML Estimate
$\bar{\mu}$	-0.9494
ζ_1	0.6146
ζ_2	0.2180
ζ_3	-0.0019
σ_θ	0.7548
σ_e	3.0065
γ_1	2.7724
γ_2	2.4792
γ_3	2.4214
γ_4	2.3710

Table 3.3: Imputed Risk Aversion and Observed Risky Behaviors

	(Log) Cigarettes Smoked Per Day[a]		Have Health Insurance		Self-Employed[b]	
	(1)	(2)	(3)	(4)	(5)	(6)
Risk aversion	-0.051**	-0.044**	0.015**	0.016**	-0.039***	-0.038***
	(0.022)	(0.022)	(0.007)	(0.007)	(0.006)	(0.006)
Income (in ten millions Rupiah)		0.009***		0.006***		0.004***
		(0.002)		(0.001)		(0.001)
Years of education		0.002		0.019***		-0.014***
		(0.002)		(0.001)		(0.001)
Age	0.032***	0.030***	0.008***	0.005***	0.016***	0.016***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
Age2/100	-0.038***	-0.035***	-0.010***	-0.004**	-0.006***	-0.008***
	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)
Male	0.611***	0.612***	0.015	0.004	-0.046***	-0.045***
	(0.074)	(0.074)	(0.013)	(0.013)	(0.012)	(0.012)
Constant	1.188***	1.180***	0.321***	0.135***	-0.014	0.141***
	(0.119)	(0.120)	(0.040)	(0.040)	(0.033)	(0.035)
Observations	7,962	7,962	17,734	17,734	17,813	17,813
R^2	0.032	0.036	0.002	0.029	0.083	0.095

Notes—[a] conditional on smoking, [b] conditional on working. All variables, except risk aversion, are measured in IFLS-5 (2014). Robust standard errors in parentheses.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

Table 3.4: Summary Statistics of the Main Sample

Variables	N	Mean	SD
Children's characteristics			
Having enrolled in a university	2,741	0.31	0.46
Age	2,741	26.3	6.04
Male	2,741	0.47	0.50
Cognitive test scores (z-scores)	2,741	0.54	0.75
Fluid intelligence test scores (z-scores)	2,741	0.61	0.80
Attended public non-religious senior high school	2,741	0.50	0.50
Parents' characteristics			
Father's risk aversion	2,741	1.75	0.41
Mother's risk aversion	2,741	3.18	0.68
Mother's potential relative income	2,741	0.30	0.12
Father's years of schooling	2,741	8.76	4.24
Mother's years of schooling	2,741	7.67	4.16
Father's age	2,741	55.0	7.13
Mother's age	2,741	50.8	6.81
Parental monthly income (ten million, 2014 Rupiah)	2,741	0.23	2.17
Other household characteristics			
Household assets (ten million, 2014 Rupiah)	2,741	12.1	21.0
Owned more than 25 books at 12 years old	2,741	0.10	0.30
Number of siblings	2,741	2.16	1.54
Urban	2,741	0.55	0.50

Table 3.5: Effects of Parents' Risk Aversion on Children's University Enrollment

	University Enrollment		
	(1)	(2)	(3)
Father's risk aversion	-0.051*	-0.053**	-0.050**
	(0.027)	(0.024)	(0.024)
Mother's risk aversion	-0.016	-0.005	-0.008
	(0.016)	(0.014)	(0.013)
Father's years of schooling		0.022***	0.019***
		(0.003)	(0.003)
Mother's years of schooling		0.024***	0.020***
		(0.003)	(0.003)
Father's age		0.008	0.010
		(0.015)	(0.015)
Mother's age		0.026	0.024
		(0.016)	(0.016)
Household assets (ten million, 2014 Rupiah)		0.002***	0.001***
		(0.001)	(0.001)
Parental income (ten million, 2014 Rupiah)		-0.002	-0.002
		(0.002)	(0.002)
Cognitive test score			0.034***
			(0.011)
Fluid intelligence test score			0.018
			(0.011)
Number of books owned at 12: 11-25			0.043**
			(0.022)

