Immigrant Impact on Local Labour Markets: Evidence from the Canadian International Student Expansion

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Abstract

In the decade between 2009 and 2019, the number of international college students filing taxes in Canada increased from 5,400 to 170,000, representing approximately 0.5% of total employment in Canada by 2019. The increase reflected both an increase in the number of international college students (which increased by over 320 % in the same time period) and a shift in regulations that allowed them to work off campus much more freely. The increase represents an exogenous shock to local labour markets since it was was completely controlled by the colleges themselves in order to increase their income from foreign student tuition, with little or no control by the government over the number of students entering or whether they actually attended classes. In this paper, we examine the impact of this labour supply shock on both other workers and firms. We find that the shock had a small negative impact on total employment in a local economy, as the international students displaced some non-student workers. Interestingly, the main employment reductions are in firms that do not hire international students, implying that competition in the final goods market plays an important role in the adjustment of an economy to an immigration shock. Using firm births and deaths, we also find evidence of a shift toward firms that do not hire students and primarily employ part time workers.

Acknowledgments:

1 Introduction

In the decade between 2009 and 2019, the number of international college students filing taxes in Canada increased from 5,400 to 170,000.[1] The increase reflected both an increase in the number of international college students (which increased by over 320 % in the same time period) and a shift in regulations that allowed them to work off campus much more freely. The labour supply increase represented approximately 0.5% of total employment in Canada by 2019 but it varied considerably at the city level and represented a substantial shock to local labour markets with colleges that intensively enrolled foreign students. In this paper, we examine the impact of this labour supply shock on both other workers and firms.

The impact of the substantial increase in the number of international college students working off campus on other workers and on firms is of interest in its own right. This is part of an expansion in Canadian immigration about which there has been considerable debate. But this particular part of the expansion is also useful as a mechanism for understanding the impact of immigrants on local economies more generally. The expansion was completely controlled by the colleges themselves in order to increase their income from foreign student tuition, with little or no control by the government over the number of students entering or whether they actually attended classes. We show that the result was an allocation of the new students across towns and cities in a way that varied by time and location but was unrelated to prior economic trends. Taking advantage of this variation, we show that the foreign student workers were disproportionately employed at large, lower productivity firms in the retail and accommodation sectors.

We find that the shock had a small negative impact on total employment in a local economy, as the international students displaced some non-student workers. Interestingly, the main employment reductions are in firms that do not hire international students, implying that competition in the final goods market plays an important role in the adjustment of an economy to an immigration shock. Using firm births and deaths, we also find evidence of a shift toward firms that do not hire foreign students and primarily employ part time workers. These results do not fit with narratives from the business community that increased hiring opportunities would benefit other workers through production complementarities. In ongoing work, we are examining whether the implied shift in firm composition was toward or away from more productive firms and what happened

[1] These numbers are rounded to comply with Statistics Canada's rules for vetting intermediate output. The final version of this paper will contain the exact digits for these summary statistics.

to the workers who were formerly employed at the firms that downsized as a result of the increase in the supply of student workers.

Our investigations benefit from our use of rich administrative data that comes from two sources. The first is the Canadian Employer-Employee Dynamics Database (CEEDD), which is a linkage of all individual tax data to the data for the firms at which they are employed for the period 2001 to 2019. This provides data on individual earnings and employment as well as firm level outcomes such as revenues, value added, and investment. The CEEDD also includes a linkage to the complete set of government records on all arriving immigrants - both temporary and permanent. From those records, we can identify immigrants entering under a study permit for either colleges or universities in Canada. The second dataset is the Postsecondary Student Information System (PSIS) and contains enrolment records for students at all public post-secondary institutions in Canada, broken down by student characteristics, including whether they are domestic or international students. From this, we can observe where the international students go to school. Combined, the two datasets provide a rich picture of where international students go to school and their activities in the labour market as well as the responses of firms and other workers.

Our study contributes to the large literature on the impact of immigrants on workers in receiving labour markets and the smaller, though still significant, literature on their impacts on firms. The literature on impacts on workers starts in its current form from the seminal Mariel Boatlift. That paper shows that the large refugee shock to the Miami labour market from the 1980 Mariel Boatlift had virtually zero impacts on both the average wages and the employment rate of native born workers. Our findings fit with the non-effect on earnings but imply somewhat more negative impacts on employment. In the literature following Card (1990), the finding that immigration has limited effects on the average wages and earnings of native born workers in the receiving economy has been replicated repeatedly in different locations and time periods. However, studies also show that there are distributional effects of immigrant inflows with low skilled immigration shocks generating reductions in wages and employment for low skilled native born workers offset by improvements for higher skilled workers. (e.g., Peri and Sparber (2009),Ottaviano and Peri (2012), Dustmann et al. (2012), and Dustmann et al. (2017)). More recently, access to matched worker-firm data has allowed researchers to examine the firm dimension of both immigrant impacts on other workers and their own adaptation to the host economy. For Canada, Dostie et al. (2023) show that movements from lower paying to higher paying firms with time in Canada plays an important role in worker

adaption to the new economoy. But more closely aligned with our work are papers on workers in the local economy seen through the lens of firm level outcomes. For example, Dustmann and Glitz (2015) examines the wage reactions to immigration both across industries and across firms within industries in Germany. They show that the wage response to immigration arose in part because of resulting employment shifts toward less skilled industries and, in part, because of changes in the skill intensity of production within firms. That is, the response has a general equilibrium form that is a combination of sector shifts and technological adaptation. Our approach, similarly, examines general equilibrium responses.

Gyetvay and Keita (2023) show that immigrant and native born workers in Germany are segregated from one another across firms. They examine the impact of large immigration inflows from Eastern Europe, finding that workers at firms with high exposure to the new inflows (because they had hired workers from the Eastern European source countries before the immigration surge) either remained in the firm and suffered wage losses or moved to other firms where they weren't exposed to the immigration shock. This cross-firm approach requires an assumption that the non-exposed firms are not treated by the immigration shock. Our estimates indicate, instead, that some of the strongest negative employment response in our setting is for firms that are not exposed in the sense of not having formerly hired international students. We show that working with relative firm outcomes in our context generates the misleading implication that exposed firms respond to an immigration shock by increasing employment.

The paper that is closest to ours is Amior and Stuhler (2023). Like Gyetvay and Keita (2023), they also examine impacts of immigration across firms but treat the segregation of immigrants and native born across firms as an endogenous outcome. In their model, immigrant and native born workers are identically productive but immigrant workers have lower reservation wages, allowing firms to pay them less. As the number of immigrants in an economy increases, some firms move to a strategy of paying low wages that are acceptable to immigrants but not the native born. Firms are not able to wage discriminate by immigrant status and, as a result, the low wage firms become immigrant worker-only firms.[2] As immigration expands, more and more firms adopt the low wage strategy and native born workers, with fewer firms paying a wage at or above their reservation wage, move out of the labour force. They examine the immigration shock to the German economy that came with the fall of the communist regimes in Eastern Europe. Fitting

[2]We also find some evidence that wage discrimination between international students and other workers is limited.

with their model, they show that the lowest paying firms had substantial declines in native born employment, replacing those workers with the new immigrants and paying lower wages. In fact, the size of the firms contracts as more native born workers are shed than immigrants are hired. Our results fit in part with this model. The college student workers are disproportionately in low paid firms and are paid similar earnings to other workers within those firms. We also find a reduction in non-TFW employment in firms that hire international students. Overall, there is a reduction in employment of non-TFW worker employment in firms that do not hire international students. This is the right sign for this overall effect but in their model, this arises because there are fewer and fewer of these kinds of firms. We do find evidence of fewer firm births for these types of firms but also evidence that the composition of the firms is shifting toward hiring more part time workers. This may indicate that competition in the final goods market is forcing some of the non-student firms toward a production form that is more similar to that used by the student hiring firms.

Our contributions relative to the existing literature comes from two elements of our investigation. First, we argue that our identifying variation is particularly clean, whereas immigration shocks such as those stemming from the end of the communist regimes in Eastern Europe or those stemming from shift-share instruments come with other, potential confounding changes in economies. Second, we have detailed data on the firm's balance sheet. That will allow us to investigate questions such as whether the shock led to a change in the distribution of firms by productivity level.

2 Data From Taxes and Educational Institutions

At the core of our investigations are two administrative datasets. The first is the Canadian Employer-Employee Dynamics Database (CEEDD), a matched employer-employee dataset maintained by Statistics Canada covering the near universe of individuals and firms in Canada from 2001 to 2019. Incorporated in the dataset are data from: the individual tax filing form (the T1), which includes information on age, location and gender; the form filed with each job (the T4), which includes job-level information on earnings and industry; and the National Accounts Longitudinal Microdata File (NALMF), which contains details on firms' financial positions. It also links in the extensive data that the government collects on all immigrants at the time of arrival (gathered in the Immigrant Database (the IMDB)). Included in the IMDB data are age at arrival, source country, education at arrival, gender, marital status, and class of entry. For our purposes,

the key class of entry is people entering under a Study Permit. Our only substantial data is restriction is that we drop all records associated with the education industry (NAICS 61) because our interest is in students working off campus as opposed to those working as TAs, in student run cafes, etc.. We define local labour markets based on Census Metropolitan Areas (CMAs) or Census Agglomerates (CAs) as defined in the 2016 Census of Population. CMAs and CAs consist of population centres and adjacent municipalities with high commuting flows, resembling U.S. commuting zones. We obtain worker/student locations from the T1 while firm location comes from the NALMF. When location information is missing for an individual, we assign that individual to a location using the location of that individual's primary employer. Note that firms in the CEEDD are defined by their Enterprise ID in the Business Registry for tax purposes, which means location data reflect the head quarter locations. For multi-location firms, in some of our analysis we assign firm outcomes such as revenue to locations based on the proportion of employees in the location in the first year of our data.

Our second dataset comes from the Postsecondary Student Information System (PSIS) and covers the allocation of students across educational institutions. The collection unit for the data is the educational institution with information on educational programmes and students collected from all not-for-profit post-secondary institutions (universities, community colleges, CÉGEPs and trade and vocational training centres) funded by a Ministry of Education. Enrolment counts are for a single date in the fall chosen by the institution. "Therefore, students who are not enrolled during this time period are excluded. This has a greater impact on colleges as they have a continuous intake of students and offer shorter programs." (STC PSIS) The data include the location of the institution which we use to assign it to the same CMA groupings as we use in our worker/firm data. The key variables for our purpose are total enrolment broken down by foreign student status. The fact that this data does not include for-profit institutions is a limitation worth noting. As we will see, there is an increasing disconnect between the CEEDD data on student entries and the PSIS data on student enrolment and part of that may be due to expansion in the private college sector.

3 Patterns and Institutions

3.1 Institutions

Canada's post-secondary landscape is dominated by two main groups of institutions. The first are universities. Universities typically grant four year undergraduate Bachelor's degrees along with a variety of professional and post-graduate degrees. They provide a more analytic and broad education. With the exception of a small number of mainly religious universities, they are all public and not for profit. Provincial funding per full time equivalent student peaked in 2009-10 but fell continuously, declining by 19% by 2015-16 and continuing to decline thereafter (Usher (2018),Usher (2024)). The provinces allowed the universities to increase domestic tuition to some degree in those years, resulting in a small overall decline in funding per domestic student. But the universities turned increasingly to international student admissions, which had no restrictions in terms of tuition or numbers apart from competition with other institutions world wide. In 2006-7, international student fees made up 19% of all tuition at Canadian universities and 4% of total university revenues. By the 2016-17 school year, international student tuition made up 35% of all tuition collected and 9.3% of total university revenues (Usher (2018)). In the decade after the 2009-10 school year, international student fees accounted for 100% of the increases in operating spending and at some institutions now account for a larger share of revenues than the grant from the government (Usher (2022)).

