

## Long-run Effects from Comprehensive Student Support: Evidence from Pathways to Education\*

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**Abstract:** We estimate long-run impacts to the Pathways to Education program, an intensive set of coaching, tutoring, and group activities, offered to disadvantaged high school students beginning in Grade 9, along with short- and long-term financial incentives for participation. Using a gradual roll-out process and eligibility requirements based on residing in public housing, we compare similar eligible and ineligible students before and after the program's introduction. High school administrative records are matched to income tax records to follow individuals up to the age of 26, even when they leave the household or province. We find significant positive effects on persistence in postsecondary education institutions, earnings and employment. Eligibility for Pathways increased annual earnings by 9 percent and employment by 6 percentage points (10 percent) and reduced the likelihood of ever receiving social assistance (welfare) by more than a third. These gains suggest long-term benefits – even from government net revenue changes alone, can justify the high program's high cost.

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\* We are grateful to Douwre Grekou and Beryl Li at Statistics Canada for help with accessing the data, Annik Beaudry, Barbara Bekooy, Chris Esposito and Joe Iacampo at Employment and Social Development Canada (ESDC) for many helpful conversations. We thank Statistics Canada and ESDC for financial support and to Abel Brodeur, Jason Garred, Steve Lehrer, Louis-Philippe Morin and Jeff Smith for comments and discussions. Any errors or omissions are those of the authors.

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## 1. Introduction

Children that grow up surrounded by poverty often remain in poverty even into adulthood (Chetty et al., 2014). To try to break this cycle, governments and nonprofit institutions have developed a broad range of policies and interventions. These include: home visitations to disadvantaged parents with young children (Schweinhart et al., 2005; Heckman, Pinto and Savelyev, 2013; Conti, Heckman and Pinto, 2016; García et al., 2017; García, Heckman and Ziff, 2017), assistance to move to better neighborhoods (Katz, Liebman and Kling, 2001; Chetty, Hendren and Katz, 2016; Chetty and Hendren, 2017), reforms to school accountability and teacher pay (Goodman and Turner, 2013; Gilraine, 2017), lowering class sizes (Chetty et al., 2011), expanding effective charter schools (Abdulkadirogulu et al., 2011; Dobbie and Fryer, 2011, 2013; Fryer, 2014) and providing subsidies for higher education (Conger and Turner, 2017; Denning, Marx and Turner, 2017).

Recent evidence indicates particular promise from offering more structure and comprehensive education support programs to disadvantaged students. A randomized trial in Chicago, for example, provided social-cognitive skill training, along with mandatory daily tutoring to improve disadvantaged youth. The program generated substantial improvements to math performance and school engagement (Cook et al., 2014).<sup>1</sup> Relatedly, the Quantum Opportunity Program offered a range of social, community, and educational after-school services to disadvantaged high school students and increased on-time high school graduation and college enrollment (Rodríguez-Planas, 2012). One of the most effective programs studied at the college-

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<sup>1</sup> Heller et al. (2017) study a randomized controlled trial that aims to improve the decision making of incarcerated adolescence in Chicago. They find that the intervention lead to short- to medium-run reductions in recidivism and crime.

level has been the Accelerated Study in Associate Program (ASAP), which requires that college students enroll full-time, attend mandatory tutoring, regular counseling and career advising services, and receive free public transportation passes and funding for textbooks. ASAP doubled graduation rates at the City University of New York and had similarly large impacts on persistence from a replication attempt in Ohio (Scrivener et al., 2015; Sommo and Ratledge, 2016). The Carolina Covenant aid program is another college-based support system, where eligible students received financial aid (through a mix of grants and work study funding) and a variety of services including career exploration workshops, peer mentoring and support with navigating the university's wellness and academic programs. Clothfelter, Hemelt and Ladd (2018) find that eligibility increased credit accumulation through the first three years of college and suggestive evidence points to positive impacts on graduation rates.<sup>2</sup>

The Pathways to Education program (often referred to simply as Pathways) resembles ASAP and Carolina Covenant but at the high school level, offering disadvantaged youth in Grades 9 through 12 free public transportation and postsecondary financial aid in exchange for commitments to regularly meet with an advisor, access tutoring assistance, and attend character-building group events. Pathways began in 2001 as a grassroots effort by social workers at the community health center in the Regent Park public housing project in Toronto. Regent Park is Canada's oldest and largest public housing project and is one of the poorest communities in Toronto. Eligibility is based solely on place of residence; for example, at its Regent Park site, only students living in the neighborhood's public housing units are eligible for the program. In previous work, we estimated that the introduction of Pathways increased high school graduation

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<sup>2</sup> Page et al. (2017) estimate the impact of the Dell Scholars program on postsecondary completion. Using two identification strategies, they find evidence that eligibility for the program increases the likelihood of receiving a bachelor's degree for low-income students.

and college enrollment by about 10 to 20 percentage points (Oreopoulos, Brown, and Lavecchia, 2017).

Programs like Pathways and ASAP appear effective at improving education attainment, but cost thousands of dollars per student. To justify these costs, it is necessary to consider longer-term benefits. What policy makers are ultimately concerned with is return on investment in raising adult outcomes, such as earnings, in order to break the cycle of poverty. Given that the short-run impacts of early childhood interventions may fade-out (Demming, 2009; Chetty et al., 2011), the ability of comprehensive programs to improve long-run outcomes is an open question.