Number of books owned at 12: >25			0.130***
			(0.030)
Attended public religious high school			0.029
			(0.044)
Attended private non-religious high school			-0.133***
			(0.019)
Attended private religious high school			-0.025
			(0.023)
Age	-0.009***	-0.010***	-0.007***
	(0.002)	(0.002)	(0.002)
Male	-0.018	-0.021	-0.015
	(0.018)	(0.016)	(0.016)
Number of siblings	-0.017***	-0.008	-0.007
	(0.006)	(0.006)	(0.006)
Urban	0.059***	-0.043**	-0.035*
	(0.021)	(0.019)	(0.018)
Constant	0.703***	-0.778**	-0.741**
	(0.079)	(0.335)	(0.331)
R^2	0.204	0.185	0.213
Observation	2,741	2,741	2,741

Notes—Sample includes children aged 18-40 in 2014, who have at least graduated from high school. Parental income and household assets are measured when children were between 12 and 18 years old, and are converted to 2014 Indonesian Rupiah. See section 2.2 for additional variable definitions and sample construction. Robust standard errors clustered at household level in parentheses.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

Table 3.6: Effects of Parent's Risk Aversion on Children's University Enrollment

	University Enrollment	
	Mother's potential share of earnings: below median	Mother's potential share of earnings: above median
	(1)	(2)
Father's risk aversion	-0.077**	0.020
	(0.035)	(0.035)
Mother's risk aversion	0.023	-0.056***
	(0.020)	(0.019)
R^2	0.182	0.278
Observation	1,156	1,156

Notes—Sample includes children aged 18-40 in 2014, who have at least graduated from high school. Mother's potential share of earnings is defined as in section 2.2.2. Each specification includes a full set of covariates as reported in column 3 of table 2.4. Robust standard errors clustered at the household level.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

Table 3.7: Parents' Risk Aversion and Educational Expectation

	Father expects higher education	Mother expects higher education
	(1)	(2)
Father's risk aversion	-0.106***	0.000
	(0.033)	(0.033)
Mother's risk aversion	-0.026	-0.058***
	(0.020)	(0.020)
R^2	0.156	0.209
Observation	1,502	1,502

Notes—Sample includes households with only children aged 7-18 in 2014, who have not graduated from high school. Dependent outcome is an indicator for whether a parent expects a child's highest level of education achieved to be at least a university degree (as measured in IFLS-5). All specifications include controls for age, sex, number of siblings, cognitive test score, type of primary school attended, as well as parents' age, years of education, earnings, household assets, and urban status. Robust standard errors clustered at the household level.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

Table 3.8: Parents' Risk Aversion and Children's Early Labor Market Outcomes

	Worked between age 18-21	Got first full-time job through friends and relatives
	(1)	(2)
Father's risk aversion	0.111***	0.086**
	(0.026)	(0.039)
Mother's risk aversion	0.005	-0.008
	(0.017)	(0.024)
R^2	0.095	0.056
Observation	1,547	969

Notes—Sample in column 1 includes the same individuals analyzed in table 2.5 with non-missing information on work history between 18 and 21. Sample in column 2 excludes those who have enrolled in a university. Each specification includes a full set of covariates as reported in column 3 of table 2.4. Robust standard errors clustered at the household level.
* significant at 0.1 level, ** significant at 0.05 level, *** significant at 0.01 level.

APPENDIX

Appendix Table A1: Effects of International Students on Natives' College Attendance, IPEDS Estimates, Stacked First Differences 2006-2015

	Public		Private, Non-Profit		Private, For-Profit	
	2-year	4-year	2-year	4-year	2-year	4-year
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Men and Women						
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	-0.023**	0.014	-0.002	-0.002**	0.002	-0.001
	(0.011)	(0.010)	(0.001)	(0.001)	(0.006)	(0.001)
Panel B. Men						
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	-0.023**	0.012	-0.001	-0.002**	-0.002	-0.000
	(0.010)	(0.009)	(0.001)	(0.001)	(0.004)	(0.000)
Panel C. Women						
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	-0.024*	0.015	-0.003*	-0.002*	0.006	-0.001
	(0.012)	(0.011)	(0.001)	(0.001)	(0.010)	(0.001)
First-stage *F*-statistic		43.3		43.3		43.3
Observations	5,700	5,700	5,700	5,700	5,700	5,700