In contrast to universities, colleges initially focussed on more practical, trades type education with course work being shorter (typically one or two years) and resulting in a diploma or certificate. However, in recent years, colleges have expanded their offerings to include some four year degrees that are similar to those at universities. Colleges faced the same environment of declining government revenues since 2009, with a decline in the share of revenues from government funding from 67% in 2009/10 to 55% in 2019/20, and embarked on an even greater shift toward replacing those revenues with international student tuition.

The residual actor in the educational landscape are small private vocational colleges which tend to offer shorter (under one year) programmes on a continuous intake basis. Some are language schools targeted at international students while the remainder tend to be specific to certain topic areas. Beginning in the early 2010's, public colleges outside the Greater Toronto Area(GTA) signed deals with private colleges under which the public institutions admitted students and collected their tuition but then paid for the private colleges to teach them. As Alex Usher describes, "This is the arrangement which super-

charged the recruitment of international students to Ontario colleges: suddenly an option existed in which colleges, regardless of geography, could gain from the desire of students, particularly from India, to get on a path to permanent residency while working and living in the GTA." (Usher (2024), p.86) Given this, our undercounting of the increase in international students at private colleges may not be substantial since many of these students would show up in the data as enrolled at public colleges. Moreover, private colleges only accounted for 7.7% of all international students at colleges. (Wall and Anderson (2024)).

Mirroring the surge in international student admissions at universities and colleges was a remarkable lack of control of the number of international students admitted to the country by the immigration system. The process for admission for an international student began with an offer of admission from a Designated Learning Institution (DLI). These are mainly public institutions, with a few private colleges, and all are certified as legitimate educational institutions by the relevant provincial government. The student would then apply to the federal government for a study permit, with the applicant requiring both the offer of admission and evidence that they had $10,000 to support themselves (in addition to funds needed for travel and tuition). The study permit application needed to be submitted and approved before the student travelled to Canada because the study permit was necessary to clear customs when the student arrived at the airport. While this process insured that the entering student had admission to a legitimate learning institution, there was no limit set by the government on the number of study permits issued (Yalnizyan (2024)). Thus, the total entry numbers were determined by the universities on the supply side and the application decisions of students on the demand side. Moreover, there was no mechanism for checking on whether the students actually attended classes or even enrolled in the learning institution after arrival.

Both the Conservative governments in power from 2005 to 2015 and the Liberal governments that followed came to see international students came to be seen as something of a silver bullet. The governments were interested in attracting international students and then having them stay in Canada after graduation as a source of human capital. The idea was that this was a better source than bringing in educated immigrants who completed their education in other countries because these students would have degrees from well-recognized Canadian institutions. In addition, while they were in school, the students could provide an increase in labour supply for a labour market in which employers were increasingly claiming that they were having trouble filling vacancies. In pursuit of these twin goals, the government introduced a Post-Graduate Work Permit

in 2005 and then expanded it to an open, 3 year permit following graduation from a designated educational institution in 2008. In addition, they introduced an Off-Campus Work Permit in 2006 to facilitate students entering the work force to a limited degree. That possibility of working off-campus was viewed as useful in attracting students and in 2014 it was effectively expanded by replacing the permit with a blanket 20 hours a week allowance for working off-campus during study terms and an unlimited work allowance out of term.

Together, this set of institution implies that the substantial increase in international student workers arose in a way that implied plausibly exogenous shocks to local labour supply in the CMA's that had colleges and, in particular, had colleges that were more aggressive in pursuing international student enrolment. At the national level, the federal government made changes to working while in school and post-graduation work restrictions that both made Canada a more attractive destination for international students and made it more possible for them to work while in Canada. The actual number of students that were admitted in response, though, was determined by individual educational institutions for reasons related to their financing problems. Because the institutions are almost all public and financed by the provinces, those problems were not related to economic outcomes in their local economy. There could be differences across provinces in education financing that relate to the economic performance of the province, but those can be controlled for with the inclusion of province by time effects. Thus, both the size and distribution of the shocks to labour supply across CMAs were determined by the interaction of national level policy changes with local educational institution decisions that are plausibly unrelated to demand shifts in the local economy. In our empirical work, we will present checks on whether the supply shocks really do appear to be unrelated to prior trends in economic outcomes in the local economy.

3.2 Patterns

In figure 1, we plot the number of foreign college students who filed a T1 form each year (from the CEEDD data) along with the number of foreign students enrolled in a publicly funded college. The number of students approximately doubles over the seven years between 2009 and 2016 but grows at an even higher annual rate thereafter, doubling again by 2019. This growth, though, is dwarfed by the growth in foreign student workers. In 2009, there are just 5400 foreign college students working in the labour market. By 2016 that number had increased by a factor of ten and by 2019 it reached approximately

170,000.[3] In 2017, the number of foreign college workers exceeded the number enrolled in public institutions. This could arise for one of two reasons. The first is that private colleges have increased and their students are more likely to work. Those students would be included in our tax data but not in the PSIS enrolment counts from public institutions. The second is that the disconnect between immigration and education policy described earlier means that some of the people admitted as students have gone to the labour market and are not actually showing up at the colleges. Choi and Hou(2023) examine the extent of "no shows" at publicly funded post-secondary institutions using a linkage of the PSIS to the IMDB at the student level.[4] They find that approximately 30% of international student Study Permit Holders (SPH's) intended for college attendance were not enrolled in a public college in 2019. The comparable number for undergraduate university SPH's was 12%. Of the college SPH no-shows, approximately half had some other government record, implying they were still in Canada, and at least 22% were studying at a private college. This suggests that something close to a quarter were working but not enrolled at either private or public colleges. Thus, at least by 2019, there appear to have been sizeable numbers of entrants to Canada who were admitted as college students but were not enrolled in classes.

In figure 2, we plot enrolment numbers and numbers of students who are working for universities. Since universities are almost solely public institutions in Canada, there is much less concern that some of the university SPH's who are observed in the tax data are at private institutions and, therefore, not accounted for in the public enrolment numbers. As with college students, the number of international students at universities who were working experienced a substantial increase (by 390%) but the expansion happened in a very different manner. While the ratio of tax filers to students reported at public educational institutions rose from 15% to 115% for international college students, it rose from 25% to 51% for international university students. Thus, university student patterns imply fewer entrants working but not going to school.

In what follows, we will examine the impact of the expansion of foreign student workers on the Canadian labour market. As we will see, the first stage in which we instrument for foreign student workers with foreign student enrollees is much stronger for college students. Given that this is also where the dramatic rise in working occurred, we will focus our attention on college students.

[3] These numbers are rounded to comply with Statistics Canada's rules for vetting intermediate output. The final version of this paper will contain the exact digits for these summary statistics.

[4] In contrast, we are only able to link the PSIS enrolment numbers to our individual CEEDD data at the CMA level and, so, cannot replicate their exercise with our data.

We turn now to summarizing the patterns of where foreign student workers are employed using the CEEDD data. In the following figures, we plot distributions for five types of workers: international students with study permits at colleges; international students with study permits at universities; temporary foreign workers (TFWs) who enter through a programme that requires employers to get a Labour Market Impact Assessment (LMIA) to demonstrate that the firm cannot find Canadian workers at the going wage in their labour market; other TFWs entering under special programmes such as those for agricultural workers; and post-graduate international students who, for much of our period, are in Canada under the three year post-graduate visa.[5] We present results for the two types of TFWs to investigate whether the students are being employed in similar types of jobs as other temporary workers versus being employed in jobs that might be using higher education skills. We present results for the post-graduates to see whether the students move into jobs that use their higher education skills after obtaining their degrees. If they are in less skilled jobs before graduation but more skilled ones after graduation then the student labour supply shock will be temporary for the unskilled labour market but may then turn to a persistent positive skill shock in the longer run.

In figure 3 we examine the distribution of annual earnings for international student workers relative to other groups. We create this figure by first generating the decile values for annual earnings for all non-TFW workers in Canada in 2019. We then assign workers from each of our groups to a decile based on their annual earnings.[6] The figure depicts the students as having low earnings. Almost a third of international college workers have annual earnings that would place them in the bottom decile for non-TFW workers and approximately 80% have earnings that fall in the bottom three deciles for non-TFWs. For international university workers, an even larger share have earnings in the first decile but somewhat less in the first three deciles combined. The relatively low earnings, particularly for the university enrolled students, may reflect low hours of work per week. We are currently working with wage and hours data to understand the extent to which the low earnings are hours driven. Interestingly, after graduation, the former students have earnings concentrated in the middle of the non-TFW distribution, with less than 20% of the observations occurring in either the bottom two or top two deciles of the non-TFW distribution.

[5]Note that because these plots are based on the CEEDD data, listing a worker as a College International student does not mean they are actually attending a college, only that they were admitted to Canada based on a study permit associated with a college.

[6]Note that there is no panel for non-TFW workers in this figure because it would just show a horizontal line at 0.1 since the decile end-points are computed for this group.

The low earnings of the international students may stem from a variety of sources. One possibility is that they tend to work at low paying firms. To examine this, in Figure 4, we calculate a leave one out average earnings at each person's firm (AVGEARN), compute the deciles of AVGEARN for non-TFWs, then find the proportion of each TFW group whose AVGEARN value places them in each decile. In this figure and the other figures based on employment, we work with full time equivalent (FTE) workers. We define full time workers as workers earning $18,000 a year or more and workers with earnings below that as part time workers. We count a full time worker as 1 FTE and part time workers as 0.5 FTE's.[7] We use these weights both when we determine the deciles for non-TFWs and as we count how many TFWs fit in each non-TFW decile. The result indicates that international college students work at lower paying firms, though the weight of their distribution at the bottom is not as extreme as with their individual earnings. Only about 15% of these workers work at firms that are in the top 40% of the distribution of average firm wages for non-TFWs, but they are under-represented in the very bottom decile of the distribution. For university workers - and to some extent the other groups, the distribution more nearly matches that of the broader population.

International student workers might be further disadvantaged if their earnings are below average in whatever firm they work in. We check this in a simple way by computing the earnings for each worker minus the leave-one-out mean earnings at their firm (which we will call EARNDIFF). In figure 5, we plot the proportion of TFW workers in each of our groups whose EARNDIFF value falls in each of the deciles of the non-TFWs distribution of EARNDIFF. Based on this, international college students are nearly equally represented relative to non-TFWs in the bottom of the distribution but are substantially over-represented in the middle distribution values and under-represented in the top two deciles of the non-TFW distribution. Thus, these students are not substantially lower paid within firms relative to non-TFWs on average, though they are less likely to be in the top paying jobs.[8] This pattern fits with Amior and Stuhler (2023)'s assumption that firms cannot wage discriminate between immigrant and non-immigrant workers. In contrast, the international university students are more likely to have below mean earnings in their firm compared to other workers. The other TFWs are more similar to non-

[7] $18,000 is approximately the annual earnings of a person working full year, full time at the mean minimum wage in our sample period.

[8] Dostie et al. (2023)examine the role of firms in the immigrant-native born earnings gap for permanent resident (PR) immigrants using the CEEDD for Canada. They find that immigrants do not work at lower paying firms, on average, but that native born workers have stronger sorting of high earnings individuals to perennially high paying firms. The pattern in figure 5 potentially fits with the latter part of their conclusion.