To shed light on this question, we offer the first set of estimates on the long-run impacts of Pathways by exploiting unique administrative data that links school records, personal income tax files and information from employers. These data allow us to follow those eligible for Pathways and a comparison group of students living in other public housing units from the year they begin high school, through college and early into early adulthood. Using a difference-in-differences research design, we find that eligibility for Pathways increases postsecondary education attainment. Between the ages of 19 and 23, eligible youth claim between \$189 and \$630 more postsecondary tuition expenditures than ineligible youth, or 30 to 90 percent. Consistent with a delayed labor market entry due to staying in school longer, eligibility for Pathways leads to lower adult earnings from age 19 to 23, but higher earnings from age 24 to 26. We estimate that by age 26, eligibility for Pathways increases earnings by about \$1,200 per-year, or 9 percent, and the likelihood of being employed by 6 percentage points.

We find that Pathways has an impact on a variety of other monetary and non-monetary outcomes. Eligibility reduces the likelihood of ever receiving social assistance (welfare) by more than a third (9.6 versus 15.4 percent), significantly reduces the likelihood of receiving

unemployment insurance benefits and reduces the likelihood of having a child as a young adult (38.4 versus 46.5 percent).<sup>3</sup> These findings suggest that the large costs from offering an envelope of comprehensive services to disadvantaged youth at the high school level may nevertheless be worth it due to impressive long-run gains.

The remainder of the paper is structured as follows. Section 2 describes the main features of the Pathways to Education program. In Section 3, we describe the administrative datasets and empirical strategy. Sections 4 and 5 report the main results and various sensitivity checks. Section 6 calculates the benefit-to-cost ratio of Pathways using our estimates and provides some concluding comments.

## **2. Background on the Pathways Program**

Pathways to Education is a non-profit organization that delivers a comprehensive program to support at-risk youth.<sup>4</sup> The program began in 2001 as a grass-roots effort by community workers in Regent Park, Canada's oldest and largest public housing project, in Toronto. In the City of Toronto, social housing is the responsibility of the Toronto Community Housing Corporation (TCH). The TCH operates high-rise apartment, single family and mixed housing units in 106 neighborhoods in Toronto. TCH residents pay rent geared to income; payments are capped at 30 percent of gross income. The application process for TCH units is centralized and units are allocated to residents based on a first-come, first-serve basis, with some preferential treatment for

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<sup>3</sup> Unemployment insurance benefits in Canada are delivered through the Employment Insurance (EI) program, managed by Employment and Social Development Canada (ESDC).

<sup>4</sup> The discussion in this section borrows heavily from Section 2 of Oreopoulos, Brown and Lavecchia (2017).

applicants that are survivors of domestic abuse and human trafficking, terminally ill applications and over-housed tenants. The average wait time for a TCH unit was around 5 to 7 years in 2001, the year in which Pathways was introduced in Regent Park.

The Regent Park public housing project comprises more than 2,000 apartment units within a self-contained downtown community. Regent Park has historically faced high levels of poverty and crime. Around the time of the introduction of Pathways, fewer than 50 percent of Regent Park youth graduated high school and more than half of households had no earnings.

The Pathways program in Regent Park is available to all students living within the community's catchment area and attending high school. Eligibility for the program was phased in for successive cohorts, beginning with the entering Grade 9 cohort in September 2001. The fact that older Regent Park cohorts were never eligible for the Program – even Grade 9 students in September 2000 -- allows us to evaluate the impact of Pathways using a difference-in-differences design, described in Section 3. Over the past decade and a half, Pathways has expanded to 20 sites across 8 provinces Canada, including three additional sites in Toronto.<sup>5</sup>

Pathways administrators have developed ties with local elementary schools in order to identify and recruit eligible students. Information about eligibility for the program was initially spread by Pathways staff that contacted eligible students and by word of mouth. Although Pathways is available to all high school students living in Regent Park, participation is voluntary and requires students and parents to agree each year in writing to the program's conditions and high expectations. In previous work, we found that take-up of the program is extremely high, often in excess of 80-85 percent (Oreopoulos, Brown and Lavecchia, 2017).

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<sup>5</sup> An up to date list of all Pathways sites is available at: <https://www.pathwaystoeducation.ca/pathways-communities>.

The Pathways program is defined by four pillars of support: counseling, financial, academic and social. Upon enrolling in the program, each student is assigned to a student-parent support worker (or SPSW) that is employed-full time by Pathways. Students meet with their SPSW at least twice a month, more if necessary, to discuss their participation in the program, attendance in school, academic performance, college applications, job search and any other issues that may arise. In later grades, SPSWs help with resume preparation, job interview practice and organizing visits with postsecondary institutions and potential employers. SPSWs also act as the point of contact for parents and schools. The student to SPSW ratio is approximately 50:1.

Financial support for Pathways students comes in two forms. Immediate assistance and incentives for attending school takes the form of free public transportation tickets and school supplies that are distributed at student-SPSW meetings. In our previous research, we found (suggestive) qualitative evidence that this short-term incentive is very salient and valued highly by Pathways students (Oreopoulos, Brown and Lavecchia, 2017)). Long-term financial assistance is provided through a trust fund for each participant. For each year of participation in Pathways, the program sets aside \$1,000 CAD, up to a maximum of \$4,000 (tax-free), that can be used towards tuition and other post-secondary expenses. This bursary covered approximately 33 percent of two-year college tuition costs and 15-20 percent of 4-year university tuition costs over the 2006 to 2014 period.

The third pillar of the Pathways program, academic support, is comprised of free tutoring up to four nights a week. Tutoring sessions are conducted in small groups or on a one-on-one basis if necessary. Pathways tutors are volunteers with varied experience – some who are former teachers themselves, others who receive some training from the organization. Tutors teach about

five hours per week. Tutoring support is available in core academic subjects. For students whose grades are below a threshold (usually 65 percent), at least 2 days a week is mandatory.