Notes—Observations = 570CZ x 10. Outcomes are period changes in per capita first-time, first-year college enrollment by natives from *t* to *t+1*. All specifications include time fixed effects, changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), race (whites, blacks, Hispanics, and Asians), the share of employed adults over 25 with a college degree, the share of employed adults that are foreign born, and the share of the population employed in manufacturing. Regressions are weighted by commuting zone 18-25 population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level
** significant at the 5 percent level
*** significant at the 1 percent level

Appendix Table A2: Robustness Checks: Baseline IV Estimates with Alternative Wage Outcomes, ACS Estimates

	Baseline: Average Wages (full-time workers only)	Average Wages (full- and part-time workers)	Average Wages at CZ x Demographic Cell Level (full-time workers only)	Average Residualized Log Wages (full-time workers only)
	(1)	(2)	(3)	(4)
$\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	0.083***	0.093***	0.077**	0.44**
	(0.025)	(0.030)	(0.031)	(0.021)
First-stage *F*-statistic	50.2	50.2	42.4	50.2
Observations	7,220	7,220	114,986	7,220

Notes—Outcomes are period changes from *t* to *t+1*. All specifications include time fixed effects, changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), race (whites, blacks, Hispanics, and Asians), and education (no college, some college, college or professional degree, and advanced degrees), the share of employed adults that are foreign born, and the share of the population employed in manufacturing. Regressions are weighted by commuting zone population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level

** significant at the 5 percent level

*** significant at the 1 percent level

Appendix Table A3: Robustness Checks: Baseline IV Estimates with Alternative Sample Restrictions, ACS Estimates

Independent Variable: $\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	Employment Rate	Average Wages	Emp. Rate x Average Wages
	(1)	(2)	(3)
Panel A			
Baseline estimates (all workers)	0.039***	0.083***	0.167***
	(0.010)	(0.025)	(0.039)
Panel B			
Same state of birth workers	0.042***	0.082***	0.173***
	(0.013)	(0.029)	(0.046)
Panel C			
Exclude CZ with the highest numbers of international students in 2005 (top 10%)	0.066***	0.134***	0.274***
	(0.020)	(0.045)	(0.074)
Panel D			
Exclude CZ with no international students in 2005	0.039***	0.092***	0.172***
	(0.010)	(0.026)	(0.040)

Notes—Outcomes are period changes from *t* to *t+1*. All specifications include time fixed effects, changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), race (whites, blacks, Hispanics, and Asians), and education (no college, some college, college or professional degree, and advanced degrees), the share of employed adults that are foreign born, and the share of the population employed in manufacturing. Regressions are weighted by commuting zone population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level

** significant at the 5 percent level

*** significant at the 1 percent level

Appendix Table A4: Robustness Checks: Baseline IV Estimates with Alternative Specifications, ACS Estimates

Independent Variable: $\Delta IS_{c,t}/Pop_{c,t-1} \times 100$	Employment Rate	Average Wages	Emp. Rate x Average Wages
	(1)	(2)	(3)
Panel A			
Baseline estimates (all workers)	0.039***	0.083***	0.167***
	(0.010)	(0.025)	(0.039)
Panel B			
Exclude international graduate students	0.076***	0.193***	0.345***
	(0.025)	(0.068)	(0.102)
Panel C			
Exclude Chinese students	0.143***	0.362***	0.647***
	(0.049)	(0.123)	(0.196)
Panel D			
Exclude Indian students	0.040***	0.084***	0.169***
	(0.010)	(0.025)	(0.038)

Notes—Outcomes are period changes from *t* to *t+1*. All specifications include time fixed effects, changes in (log) population, the share of females, the shares of the population by age (16-34, 35-49, 50-64, and over 65), race (whites, blacks, Hispanics, and Asians), and education (no college, some college, college or professional degree, and advanced degrees), the share of employed adults that are foreign born, and the share of the population employed in manufacturing. Regressions are weighted by commuting zone population in 2005. Robust standard errors in parentheses are clustered at the commuting zone level.

* significant at the 10 percent level

** significant at the 5 percent level

*** significant at the 1 percent level

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