TFWs in this dimension, except at the very top where post-graduate former international students have quite a low probability of being paid at the top of their firm's earnings structure. Taken together, these figures imply that international college student workers have quite low earnings mainly because they work in relatively low paying firms, magnified to some extent by their being disproportionately in the lower half of the distribution within firms. For university worker, it is the reverse: their low earnings come more from their being relatively low paid within firms than from their being at low average earnings firms. This could fit with them working relatively low numbers of hours at firms of all different types.

We are also interested in delving further into why the firms that the college students work for are typically low paying (and why that is less the case for the university students). Is it because those firms are lower productivity? To examine that possibility, in figure 6, we repeat our exercise of examining where the TFWs fit relative to the distribution for non-TFWs but for the average revenue per worker at the firm. For college students this distribution looks similar to the distribution of average earnings per worker (figure 4), though not weighted quite as heavily to the bottom half of the distribution. Thus, the students are, to some extent, in better productivity firms but they are disproportionately at firms, even among the more productive, that do not pay well on average. For university students, the result is, if anything, the opposite - more of them are in low productivity firms than the average earnings per firm might predict. In contrast, after graduation, former students are disproportionately at top decile firms in terms of productivity.

A defining feature of the firms at which the international students work is their large size. In figure 7, we repeat our exercise of looking at where TFW outcomes fit relative to the distribution for non-TFW workers but, in this case, for total number of employees at the firm. For all the TFW groups, over 60% of the TFWs are in firms with size that would put them in the top decile of the distribution of firm sizes for the non-TFWs. Given that we can see firms rather than establishments, this likely fits with multi-establishment firms such as fast food chains.[9]

Many of the patterns that we have seen to this point can be explained (at least in part) by the sectoral concentration where the immigrants work. In Figure 3, we plot the proportions of our five worker types plus all other workers across industries. We

[9]We attempted to see the size of establishments by looking at locations where at least 5 workers from a given firm were living that was not the listed location of the head office. When we do that, x% of international student firms fall in the top decile of firm size for the non-TFWs.

present the industries in groupings that correspond to the top employers of international students: Accommodation and Food Services (NAICS code 72); Administration and Support (NAICS code, 56); Professional, Scientific and Technical Services (NAICS code, 54); Retail (NAICS code, 44 or 45); and all Other. The Accommodation and Food Services and Retail sectors include lower skilled service and retail jobs. Similarly, Administration and Support includes jobs like security guards, cleaners, and waste disposal. In contrast, the Professional, Scientific and Technical Services industry, includes jobs that require expertise and training. For international college students, 69% of workers are in the three low skilled industries (Food and Accommodation, Retail, and Administrative Support) with only 4% in the higher skilled Professional industry and 26% in any other industry. That is, they are heavily concentrated in low skilled industries. Indeed, their proportions in each of the three low skilled industries is approximately double that of all other workers in the economy and their proportion in the higher skilled Professional sector is half that of other workers. International university students have somewhat lower concentrations in Food and Accommodation and Administrative support and higher concentrations in the Professional and Other industries. Nonetheless, even the university students are disproportionately concentrated in lower skilled sectors. Both groups are more concentrated in these industries than other TFWs, which may reflect the other TFWs being concentrated in the agriculture, child care, and health services sectors. By and large, this means the the student shock is focused on different sectors from the TFW supply and, so, might be expected to have different effects. Finally, the post-graduate workers have a distribution that is quite similar to that for all workers. That is, once the students complete their degrees, they move into the labour market in a way that is not particularly concentrated in lower skilled jobs. This may be because the post-graduate students are disproportionately university rather than college students. In any case, the plots indicate that student workers, before degree completion, constitute a shock to a small number of low skilled industries.

4 Empirical Approach

4.1 Main Specification

We are interested in the impact of the international students on both the other workers and firms in the local economy. Our main estimating equation is given by:

$$\ln y_{gct} = \beta_0^g + \beta_1^g SW_{ct} + \beta_2^g OTFW_{ct} + \alpha_c^g + \gamma_t^g + \epsilon_{gct} \tag{1}$$

where: g indexes groups that will be defined by a combination of age groups, industries, and firm type;y_{gct} is employment of group g in city c in year t; SW_{ct} is the number of student workers in city, c, in year, t; $OTFW_{ct}$ is the number of other Temporary Foreign Workers; α_c^g are a complete set of city effects; and γ_t^g are a complete set of year effects. Because we estimate equation (1) separately by group, we are allowing for the effects of all covariates, including the location and time effects to vary by group. We include the number of other TFWs ($OTFW_{ct}$) out of concern that our student worker variable may partly capture the effects of other TFWs if they are going to similar places. We estimate (1) in 5 year differences, pooling the differences by location for the 2010-2014 difference and the 2015-2019 difference. It is worth highlighting that the student worker variable varies at the city by time level, not at the group level within cities. As Dustmann et al. (2017) point out, this means that our estimates will capture total effects (including any feedback loops through, for example, congestion externalities in search) rather than cross-group effects. We return to this point after presenting our results.

Given that we view ϵ_{gct} as containing productivity shocks at the local and firm level, there might be concern that the number of student workers who are employed in a location (SW_{ct}) is related to those shocks. One might be concerned, for example, that more students from the local college decide to work off campus when the local labour market is strong. We instrument for SW_{ct} with FS_{ct}, the number of foreign students present in city c in year t.[10] As discussed earlier, the number of foreign students in a location (and, hence, the potential labour supply they represent) is determined by the colleges themselves for reasons related to their financing. Importantly, all the colleges and universities are public and get their funding from the provincial government, implying that any funding shortfalls that induce colleges and universities to bring in more foreign

[10]Given that the enrolment variable FS_{ct} is measured in the fall semester of the academic calendar, we use the number of enrolled students in academic year $t-1$ to t to measure the foreign students that are enrolled in year t. For example, for year 2010, we measure the foreign students that are enrolled using the number of students counted in the 2009-2010 academic year.

students are not related to conditions in their city.

In contrast to SW_{ct}, we do not have a credible instrument for $OTFW_{ct}$. As a result, we include $OTFW_{ct}$ as a simple covariate and interpret it as what Stock and Watson (2011) call a control variable – a variable that is not of direct interest in its own right but is useful for picking up its own effect and those of correlated omitted variables. In our case, we view $OTFW_{ct}$ as capturing local demand shifts and labour supply shortages in a location that would cause local employers to apply to bring in TFWs. Stock and Watson (2011) show that the estimated coefficient on SW_{ct} will be consistent for the causal effect of changes in the number of student workers on the dependent variable under the assumption that the instrument is independent of the error term once we condition on the control variable. On the other hand, the coefficient on $OTFW_{ct}$ does not have a causal interpretation. They also show that standard IV inference results, such as weak instrument tests, are valid under the conditional mean independence assumption. In our case, we view the error term as mainly including local and firm specific productivity shifters. We will argue that our instrument is plausibly independent of those and that this independence becomes even more plausible once we control for the types of productivity shocks that are correlated with attracting other TFWs to an area.

4.2 Establishing the First Stage

While we view our instrument as plausibly independent of the error term, we examine correlations to try to further establish the plausibility of this assumption. In Figure 8, we plot the change in the log of international student college enrolment for each city between 2015 and 2019 (the percentage change in our instrument in the period when enrolment surged) against the change in the log of employment in the city over the previous 5 years (2010-2014). Importantly, the figure shows the lack of a relationship between the two and, in fact, a regression of the enrolment change on the lagged employment change yields a coefficient of -0.47 with a standard error of 2.23, and, therefore, not statistically significant at any standard level of significance. The plots of university enrolment against lagged employment in figure 9 shows the same lack of relationship.[11] We interpret these figures as showing that the pattern of expansions in international and college student enrolment across cities during 2015-19 surge were not predictable based on the economic growth of the city in the prior 5 years. This reinforces our claim that the international student expansions were not in response to either growth or decline in the local economies

[11] For university enrolment, the coefficient on lagged employment growth is 0.20 with a standard error of 0.85.

In figure 10, we represent our first stage by plotting the changes in the log of employment of international college students by city and time (both the 2010-2014 and 2015-2019 changes) against the matching change in the log of international college student enrolment. In this case, there is a clear positive relationship. The first stage regression, which consists of a regression of the 5 year changes in college student employment on the matching changes in college student enrolment, yields a coefficient of 0.37 with a standard error of 0.066, significant at the 1% level of significance. The corresponding F-statistic is 23.28. Thus, our first stage is strong. At the same time, it is interesting that the coefficient is substantially less than 1. This reflects what we saw in figures 1 and 2 - that movements in international student enrolment and employment are correlated but clearly do not move perfectly together as they would if the proportion of student enrollees working off campus was constant over time. In contrast to the college students, the first stage for university students is not strong and from this point on, we focus only n international college students.

5 Results

We begin with the estimation of specification (1) with the employment of all workers (i.e., international students, other TFWs, and all other workers) in a city as the dependent variable. This provides insight into the overall impact of the international student inflows on employment, netting out hiring for the students and any displacement amont other workers.[12] Our result for overall employment indicates that impact is not large. The estimated coefficient on the change in the log of the number of international student workers is -0.022 with a standard error of 0.012 and a p-value of 0.072, i.e., a 10% increase in student workers leads only a 0.2% decline in overall employment that is not significant at the 5% level. This fits with evidence from Card (1990) and following papers that find that immigration has limited impacts on overall employment, Card (1990) examines the impact on employment of the native born while, to this point, we are looking at total employment.

In Figure 11, we plot the coefficients on the student worker variable from regression (1)

[12]We have also estimated the specification with the employment of other TFWs as the dependent variable. We separate them out of employment because they hold a very different place in policy debates about employment. We do not find statistically significant effects of the international students on the employment of other TFWs. This suggests that they may not compete very directly, which may make sense based both on differences in the industries in which they are concentrated and on the fact that other TFWs work long hours while most student workers are fitting work in with their studies.

for different groups. Here, we are focusing attention on not-TFW workers (i.e., Canadian born and permanent resident immigrants). We define groups based on the age of workers, industry, and firm characteristics. We divide workers into three age groups: Youth (age 16 to 30); Prime Age (age 31 to 65); and Other (under age 16 or over age 65). The latter group is not one that is usually highlighted but given that students and retired people are more likely to work part time and in the industries where international students tend to focus, it seems like a useful group to isolate.[13] We divide industries into two groups: the Main 5 (Accommodation and Food Services (NAICS code 72); Administration and Support (NAICS code, 56); Professional, Scientific and Technical Services (NAICS code, 54); Retail (NAICS code, 44 or 45), which are the industries that we saw earlier employ 76$ of student workers; and the Not 5 (all other industries). We divide firms into groups based on their international student hiring patterns: employed no international students at either the start or the end of the 5 year period defining our difference (which we call 00 firms); employed no international students at the start of the 5 year period but did have international students at the end (0I firms - where I stands for international students); employed international students at the start but not the end of the 5 year period (I0 firms); and employed international students at both the start and the end of the 5 year period (II firms). We generated results for set of cells defined by the complete interaction of then age, industry and firm type groups, though we do not include the results for the I0 firms since they seem less relevant for our exercise and, indeed, show no significant effects.

Several patterns jump out from looking across the panels that correspond to the different industry by firm type groups. First, the biggest effects in all the groups is for the "Other" age group (teenagers and retirees). In the II type firms in the Main 5 industries, a 10% increase in the number of college international students in the city generates a 2.6% reduction in the number of Other age group Non-TFW workers. In II firms in the Not 5 industries, the effect is almost as large (a coefficient of -.23). Both are significant at the 10% level of significance. Firms in the Main 5 industries that take up hiring of international students have nearly as large an effect for this age group (-0.22, and significant at the 5% level), though less so for the Not 5 industry firms of this type. Interestingly, the firms that do not hire international students also see a decline in employment in the Other age. These effects are about half the size of those in the firms that hire international students but are statistically significant at the 5% level. In

[13] In initial estimates, we broke the various age groups down further but found that the patterns of estimates fit well with aggregating to these three groups.

the firms that hire international students, the negative effects on the employment levels of other workers may reflect a substitution of the international college student workers for teenagers and retirement aged workers within the firm. This makes sense given that both the Other non-TFW workers and the students likely work part time. For the firms that do not hire students, the negative effects on employment potentially reflect an effect of competition with the student-employing firms in the final goods market.