The fourth pillar of the Pathways program is social support. In grades 9 and 10, this support takes the form of group mentoring activities. Students select at least two activities per month from a list of daily options provided by the program. In recent years, these activities have included: attending sporting events, theater, participating in creative arts programs, cooking, community recycling projects and martial arts. These activities are designed to develop students' social and group work skills, as well as to foster friendships among program participants. The typical mentoring group activity features 15 students and three volunteer mentors. Often the organization arranges backstage events or meetings with well-known groups or personalities. It also allows students to take a more active role in selecting mentoring activities as they progress through high school. In grades 11 and 12, students are able to propose biweekly activities to their SPSW that better align with their interests and skills, including tutoring younger grades.

### **3. Data and Empirical Strategy**

#### ***3.1 Data***

This study uses administrative data drawn from six Statistics Canada datasets, the Toronto District School Board (TDSB) and TCH addresses. In this section, we summarize the data sets and the construction of key variables. Online Appendix A contains additional details. TDSB administrative data are available for students who entered grade 9 beginning in September 2000, the year before Pathways was introduced. We also use cohort data for students that enrolled in Grade 9 in September 1999 in the former City of Toronto before the city was amalgamated in 1998

to include the suburbs of East York, Etobicoke, North York, Scarborough and York. This additional year of data is used to check the sensitivity of our results to having one pre-Pathways cohort in our baseline sample. The TDSB data are matched to TCH data using uniquely identifiable postal codes from school enrollment forms. This allows us to construct a dataset of all students that enrolled in TDSB schools and lived in one of the 70 public housing projects built by TCH that only house families paying subsidized rents.<sup>6</sup>

The TDSB-TCH data is then matched with administrative data from Statistics Canada for the 2005-2013 years.<sup>7</sup> These data provide rich information on Canadian tax filers' postsecondary enrollment and tuition expenditures, earnings, social assistance and UI receipt, as well as marital status and number of children. TDSB public housing students are matched to the administrative tax records using their first and last name and date of birth. Although individuals appear in the tax data as soon as they obtain a Social Insurance Number (SIN) and file a tax return, we restrict the analysis sample to those at least 19 years old in each calendar (tax) year. This leaves us with an unbalanced panel of 8,605 public housing students between 2005 and 2013 or 35,772 individual-year observations.

We estimate the causal effect of eligibility for Pathways on a variety of long-term outcomes, beginning with persistence in postsecondary education programs. The tax data contain information on the tuition payments individuals make to recognized postsecondary institutions over a calendar year (taxfilers in Canada over the age of 16 may claim a nonrefundable tax credit

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<sup>6</sup> As mentioned earlier, the TCH operates properties in 106 neighborhoods in Toronto. While 70 sites exclusively house tenants paying rent geared to income, the remainder house a mix of families paying subsidized and market rent or seniors.

<sup>7</sup> The six Statistics Canada administrative datasets are the T1 Family File (T1FF), the T1, T2, T3 and Payroll Deduction (PD7) tax files, and the Longitudinal Immigration Database (IMDB). For more details, see Online Appendix A.

for eligible tuition payments). We proxy for persistence in college or university using either the tuition payments made over the course of a year or the number of years in which tuition expenses are incurred. Our two primary labor market outcomes are: a dummy variable equal to one if an individual reports positive employment earnings and zero otherwise and the total earnings over a calendar year.<sup>8</sup> Earnings for those that are not working are coded as zero.

Our data also contain information on other long-term outcomes such as social assistance payments received and unemployment insurance (UI) benefit payments. From these we construct variables for ever having received social assistance or UI benefits. We also have information on marital status and the number of children (both under the age of 6 and under the age of 18). Background variables and other covariates are constructed from both the TDSB and tax data and include gender, immigrant status, language spoken at home, age at the start of high school, and age in the current tax year.

Table 1 reports summary statistics for select variables for 2013. The sample is all individuals that enrolled in a TDSB school between 2000 and 2008 and lived in a TCH public housing project. Column 1 reports means (standard deviations are in brackets) for Regent Park students. Columns 2 and 3 report means for students from the Rexdale and Lawrence Heights projects (where Pathways was introduced in 2007) and other public housing students, respectively. Across all sites, the fraction of individuals working ranges between 63 and 68 percent and (unconditional) average annual earnings range between \$9,500 and \$11,000. The low level of mean earnings partially reflects the age range of our sample in 2013 and partially reflects the fact that the employment rate is low. In particular, while students in the 2000 Grade 9 cohort are 27

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<sup>8</sup> For individuals work worked for multiple employers, earnings are equal to the sum of the wages paid at all firms. Our measure of earnings also includes self-employment income.

years old in 2013, students in the 2008 cohort are only 19. Table 1 also shows that Regent Park students claim more tuition spending and are more likely to be immigrants than students from other public housing sites.