For the remaining age groups, the effects are more mixed. Some of the results for the Prime Age group are significant but all are -0.10 or less. For Youth - a group that might be expected to be direct competitors with the international students - the effects are almost all small and not statistically significant. The only exception is in firms that always hire international students, where the estimated effect is -.15 and significant at the 10% level. The effects are smallest in the 00 firms, which employ the majority of workers. To see the actual importance of the estimated effects in the different firm types and sectors, we need to account for their relative importance. That is done in the decomposition exercise in the next section.

5.1 Decomposing the Impact

We are interested in relating the estimated impacts by group that we saw in figure 11 to the total employment impact of international student workers. To do this, we can decompose the percentage growth in employment in a city in a manner that follows methods in the firm growth literature (e.g., Haltiwanger et al. (2013)).

To understand the approach, consider a situation in which there are two types of firms, indexed by 1 and 2 (e.g., firms that hire students and firms that don't). Then, we can write the percentage growth rate in employment at the city level as:

$$\frac{\Delta Emp_{ct}}{Emp_{ct-1}} = \frac{\Delta Emp_{f1ct}}{Emp_{ct-1}} + \frac{\Delta Emp_{n1ct}}{Emp_{ct-1}} + \frac{\Delta Emp_{f2ct}}{Emp_{ct-1}} + \frac{\Delta Emp_{n2ct}}{Emp_{ct-1}} + \frac{EmpNew_{ct}}{Emp_{ct-1}} - \frac{EmpDie_{ct-1}}{Emp_{ct-1}} \tag{2}$$

where, $\Delta X_{ct} = X_{ct} - X_{ct-1}$, Emp_{ct} is total employment in city c at time t, ΔEmp_{f1ct} is the change in employment of foreign students at firms that start with student employees, ΔEmp_{f2ct} is the change in employment of foreign students at firms that start with no student employees, ΔEmp_{f2ct} is the change in employment of foreign students at firms that start with no student employees, ΔEmp_{n2ct} is the change in employment of other workers at firms that start with no student employees, $EmpNew_{ct}$ is employment at time

t of firms that did not exist at time t-1, $EmpDie_{ct-1}$ is employment at time t-1 of firms that die before time t. Note that in each case, the denominator is total employment in the city at time t-1 - not the base period employment of the particular type of employment - implying that the changes on the right hand side add up to the overall growth rate.

We extend the logic in (2) by using the groups used in figure 11 to formulate the various sub-elements in the decomposition. For each group, g, we form $\frac{\Delta Emp_{fgct}}{Emp_{ct-1}}$ and $\frac{\Delta Emp_{ngct}}{Emp_{ct-1}}$ and use each as the dependent variable in regression (1). The coefficients in each of those sub-regressions shows the impact of an increase in the number of foreign student workers on employment in each group. The sum of the coefficients equals the total effect of international students on the overall growth rate in the city.[14]

We present the estimated coefficients on the international student employment variable in the panels in figure 12. Because the panels all have the same horizontal scale and the coefficients add up to the effect of student employment on total employment, the various bars in the panels show both the significance of effects and the relative size of the effects in the various subgroups. Recall that the total effect is approximately -0.02 and, so, the estimated effects for the subgroup are quite small.

The top left panel shows the impact on the employment of international college students in the various industry x firm type groups. The estimated effects are all positive (as expected) but because the students make up a small proportion of total employment, their sizes (normalized by total total employment of workers of all types in the city at the start of a difference period) are very small. The largest effect is for employment in firms in the Main 5 industries that begin to hire international students, having not done so before, and it is approximately one-tenth of the total effect (though of the opposite sign). The effect on firms in the Main 5 industries that continually hire international students is also positive and significant but half the size for the 0I firms. The impacts in the Not 5 industries are smaller, with the effect for Not 5 industries that start the period without international student being quite small and insignificant. Thus, as expected, the international students go predominantly to the Main 5 industry firms.

The top right panel shows effects through employment in firms that are either born or die in our 5 year windows. For firms that had no international student employees (either when they were born or just before they died), an increase in the college student workforce generates a complicated reaction. On one side, it results in a reduction in firm

[14]We earlier reported on the estimated effect of the international students on the change in log employment. $\frac{\Delta Emp_{ct}}{Emp_{ct-1}}$ is, of course, very similar to the change in log employment and we obtain a very similar estimated effect (-0.025 with a standard error of 0.012 and a p-value of 0.062.

births (an effect that is statistically significant at the 10% level). On the other side, it also generates a reduction in firm deaths (in the regressions, the employment in firms that die is multiplied by -1 so a positive estimated coefficient on SW_{ct} corresponds to a reduction in the employment losses that occur through firm deaths). This effect is nearly as large as the reduction in employment through the reduction in firm births but is not statistically significant at any standard level of significance. In separate estimates for full and part time workers, we find that the reduction in employment loss due to firm deaths is mainly for part time workers while the reduction in firm births is more related to the employment of full time workers. Thus, the injection of international students seems to shift the composition of firms that do not hire students toward structures with more part time workers, which are, perhaps, the ones that are more able to compete with firms that hire (predominantly part time) international students. Thus, the biggest effect of increases in international college students in a city operated through changes in the composition of firms that do not hire students.

The remainder of the panels show effects for subgroups defined in the same way as in figure 11 for non-TFW workers. Note that they all correspond to changes in employment within ongoing firms (i.e. balanced panels), with the effects of changes in the number of firms captured in the births and deaths panel. Here, too, the largest effects happen in firms that do not hire international students. This is true, in part, because they form a much larger proportion of total employment than do firms who hire students. For both firms in the Main 5 industries and in the Not 5 industries, the largest effects are for workers age 31 to 65 (both statistically significant at the 5% level). We also estimated these specifications separately for full time and part time workers. The patterns are broadly similar for both, but for full time non-TFW workers the effects are solely for the 31 to 65 year olds while for part time workers, there are equal sized negative effects for those Prime Age workers and the teenager/retiree category (for whom part time work is particularly important). The lower panels show that there are also negative effects on employment for firms that hire international students (many of which are significant at the 10% level) but they constitute a much smaller component of total job loss than the non-student firms.

Taken together, the evidence indicates that increases in the international college student workforce that arose from the combination of the increased student enrolment and the relaxing of rules about working off campus reduced employment for non-TFW workers primarily in firms that did not hire international students. The change in employment at 00 type firms (relative to total employment in the local economy) equalled -0.021 (and

are significant at the 1% level). This happened mainly through reduced hiring at ongoing firms. It also caused a change in the composition of firms that do not hire students, with a shift toward firms that have more part time workers. In comparison, the changes in employment at 0I and II firms (again, expressed as a ratio to total employment) -0.003 and -0.004, respectively, with neither being statistically significant at any standard level of significance. Recall that these firms saw that biggest percentage decreases in non-TFW employment in response to the student supply shock and, thus, the near zero overall employment effects imply that these firms swapped international students for non-TFW employees nearly one for one - with the largest swaps being for workers under age 16 and over age 65. These changes represent a shift in employment in local economies toward the industries in which international students tend to be employed (the Main 5 industries) and, as a consequence, toward lower productivity and lower paid firms.

5.2 Working with Relative Firm Effects

It is interesting to think of these results relative to using the data to estimate the impact of the immigration shocks on individual firms, as several recent papers have done. In that context, one could imagine running a regression of the form:

$$y_{fct} = \delta_1 + \delta_2 SW_{fct} + u_{fct} \tag{3}$$

where, y is employment in firm f in city c in year t. Thus, the question is whether hiring student workers helps firms to expand (perhaps due to some type of labour constraint in the local labour market) or causes them to reduce their number of employees (if, for example, the students are more productive than other workers). Given concerns that SW_{fct} would be correlated with u_{fct} because the latter includes firm productivity, we could instrument for SW_{fct} using the city level enrolment shock. In particular, consider a Bartik type instrument in which we allocate student workers to firms based on whether they employed students in the initial period. If we then aggregate to the level of firms in the city who have student employees in the initial period (type 1 firms) and ones who do not (type 0 firms) then we can think of an instrument in which we assign the entire change in $SWct$ to the type 1 firms and none to the type 0 firms. In that case, the IV estimator would equal:

$$\delta_2^{IV} = \frac{\Delta y_{1,ct} - \Delta y_{0,ct}}{\Delta SW_{ct}} \tag{4}$$

where, $\Delta y_{1,ct}$ is the change in log employment at type 1 firms in city c and $\Delta y_{0,ct}$ is defined analogously. We go one step further and replace ΔSW_{ct} with an estimated version from a first stage in which we regress it on the change in the number of international student enrollees in the city. This makes sure that common city-wide shocks to productivity are not biasing our estimates. But, then, we can get a rough estimate as:

$$\frac{(\frac{\Delta y_{1,ct}}{y_{ct-1}})}{\Delta \hat{SW}_{ct}} - \frac{(\frac{\Delta y_{0,ct}}{y_{ct-1}})}{\Delta \hat{SW}_{ct}} \tag{5}$$

i.e., by using the estimated coefficients from our decomposition exercise. That yields an estimate of 0.0098. Taken at face value, this would imply that firms that have access to more student workers expand their total employment. However, we know from our investigations separated by firm type that both firms that initially have student workers and those that do not cut their employment. It is the firms without student workers who cut employment more. This points to general equilibrium effects at the economy level that imply that the relative changes across firms is misleading as a way of understanding firm responses to immigration shocks.

6 Conclusion

In this paper, we take advantage of a larger and, we argue, exogenous shock to local labour supplies to examine the impacts on other workers and on firms. The shock that we work with is an increase in international students working off campus that was generated from a combination of a loosening of rules about working off campus and colleges and universities turning more and more toward international students as a revenue source. Thus, the extent of the shock in different local labour markets is determined by decisions made by educational institutions that are divorced from the conditions in the local economy. The international students disproportionately work in lower productivity, lower earnings firms and firms concentrated in the service and retail sectors. At the same time, there is limited evidence of them earning less than others in the same firms, implying that the firms were not able to wage discriminate between the student workers and others.

We show that this labour supply shock led to small decreases in overall employment in local labour markets but underlying that overall effect was a reallocation within the local labour market. It resulted in decreases in the employment of non-TFW workers (i.e., native born and permanent resident immigrant workers), particularly at firms that employed student workers. But the largest employment effects relative to the size of total

employment in the local labour market happened in firms that never hire international students. This raises the possibility that key effects of immigration shocks happen across firms in the final goods market. Our next step is to investigate the nature of the changes for firms in terms of revenue, earnings, and productivity outcomes.