### ***3.2 Empirical Strategy***

We estimate the causal effect of eligibility for Pathways on long-term outcomes using a difference-in-differences approach, taking advantage of the program’s gradual roll-out to successive Grade 9 students. Our research design compares the outcomes of individuals that lived in Regent Park during high school with students that lived in other Toronto public housing projects before and after Pathways was introduced. Given our sample includes adolescents that are just out of high school and those in their late 20s, we expect that eligibility for Pathways will have heterogeneous impacts by age. Our empirical specification is as follows

$$y_{ipct} = \sum_{a=20}^{27} \gamma^a 1[age_{ipct} = a] + \sum_{a=20}^{26} \beta^a T_{pc} 1[age_{ipct} = a] + X'_{ipc} \delta + e_p + e_c + e_{ipct} \quad (1)$$

where the subscript  $i$  denotes individuals,  $t$  denotes calendar time (in years),  $p$  denotes housing projects and  $c$  denotes cohorts (year entered grade 9). The variable  $1[age_{ipct} = a]$  is equal to one if individual  $i$  is age  $a$  in year  $t$  and zero otherwise (the omitted age dummy variable is for 19 year-olds). Individual time invariant characteristics (age when started high school, immigrant status, first-language status and gender) are encapsulated by the variable  $X'_{ipc}$ , and  $e_p$  and  $e_c$  are housing project and year fixed effects, respectively.  $T_{pc}$  is a dummy variable equal to one if individuals

who lived in housing project  $p$  and entered grade 9 in cohort  $c$  are eligible for the Pathways program and equal to zero otherwise. Standard errors are clustered at the housing project level to allow for serial correlation and heterogeneity in the outcomes of students that resided in the same housing project (Cameron and Miller, 2015).<sup>9</sup>

The coefficient  $\beta^a$  is the average causal effect of being eligible for Pathways on outcome  $y$  at age  $a$ .<sup>10</sup> If eligibility for Pathways increases postsecondary persistence and delays labor market entry, we expect that the  $\beta^a$  coefficients will be larger at younger ages and smaller at older ages when postsecondary tuition expenses is the dependent variable. We expect the opposite age pattern when earnings and labor supply variables are the dependent variables of interest. The identification of causal effects in our setting requires that the parallel trends assumption is satisfied: in the absence of the introduction the program, the average outcomes of Pathways projects would have followed the same path as the other public housing (OPH) projects. Section 4 reports a number of robustness checks to assess the validity of this assumption. In particular, we show that our baseline estimates are similar for alternative comparison groups. This includes restricting the analysis to the sub-sample of students in the old City of Toronto for whom we data for an additional pre-Pathways cohort (i.e. students that entered TDSB schools in September 1999 and lived in public housing).

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<sup>9</sup> As a sensitivity test, we also implement the effective degrees of freedom correction for the clustered robust variance estimator suggested by Young (2016). The results are reported in Appendix Table A3. In general, the estimated clustered robust standard errors using this procedure are larger than those reported in the main results. However, it is unclear how to interpret this evidence given that the bias correction and effective degrees of freedom procedure suggested by Young (2016) may have undesirable properties in situations in which there is heteroskedasticity across clusters, as in our application. See Online Appendix B for more details.

<sup>10</sup> Oreopoulos, Brown and Lavecchia (2017) show that the registration rate for Pathways is in excess of 80-85 percent for most cohorts at the Regent Park site (see Figure 1 in their paper). Consequently, the casual effects of participation in the program or treatment-on-the-treated (TOT) effects will be similar to the intent-to-treat (ITT) effects reported in this paper.

Our estimate of the causal effect of eligibility for Pathways on earnings for young adults may understate the effect of the program on middle age or more mature workers. This is because a delayed labor market entry (due to increased schooling) will mean that Pathways-eligible Regent Park youth will have less labor market experience, on average, than ineligible youth. Recent research suggests that the earnings-experience profile is steep for young workers in Canada (Boudarbat, Lemieux and Riddell, 2010). This is important to keep in mind when interpreting the results in Section 4.

## **4. Results**

### ***4.1 Graphical Evidence***

Figures 1 to 4 illustrate the main impacts of the Pathways program on tuition expenditure claims, tuition tax credit receipt, adult earnings and employment graphically. In Figure 1, the impact of eligibility for Pathways on tuition expenditures is presented. The figure shows the average postsecondary tuition expenditures of Pathways eligible and comparison group students between the ages of 19 and 26.<sup>11</sup> The solid line with circle markers represents the average tuition expenditure of Pathways eligible students (those that lived in Regent Park) at each age. The dashed line with diamond markers plots the average tuition expenditures of students in the comparison projects at each age. On average, students in the comparison projects claim \$635 in tuition expenditures at colleges and universities at age 19. The postsecondary tuition expenditures for this group increases through ages 22 before declining through age 26. In contrast, Regent Park youth

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<sup>11</sup> Figures 1A, 2A, 3A and 4A are constructed by adding  $\gamma^a + \beta^a$  to the unconditional means for comparison group (OPH) students at age 19 for each age  $a \in (20,26]$ .

spend more on tuition at colleges and universities than the comparison group between the ages of 19 and 24. Figure 1A shows that the gap in tuition expenditures is widest between the ages of 20 and 23, in line with typical age patterns for postsecondary attendance.

By assuming that the tuition expenditure claims of those that lived in Regent Park would have followed the same pattern as those that living in the other TCH projects if Pathways had not been introduced, we can interpret the difference between the two lines in Figure 1A as the causal effect of eligibility for the Pathways program at each age. This is illustrated in Figure 1B. Figure 1B shows that between the ages of 19 and 24, eligibility for Pathways leads to a large positive impact on persistence in postsecondary education, before tapering off by age 25 to 26.

Figures 2 to 4 are constructed in the same way as Figure 1, but for different outcomes. In particular, Figures 2, 3 and 4 illustrate the impact of eligibility for Pathways on tuition tax credit receipt, earnings and employment, respectively. Figure 2 shows that the youth from Regent Park and other public housing sites receive a similar tuition tax credit between the ages of 19 and 22. However, beginning at age 23, the tax credit received by Regent Park youth increases significantly. Between the ages of 23 and 26, the gap between the two groups is \$400-\$800 per year.

Figure 3A plots the average annual earnings of students from Regent Park and the comparison group by age. The average student in the comparison group earns \$3,828 at age 19. The annual earnings OPH youth increase steadily with age to nearly \$15,000 by age 26. The earnings of youth from Regent Park are also increasing in age, but there is an important difference between the age pattern of earnings between Regent Park and OPH youth. Between the ages of 19 and 23, the average earnings of Regent Park youth are lower than their peers in the comparison group. However, the earnings gap flips beginning at age 24. By age 26, Regent Park youth eligible for Pathways earn, on average, \$1,200 per year more than students from other public housing sites.

Figure 4A shows that the fraction of individuals in the comparison group that are employed at age 19 is similar to that of youth from Regent Park. However, beginning at age 20, the employment rates between the two groups diverge. While the employment rate of youth in the comparison group remains around 63 percent between the ages of 20 and 26, the fraction of Regent Park youth that are working is much higher. The employment rate of youth that were eligible for Pathways is between 2 and 6 percentage points higher than those ineligible for Pathways. Together, the evidence in Figures 1 to 4 suggests that eligibility for Pathways increases persistence in postsecondary institutions, leading to higher earnings by age 24-26. The fact that eligibility for Pathways leads to higher employment rates and lower earnings between the ages of 19 and 23, is consistent with an increase in part-time employment among Regent Park youth while in college or university.

#### ***4.2 Regression Analysis***

Table 2 reports coefficient the estimates and standard errors for  $\gamma^a$  and  $\beta^a$  for the four outcomes of interest. In column 1, the dependent variable is postsecondary tuition expenditure claims. The estimate for  $\beta^{19}$  suggests that eligibility for Pathways increases tuition expenditure by \$189 at age 19. Between the ages of 20 and 23, eligibility for Pathways leads to tuition expenditure increases between \$475 and \$630. To put these numbers in perspective, the average tuition expenditure at age 19 for youth ineligible for Pathways is \$635. Compared with this benchmark, eligibility for Pathways increases tuition expenditure claims by 30 to 91 percent between the ages of 19 and 23.

In previous work, we found that eligibility for Pathways increased high school graduation rates and the fraction of youth admitted to a college or university (Oreopoulos, Brown and Lavecchia, 2017). As many studies show, however, enrollment in a postsecondary institution does not guarantee success or graduation. This is especially true for students from disadvantaged families that face additional pressures, such as financial constraints, work requirements and family obligations (Oreopoulos and Petronijevic, 2013; Scrivener et al., 2015). Although our administrative data does not have a direct measure of postsecondary education attainment, postsecondary tuition expenditure claims are a useful, albeit indirect, proxy for persistence at colleges and universities. This is because tuition expenditure claims allow us to observe the number of (calendar) years a student attends a postsecondary institution. The estimates in column 1 of Table 2 suggest that eligibility for Pathways leads to higher expenditures at colleges and universities precisely during the period in the lifecycle when most young adults invest in postsecondary education.

In column 2, the dependent variable is the postsecondary tuition tax credit received. The age pattern of the  $\beta^a$  coefficients differs from column 1. Eligibility for Pathways leads to increased tuition tax credit receipt later in the lifecycle, between the ages of 23 and 26. This is not surprising because the postsecondary tuition tax credit is nonrefundable and because tuition fees can be partially carried forward to future years. Thus, older individuals are more likely to receive a tax credit as their earnings increase with age. The coefficient estimates in column 2 suggest that eligibility for Pathways increases the tuition tax credit received between the ages of 23 and 26 by between \$425 and \$780.

The dependent variable in column 3 of Table 2 is earnings from all employment activities. The coefficient estimates  $\gamma^a$  follow the expected pattern: the earnings of OPH youth increase by

approximately \$1,000 to \$2,000 per year from age 19 to age 27. Among students that are ineligible for Pathways, 20 year-olds earn \$1,129 more than 19 year-olds (the omitted group), on average, while 26 year-olds earn \$11,746 more than 19 year-olds, on average. The  $\beta^a$  estimates are also increasing in age. While eligibility for Pathways lowers earnings at age 19 by a statistically significant \$955, the average effect of eligibility for Pathways at age 20 is -\$563. By age 24 to 26, the average effect of eligibility for Pathways increases to \$1,200. To put the \$1,200 earnings gain in perspective, the average earnings of the 2000 TDSB cohort ineligible for Pathways at age 26 is \$13,415.<sup>12</sup> This suggests that eligibility for Pathways increases age 26 earnings by 9 percent (1,208/13,415) per year. This estimate is comparable to recent estimates of the return to an additional year of high school or postsecondary education (Oreopoulos and Petronijevic, 2013; Heckman, Humphries and Veramendi, 2018).

The estimates in column 3 suggest that Pathways increases adult earnings by an amount that is economically and statistically significant. Unconditional earnings can increase because of an increase in the likelihood of working (extensive margin), an increase in earnings conditional on working (intensive margin), or both. In column 4, we explore the extent to which the effect of Pathways on earnings is due to an extensive margin response. Eligibility for Pathways has a small and statistically insignificant effect on working at age 19. By age 21, eligibility for Pathways is estimated to increase the likelihood of having positive earnings by 4.9 percentage points. This effect stabilizes to between 2 and 6 percentage points for those between the ages of 24 and 26. Our

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<sup>12</sup> The employment rate among 26 year-olds in the 2000 cohort *ineligible for Pathways* is 61 percent. This implies that the average earnings, conditional on working, is  $\$13,416/0.61 = \$21,992$ . This corresponds to the 37<sup>th</sup> percentile of the 2013 conditional earnings distribution for Toronto. In 2013, the median individual income in Toronto was \$29,750 (see <http://www5.statcan.gc.ca/cansim/a47>).

estimate for  $\beta^{26}$  suggests that eligibility for Pathways increases the likelihood of having positive earnings by 6.1 percentage points or 10.1 percent (0.061/0.603).