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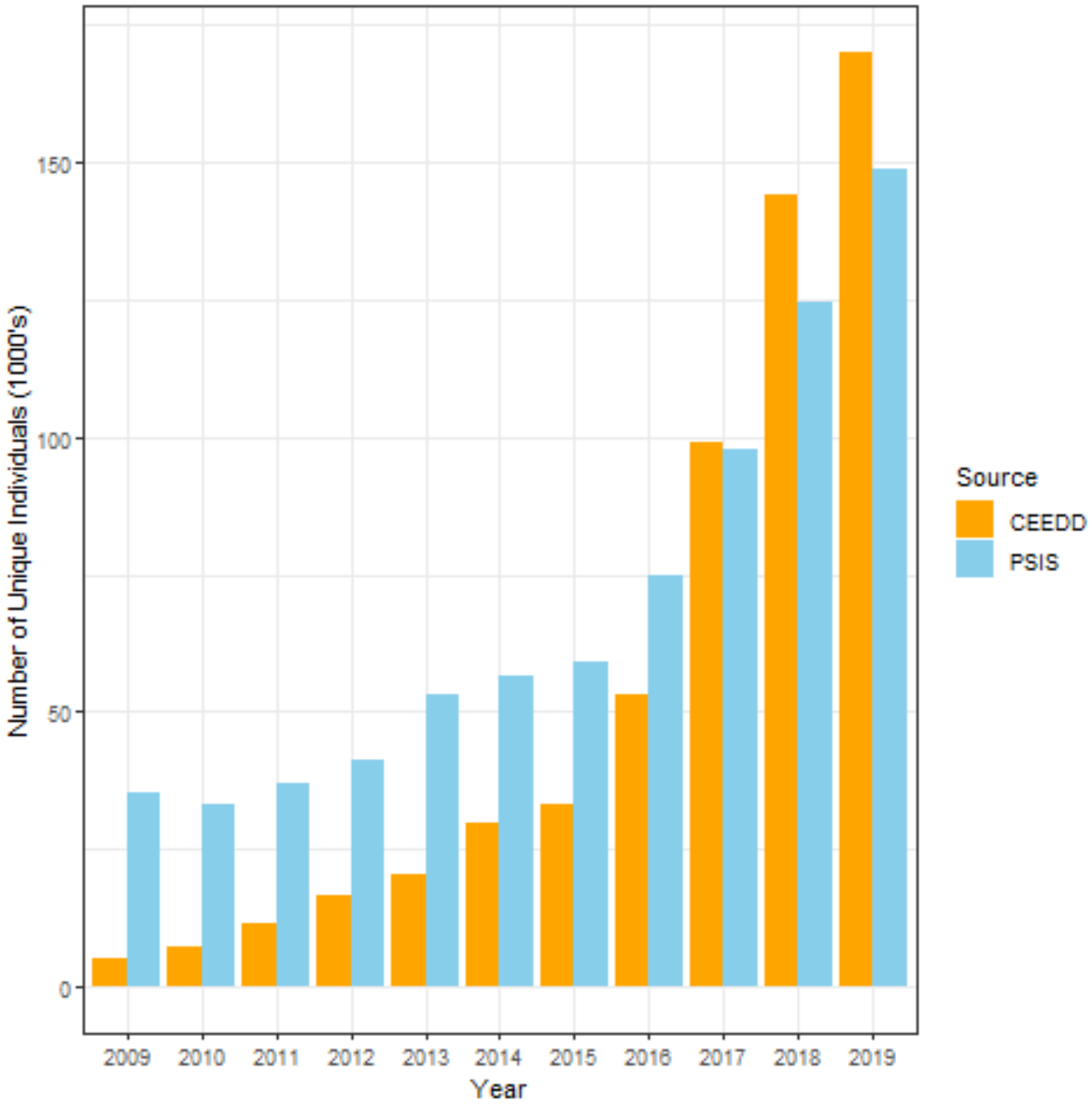

Figure 1: Working (CEEDD) and Enrolled (PSIS) Foreign College Students

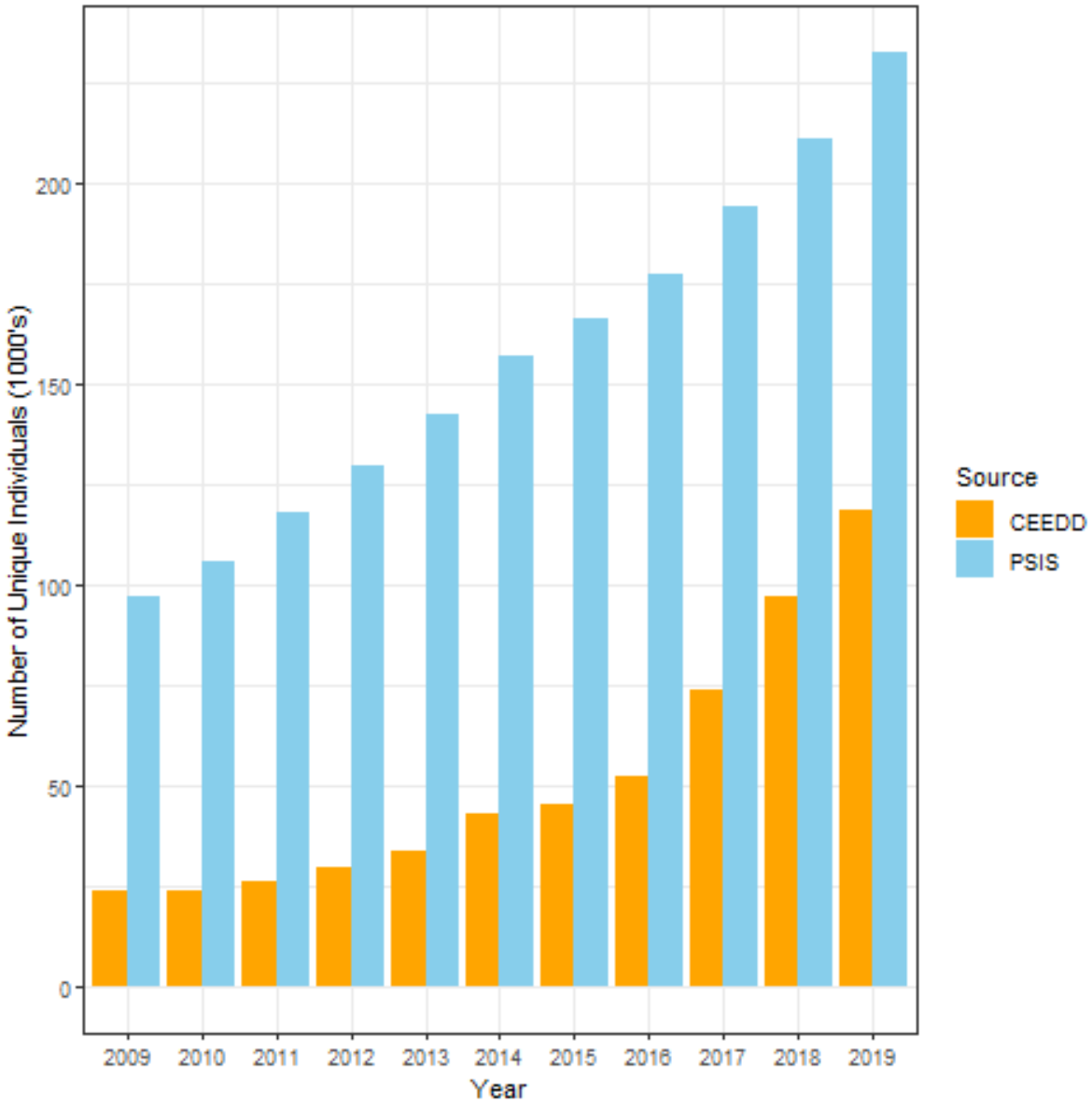

Figure 2: Working (CEEDD) and Enrolled (PSIS) Foreign University Students

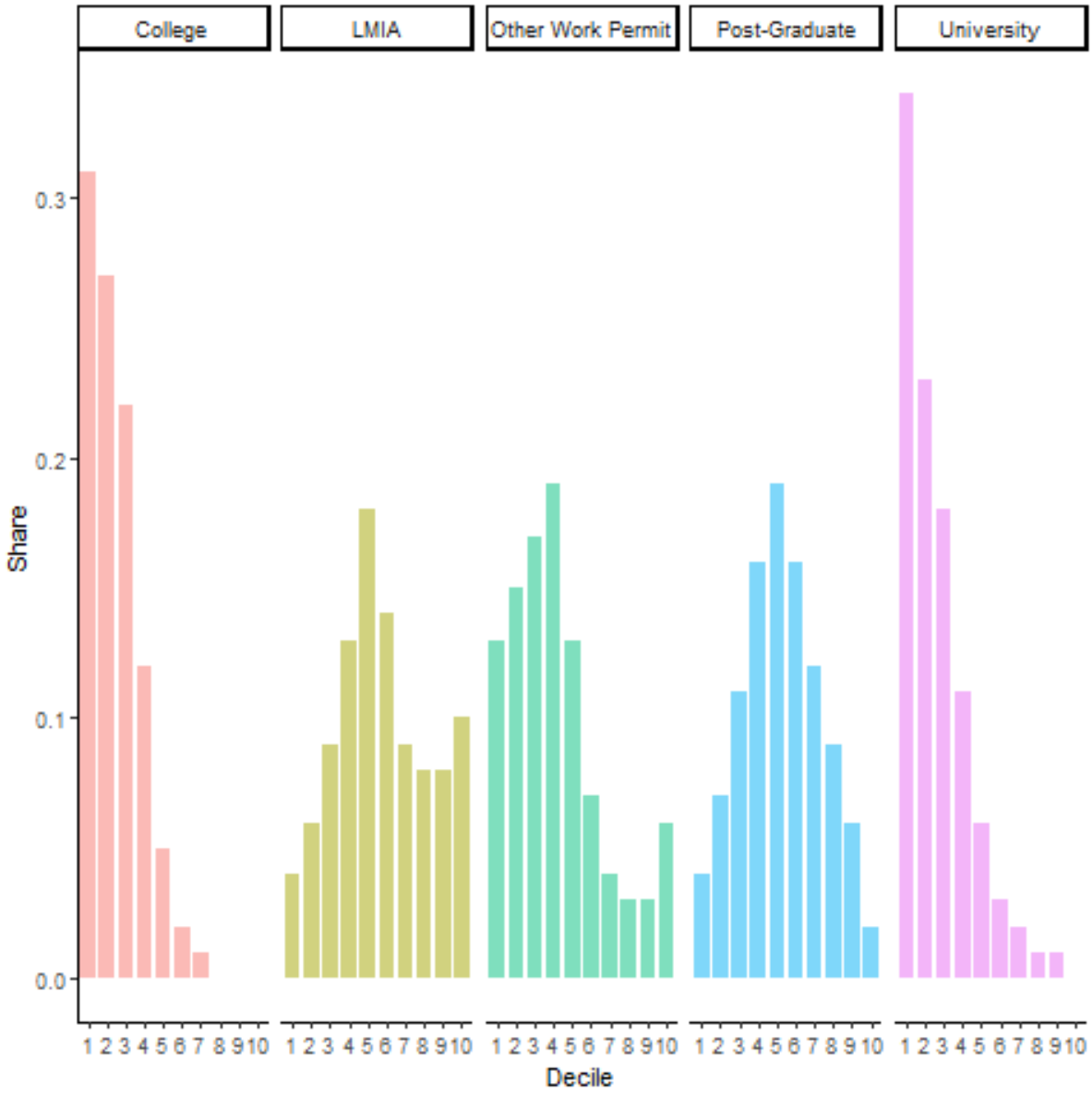

Figure 3: International Worker Annual Earnings by Decile of the Non-TFW Earnings Distribution