It is also possible that eligibility for Pathways increases earnings conditional on working. There are several possible channels through which Pathways might increase earnings conditional on working. For example, the job search assistance provided by SPSWs may help match Pathways participants with better-paying firms. Another possibility is that Pathways increases human capital through education, leading to higher earnings in adulthood. However, a naïve estimation of equation (1) on the sub-sample of individuals with positive earnings will lead to biased estimates of the  $\beta^a$  coefficients. This is because of the significant extensive margin response. In particular, the positive extensive margin response implies that those with positive earnings from Regent Park and other public housing may not be comparable after the introduction of Pathways, even if the two groups were comparable before the introduction of the program. Under the assumption that students induced to work by Pathways have a lower earnings potential, on average, than those that would have worked in the absence of the program, then conditioning on the sub-sample of those with positive earnings will cause the estimates for  $\beta^a$  to be biased downwards.

Despite this limitation, we can assess the relative magnitudes of the extensive and intensive margin effects of Pathways by recognizing that the overall effect of Pathways on earnings at any age  $a$  can be decomposed into a weighted average of the extensive margin and conditional-on-positive (COP) effects as follows<sup>13</sup>

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<sup>13</sup> This decomposition ignores covariates, but these can be accommodated by residualizing the data and then taking averages of the residuals.

$$\begin{aligned}
& \Delta E[y_i|p = RP, a] - \Delta E[y_i|p = OPH, a] \\
& = \underbrace{\{\Delta P[y_i > 0|p = RP, a] - \Delta P[y_i > 0|p = OPH, a]\}}_{Extensive\ Margin\ Effect} E[y_i|y_i > 0, p = RP, c \geq 2001, a] \\
& + \underbrace{\{\Delta E[y_i|y_i > 0, p = RP, a] - \Delta E[y_i|y_i > 0, p = OPH, a]\}}_{COP\ Effect} P[y_i > 0|p = OPH, c = 2000, a]
\end{aligned}$$

where  $\Delta E[y_i|p = RP, a]$  is the difference in the average earnings of Regent Park students at age  $a$  before and after Pathways was introduced and  $\Delta E[y_i|p = OPH, a]$  is the difference in the average of other public housing students at age  $a$  over the same period.  $\Delta P[y_i > 0|p = RP, a] - \Delta P[y_i > 0|p = OPH, a]$  is the difference-in-differences estimate of the effect of eligibility for Pathways on the likelihood of working at age  $a$ . The difference  $\Delta E[y_i|y_i > 0, p = RP, a] - \Delta E[y_i|y_i > 0, p = OPH, a]$  is the average casual effect of eligibility for Pathways on earnings at age  $a$  for those with positive earnings. Recall, the estimates in columns 3 and 4 of Table 2 suggest that eligibility for Pathways increases unconditional earnings at age 26 by \$1,208 and the likelihood of working at age 26 by 0.061. Furthermore, conditional on working, Pathways-eligible Regent Park students earn \$23,459, on average, at age 26. Together, these estimates suggest that the extensive margin response to Pathways explains all of the earnings impact  $((\$23,459 * 0.061 / 1,208) * 100 = 118 \text{ percent})$ .

### 4.3 Robustness Checks

The estimates in Table 2 suggest that eligibility for Pathways increases postsecondary education persistence and ultimately earnings for young adults that grew up in disadvantaged neighborhoods. In Table 3, we explore the robustness of our results by restricting the analysis to the sub-sample of individuals who started grade 9 between 2000 and 2003 (henceforth the 2000-

2003 cohorts). The oldest individuals in our baseline sample are 26-27 years old in 2013, while the youngest are 21 years old. Restricting the analysis to the older cohorts allows us to check whether our estimates are sensitive to dropping individuals that are too young to be followed for at least five years after high school. In general, the estimates in Table 3 are very similar to those in Table 2. For example, the estimates in column 1 of Table 3 suggest that eligibility for Pathways significantly increases postsecondary tuition expenditure claims between the ages of 19 and 24, before tapering off for older individuals. In column 3, the estimates for  $\beta^{24}$  to  $\beta^{26}$  imply that eligibility for Pathways increases adult earnings by approximately \$1,000 to \$1,200 per year. Similarly, the estimates for the effect of eligibility for Pathways on the likelihood of working tuition and the tuition tax credit received in columns 2 and 4 are very similar to Table 2.

Table 4A explores the robustness of our tuition expenditure estimates to alternative comparison groups. Column 1 reports our baseline estimates from Table 2 as a benchmark. In column 2, the comparison group is restricted to the 11 largest housing projects in Toronto. These projects each house several hundred residents and face poverty rates similar to Regent Park. The age pattern of the  $\beta^a$  coefficients is very similar to the baseline sample. For example, in column 2 of Table 4A, the estimates for  $\beta^{20} - \beta^{23}$  suggest that eligibility for Pathways increases postsecondary tuition expenditure claims by between \$373 and \$581. Furthermore, each of the estimates is statistically significant at the 5 percent level. In column 3, the comparison group is restricted to youth that went to high school in one of Toronto's so-called "priority neighbourhoods", which are areas with concentrated levels of crime and poverty. The estimates for  $\beta^a$  for this sub-sample are also very similar to those in columns 1 and 2.

The validity of our difference-in-differences strategy requires that the counterfactual outcomes of youth that resided in Regent Park follow the same trend as those that resided in other

TCH projects. With only one pre-Pathways cohort, we are unable to assess the plausibility of this assumption using our baseline sample of students that entered high school between September 2000 and 2006. To address this limitation, we use data for the 1999 Grade 9 cohort, which is only available for students that enrolled in schools in the legacy Metro Toronto school board.<sup>14</sup> Figure 5A plots the average tuition expenditures by year entered Grade 9 (cohort) for Regent Park and other public housing students for the 2012-2013 calendar (tax) years. Recall the inverse relationship between Grade 9 cohort and age in 2013: the youngest (respectively oldest) individuals in 2013 began high school in 2006 (respectively 1999). Reassuringly, the path of tuition expenditures of Regent Park students in the pre-2001 cohorts is similar to the path of students in the comparison group, suggesting that the parallel trends assumption is plausible.

Column 4 of Table 4A reports the estimates from equation (1) when the comparison group is restricted to the aforementioned public housing sites in the legacy Metro Toronto school board. As suggested by Figure 5A, the age pattern of the effects of Pathways is very similar to the results from the baseline sample. For example, the estimates for  $\beta^{19} - \beta^{23}$  suggest that eligibility for Pathways increases tuition expenditures by between \$190 and \$560 between the ages of 19 and 23. The estimates for  $\beta^{25}$  and  $\beta^{26}$  are small and statistically insignificant, in line with column 1. In Table 4B and Figure 5B, we explore the robustness of our estimates of the effect of eligibility for Pathways when the dependent variable is the postsecondary tuition tax credit received. Across all subsamples, the estimates are very similar to Table 2.

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<sup>14</sup> To increase sample size, the legacy Metro Toronto sample includes both uniquely matched postal codes for public housing projects as well as close-by mixed residences. Estimated effects from the sample of postal codes that match uniquely to public housing addresses only are similar but noisier.

Table 4C explores the robustness of our estimates of the effect of eligibility for Pathways on earnings. Across the various subsamples considered, the age pattern of the  $\beta^a$  coefficients are similar to the estimates using the baseline sample. When the comparison group is large density TCH projects (column 2 of Table 4C), eligibility for Pathways reduces earnings at age 19 by a statistically significant \$1,863, decreases earnings at age 20 by a statistically insignificant \$1,231, and increases earnings at age 25 by a statistically insignificant \$397. In column 4 of Table 4C, the comparison group is restricted to students in the legacy Metro Toronto school board. In that case, the estimate for  $\beta^{19}$  implies that eligibility for Pathways reduces earnings at age 19 by \$1,347. Beginning at age 24, however, eligibility for Pathways increases earnings by \$985. The estimates for  $\beta^{24}$  to  $\beta^{26}$  imply that eligibility for Pathways raises annual earnings by between \$625 and \$1,470.

The earnings of the young adults in our sample are more volatile and have a greater variance than other outcomes, such as postsecondary tuition tax expenditures. Consequently, restricting the comparison groups leads to smaller sample sizes and larger standard errors on our estimates of the effect of eligibility for Pathways. For example, when the comparison group is restricted to students from the legacy Metro Toronto school board, the number of student-year observations falls from 35,772 to 12,899. Despite the fact that the estimates for  $\beta^{20}$  to  $\beta^{26}$  in column 4 of Table 4C are similar in sign and magnitude to the estimates in column 1, none are statistically significant at conventional levels. We conclude that the large long-term earnings gains from eligibility for Pathways in Regent Park in our baseline sample are relatively insensitive to alternative comparison groups.

## **5. Other Long-Term Outcomes**

Our baseline estimates suggest that eligibility for Pathways increases postsecondary education attainment, as well as the earnings and employment probabilities of disadvantaged young adults in Regent Park. In Table 5, we report estimates of the effect of Pathways on additional long-term outcomes. These outcomes corroborate our earnings estimates and suggest that Pathways impacts certain social outcomes as well as labor market outcomes. We restrict the analysis to the 2013 year (the last year of data available) and the 2000 to 2003 cohorts (as in Table 3) to focus on older individuals and the long-run effects of Pathways. Our results are from regressions with the following specification.

$$y_{i(pc2013)} = \gamma + \beta T_{pc} + X'_{i(pc)} \delta + e_p + e_c + e_{i(pc2013)} \quad (2)$$

In column 1, the dependent variable is the number of years postsecondary tuition expenditures are claimed on students' tax returns. We view this variable as a good proxy for postsecondary education attainment (college and university). The estimate for  $\beta$  implies that eligibility for Pathways increases postsecondary education attainment by 0.47 years. To put this number in perspective, students that lived in OPH projects obtained 1.91 years of postsecondary schooling by age 26, on average. This suggests that eligibility for Pathways increased college and university attainment by approximately 25 percent. Given that Pathways supports postsecondary education attainment through the \$1,000 per-year bursary and assistance with college applications and campus visits, it is reassuring that it raises the level of schooling of participants.

In columns 2 to 5, the dependent variables of interest are: a dummy variable for ever being on social assistance (welfare), ever being on unemployment insurance (UI), the level of social assistance payments received in 2013, and the level of UI benefits received in 2013. Among students that lived in OPH projects, 15.4 percent received social assistance at least once by age 26.

Eligibility for Pathways decreases the likelihood of ever receiving social assistance and UI by 5.1 percentage points or a 33 percent decline. Eligibility for Pathways also lowers the likelihood of ever receiving UI by 5.8 percentage points. This leads to lower social assistance and UI benefit payments. The estimates in columns 4 and 5 imply that Pathways reduces the (unconditional) amount of social assistance and UI benefits received by \$525 and \$183, on average. All of the estimates for  $\beta$  in columns 2 to 5 are statistically significant at the 1 percent level. These results are important for a cost-benefit evaluation of the program. In particular, these estimates imply that the fiscal benefit of Pathways is two-fold: participants earn more, on average, leading to higher income tax revenues and receive less social assistance.