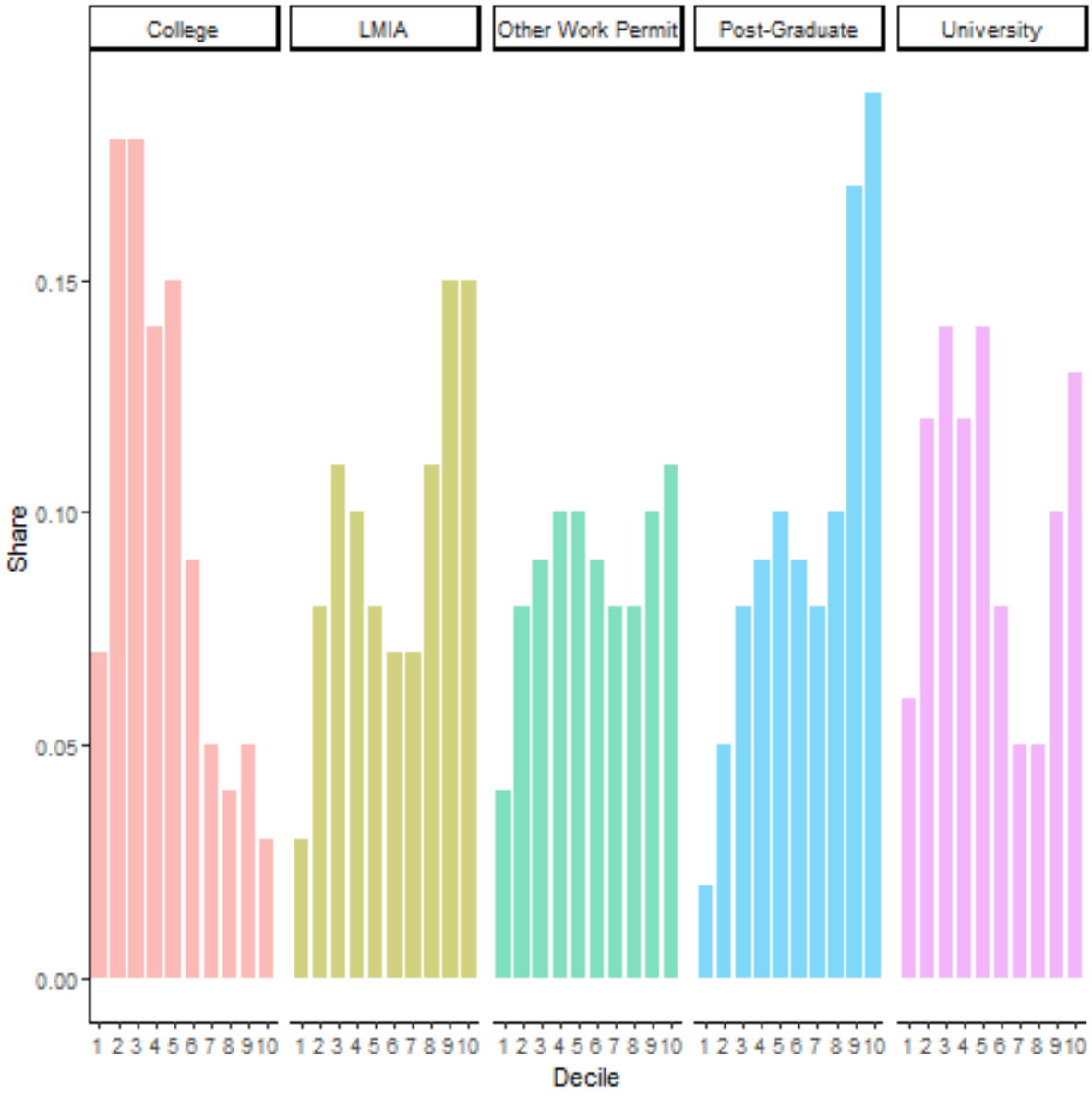

Figure 4: International Worker Average Earnings at Firm by Decile of the Non-TFW Distribution of Average Earnings at Firm

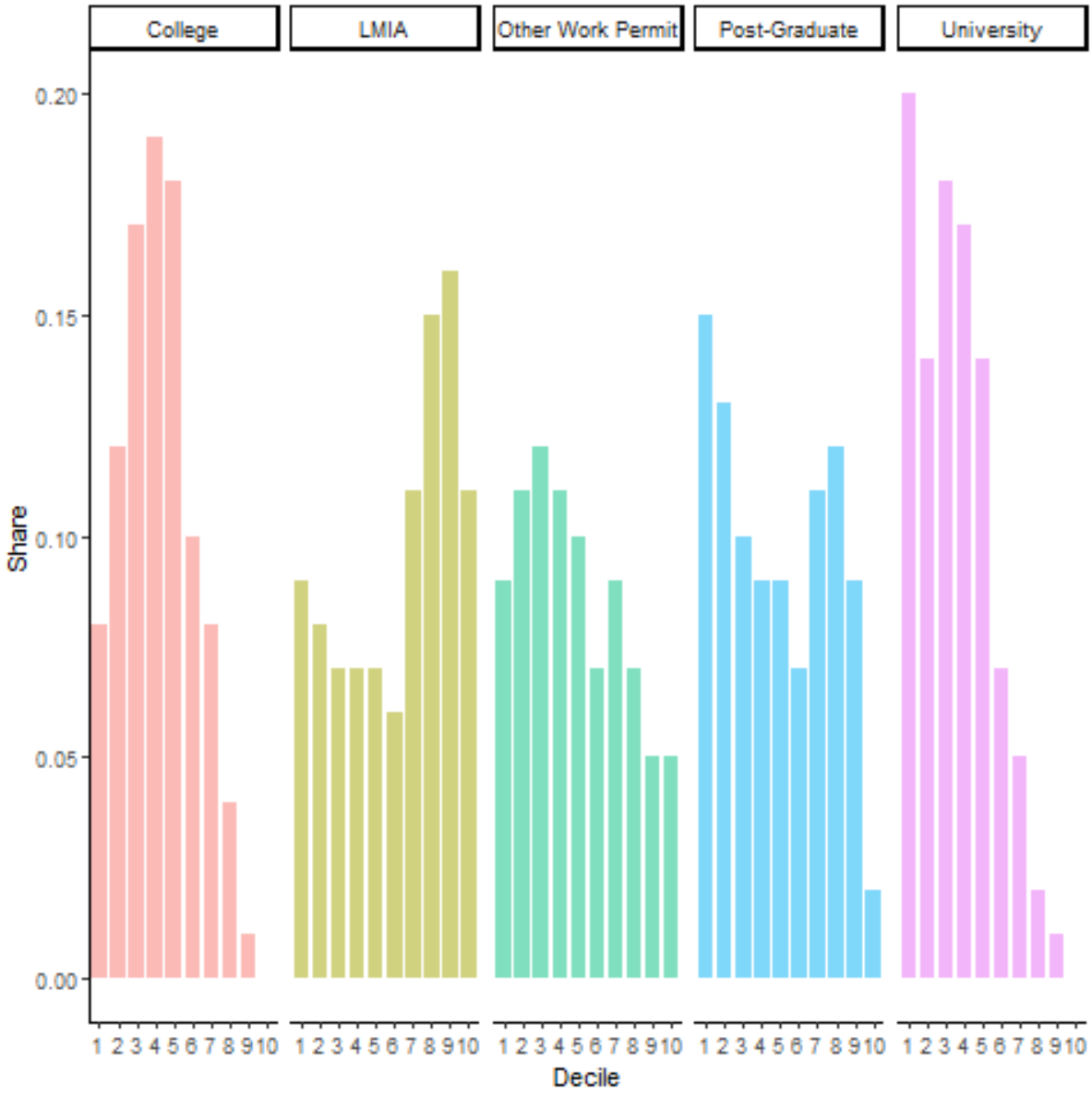

Figure 5: International Worker Annual Earnings Minus Average Earnings at their Firm by Decile of the Non-TFW Earnings Minus Firm Average Earnings Distribution

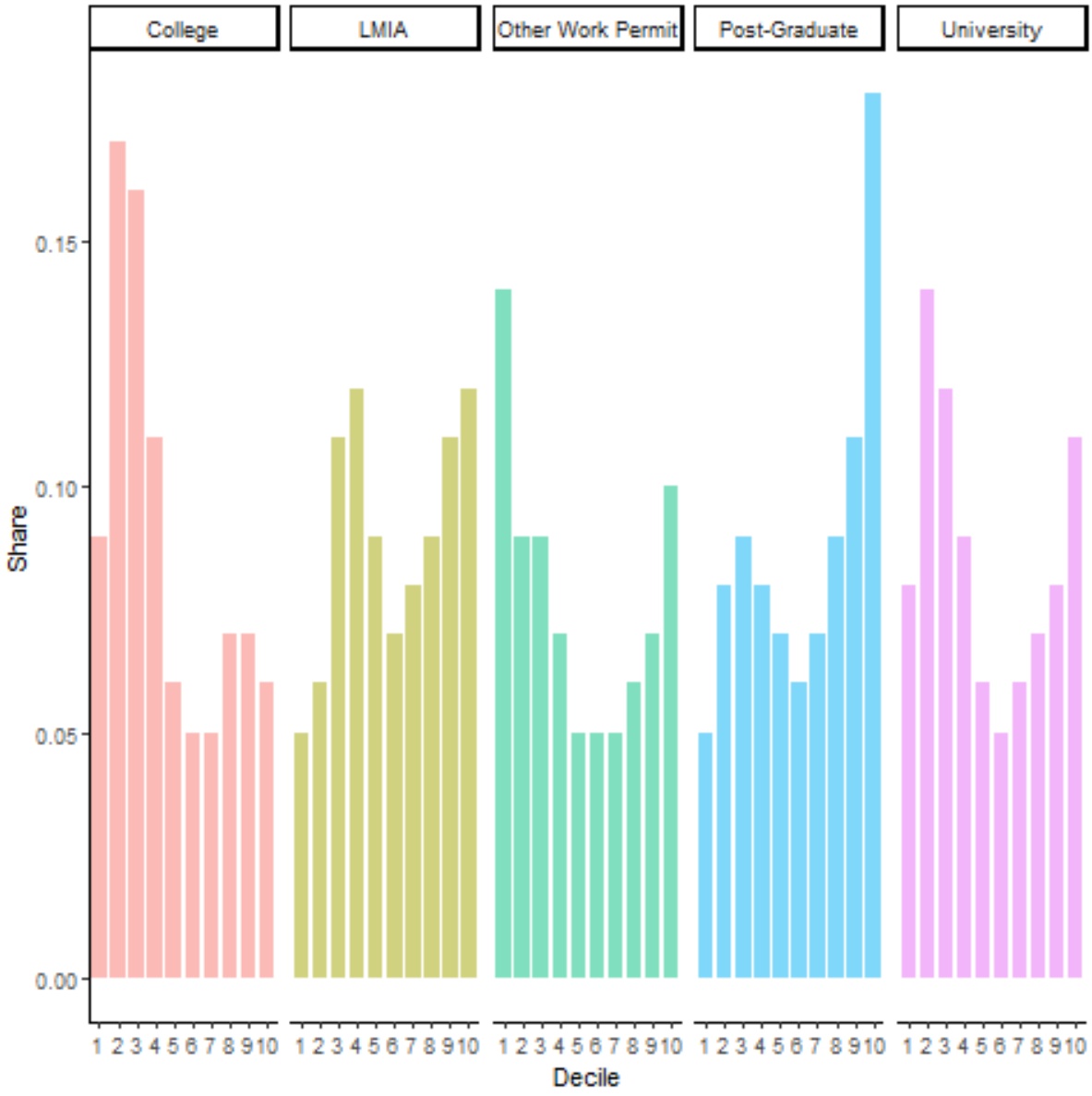

Figure 6: International Worker Revenue Per Worker at their Firm by Decile of the Non-TFW Revenue Per Worker Distribution

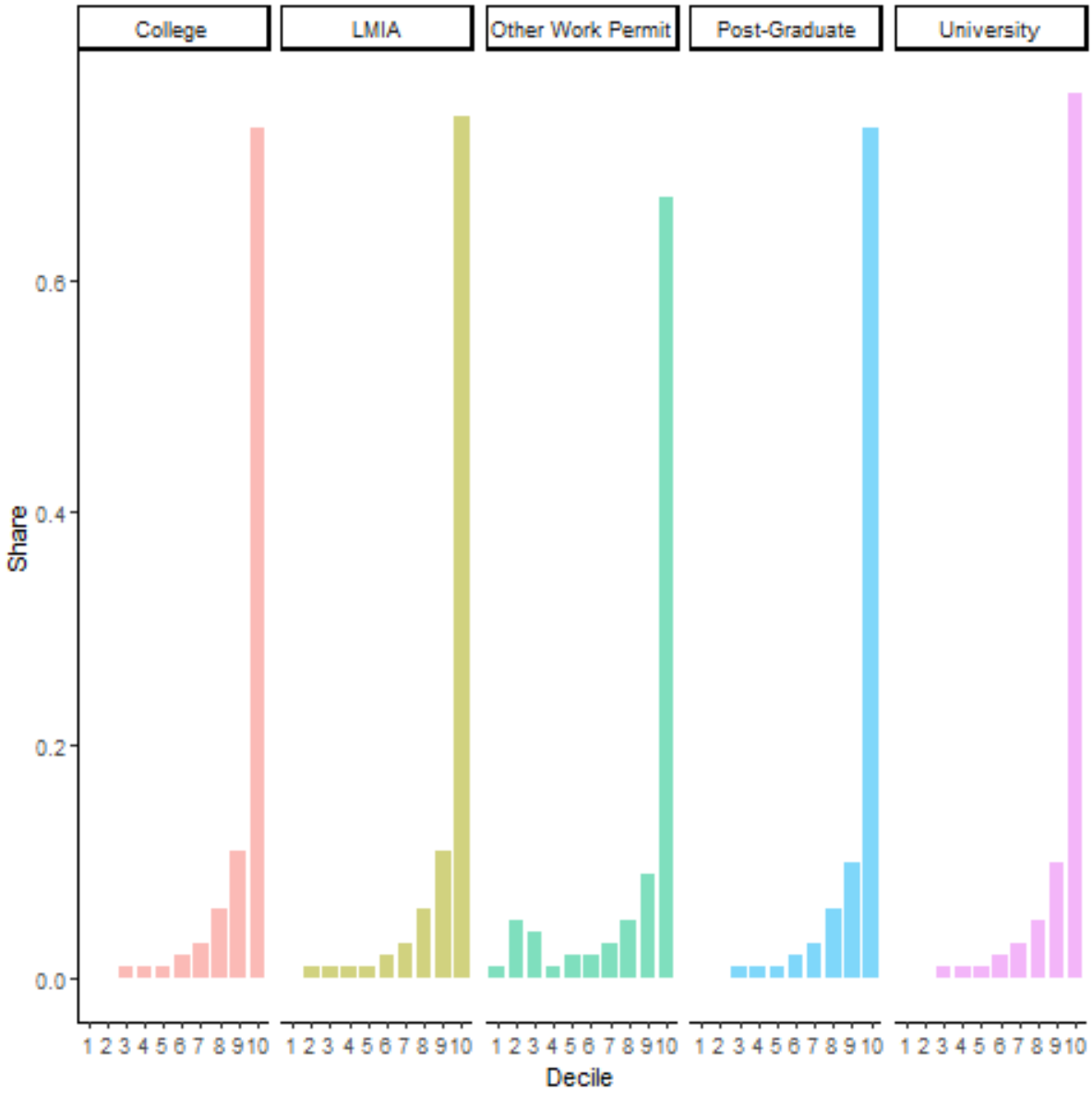

Figure 7: International Worker Number of Employees at their Firm by Decile of the Non-TFW Number of Employees at their Firm Distribution

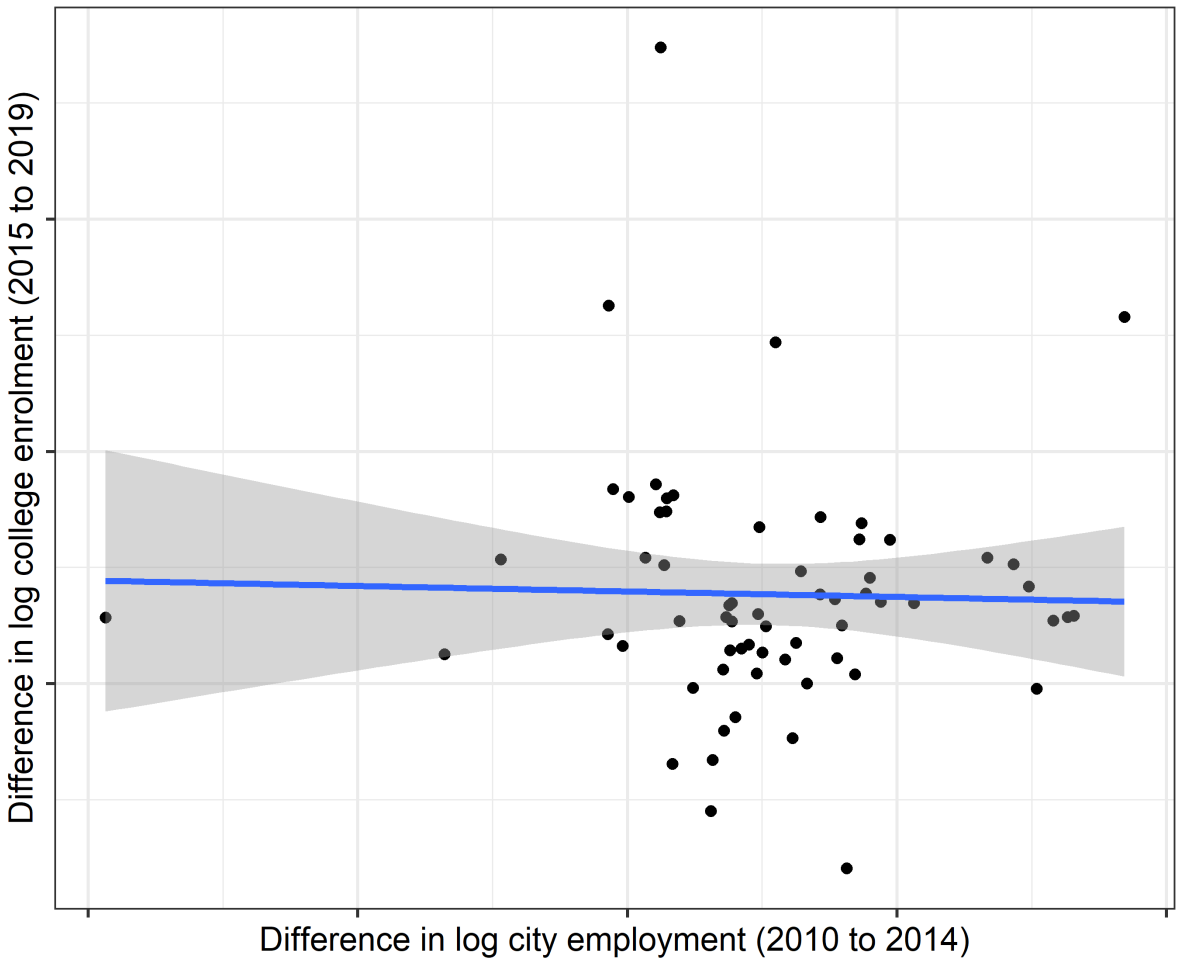

Figure 8: Percentage Change in College Enrolment (2015-19) vs Lagged Percentage Change in Employment (2010-2014) by City

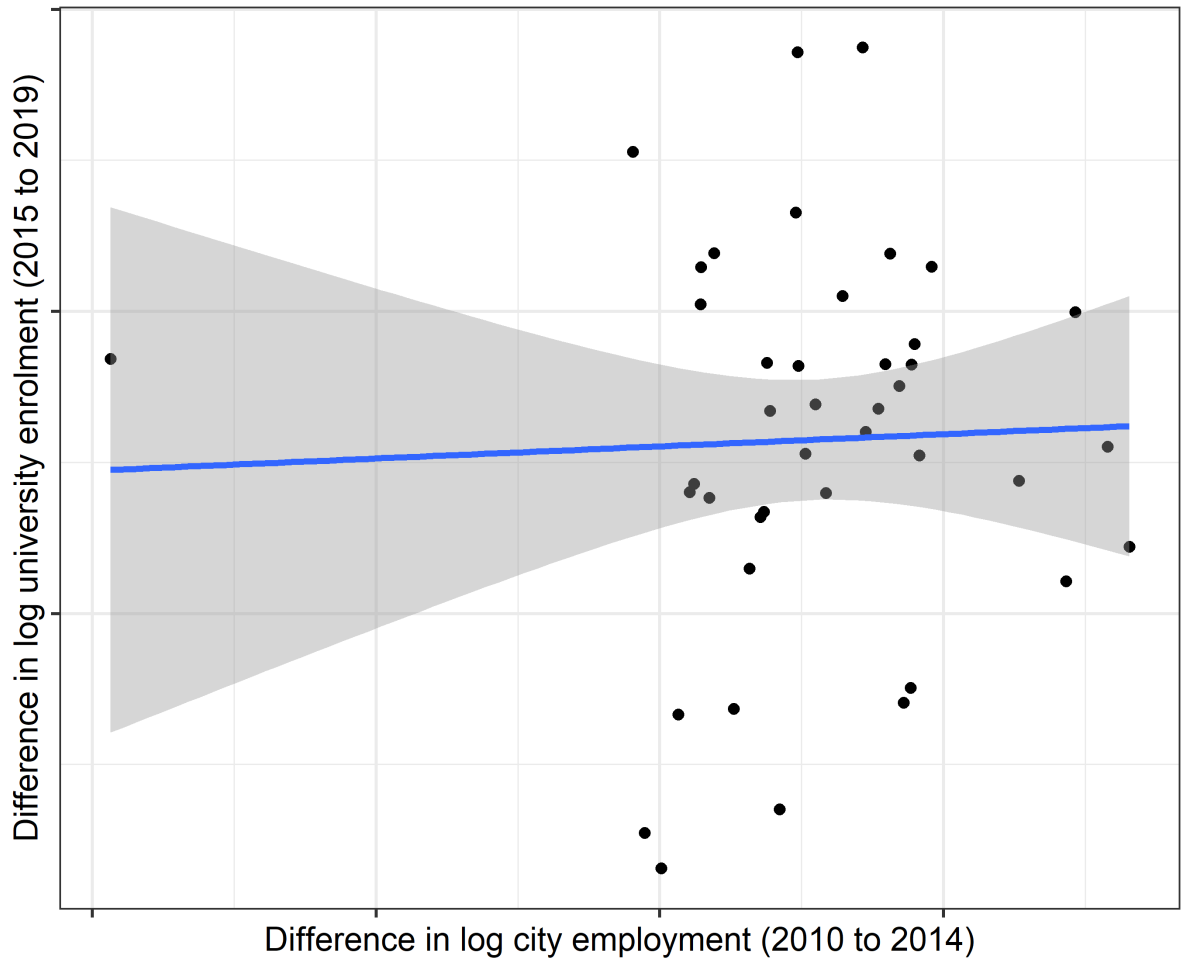

Figure 9: Percentage Change in University Enrolment (2015-19) vs Lagged Percentage Change in Employment (2010-2014) by City

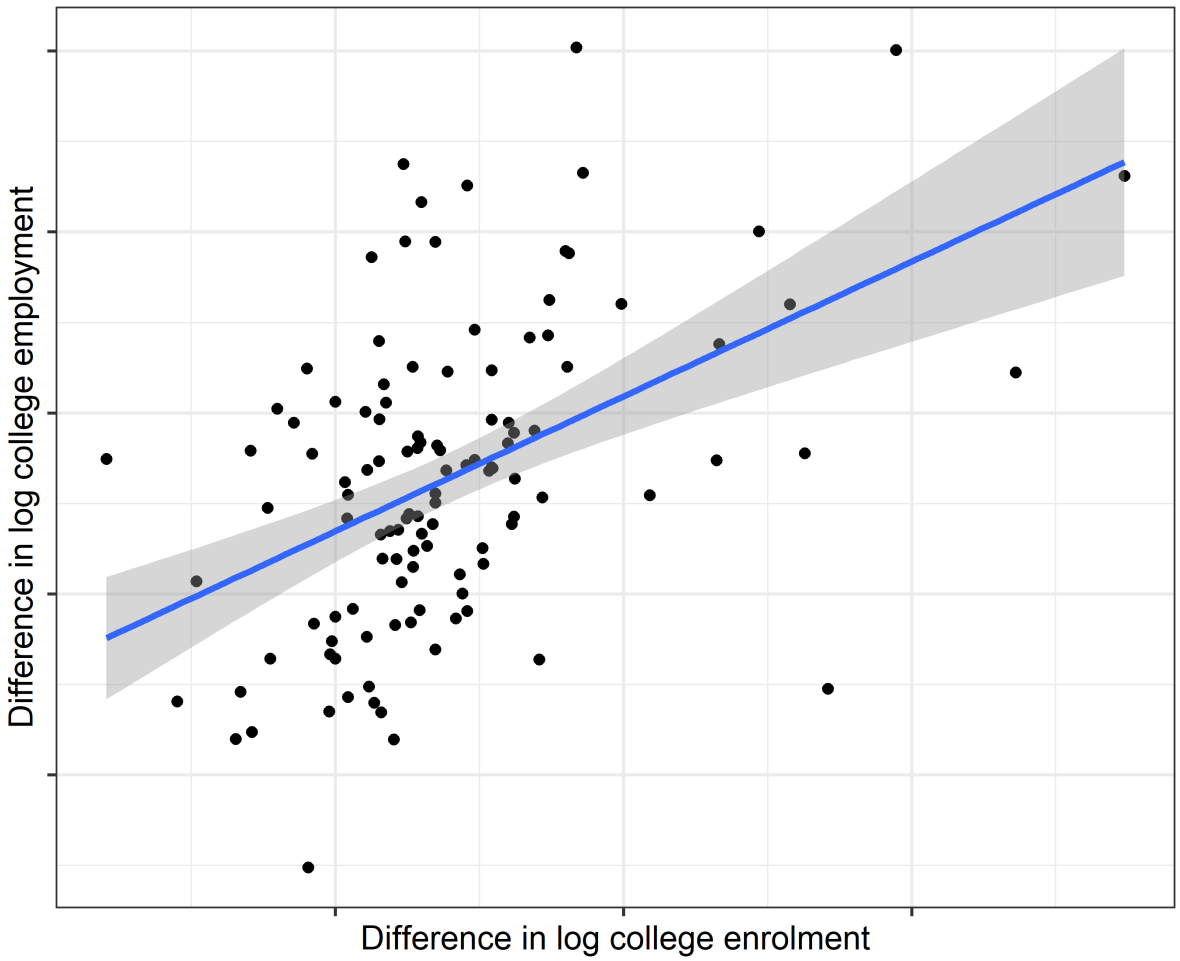

Figure 10: 5 year Percentage Change in College Student Employment vs Percentage Change in College Enrolment by City

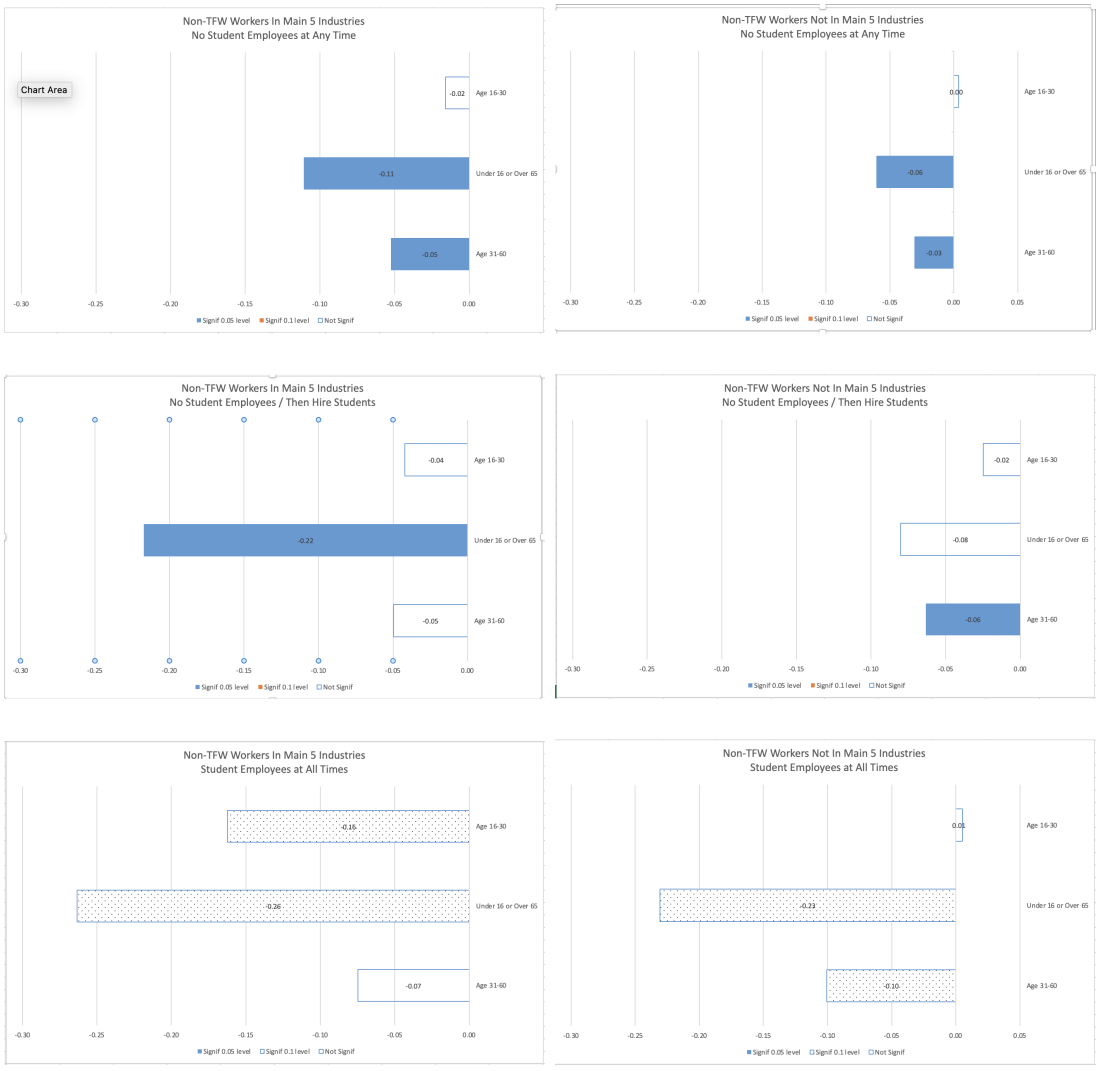

Figure 11: Estimated Log Student Worker Coefficients in Change in Log Employment Regressions, By Firm Type and Age

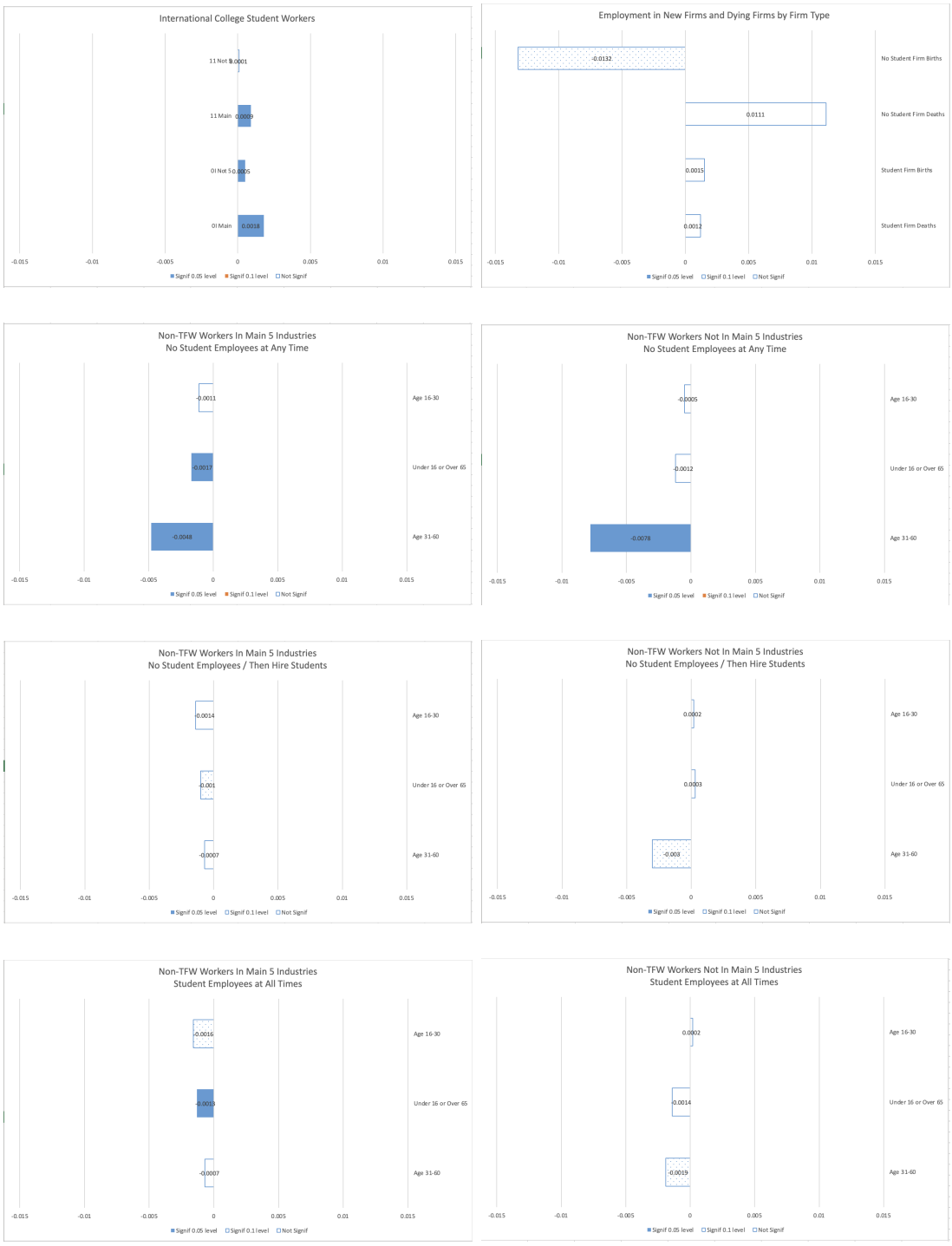

Figure 12: Estimated Log Student Worker Coefficients in Decomposition Element Regressions, By Firm Type and Age