The estimates reported in columns 6 and 7 of Table 5 show that Pathways has an impact on social outcomes as well as labor market outcomes. In particular, eligibility for Pathways reduces the likelihood of having a child as a young adult by 8.1 percentage points and increases the likelihood of being married by 1.2 percentage points, although only the former is statistically significant at conventional levels.

Although our estimates suggest that Pathways has been successful in raising the average earnings of those eligible for the program, an outstanding question is whether this earnings gain is distributed uniformly across the income distribution or whether the gains are concentrated among those with particularly high or low incomes. The estimates reported in Table 6 address this question by estimating quantile regressions for the impact of Pathways at different percentiles of the 2013 unconditional earnings distribution. Specifically, columns 1, 2 and 3 of Table 6 report the impact

of Pathways at the 25th, 50th (median), and 75th percentiles of the earnings distribution in our sample.<sup>15</sup>

The estimate in column 1 suggests that eligibility for Pathways has no impact at the 25th percentile of the (unconditional) earnings distribution. This is because the bottom 30 to 35 percent of individuals in our sample have no employment earnings (recall the estimates in column 2 of Table 2). At the 50th percentile (column 2), eligibility for Pathways has a large and statistically significant effect on earnings. In particular, while the regression-adjusted median earnings is \$43,495, eligibility for Pathways increases earnings by \$6,132 or 14 percent per-year to \$49,627. The estimate for the impact of Pathways at the 75th percentile suggests that Pathways still increases earnings, but by relatively less, for those higher up in the earnings distribution. Specifically, eligibility for Pathways increases earnings at the 75th percentile by \$3,884 or 3.8 percent. The estimates in Table 6 corroborate the evidence from Table 2 that Pathways increases earnings for those at the middle of the unconditional earnings distribution the most, primarily by increasing the fraction of young adults that are working.

## **6. Discussion**

In this paper, we evaluate the impact of the Pathways to Education program on the long-term outcomes of disadvantaged youth. Using unique administrative data from Statistics Canada, the Toronto District School Board (TDSB) and Toronto Community Housing (TCH) we estimate the effect of Pathways on earnings, employment, persistence in postsecondary institutions, as well as a variety of other labor market and social outcomes. Our findings extend our previous work in

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<sup>15</sup> For confidentiality reasons, we are unable to report estimates of the impact of Pathways at the extreme upper and lower tails of the earnings distribution.

Oreopoulos, Brown and Lavecchia (2017) and show that, at least for the Regent Park site, the positive impacts from Pathways extend significantly beyond adolescence and into early adulthood. Specifically, we find that eligibility for Pathways increases annual earnings at age 26 by approximately \$1,200 or 9 percent. Eligibility for Pathways is also found to have a large positive impact on the fraction of disadvantaged youth that are employed as adults and postsecondary education attainment. The program also decreases the likelihood of receiving social assistance and UI.

Our estimates suggest that all of the unconditional earnings gain from Pathways is due to higher employment rates, rather than an increase in earnings conditional on working. However, students eligible for Pathways differ in years of experience because the program increases high school graduation rates and increases the number of years students attend college and university. Given that the earnings-experience profile is very steep for young workers (Mincer, 1974; Boudarbat, Lemieux and Riddell, 2010), our estimates may understate both the unconditional and conditional earnings impact of Pathways later into adulthood.

Our paper contributes to a growing set of papers which study the impacts of comprehensive school supports to help disadvantaged youth (Scrivener et al., 2015; Heller et al., 2017; Clotfelter, Hemelt and Ladd, 2018). The results summarized above suggest that the Pathways program leads to significant improvements in adult outcomes nearly a decade after participants stop receiving services. Moreover, the results suggest that delivering a comprehensive program, similar to ASAP but at the high school level, can lead to significant improvements in adult outcomes. An important question for future research, therefore, is whether programs at the high school and college levels are substitutes or are work best when delivered together.

Although Pathways appears to have led to significant benefits for youth at the Regent Park site, the comprehensive nature of the program means that its delivery entails significant costs. The direct (operating) cost per student-year is \$3,500 in 2010 dollars and head-office administrative costs are \$1,200 per student-year.<sup>16</sup> The present value direct operating costs over a participant's high school tenure is \$13,400, plus indirect administrative costs and costs to provincial governments due to staying in high school longer and attending college or university.<sup>17</sup>

Estimating the long-term benefits of the program requires making assumptions about how the earnings gain from Pathways evolves beyond early adulthood. Our calculations assume that the earnings gain from Pathways at age 26 (\$1,208) persists until retirement at age 65 and that future earnings are discounted at an annual rate of 3 percent (Krueger, 1999; Chetty et al., 2011). We also deflate the costs of Pathways by 0.83 because the direct operating and administrative costs are per Pathways participant, while our estimate for the earnings gain is an average across all individuals eligible for the program. This implies that the expected direct costs of the program per eligible student is  $0.83 * \$13,400 = \$11,122$ . The expected direct plus administrative cost per eligible student is \$14,935.

Using estimates of the impact of the program on postsecondary education attainment, employment earnings and social assistance payments we calculate the estimated financial benefits from Pathways. We estimate that the discounted lifetime earnings gains from Pathways is \$20,550 per student, on average. If only the direct costs of the program are considered, the long-run benefit-

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<sup>16</sup> Direct operating costs comprise 20 percent for public transportation tickets, 15 percent for the postsecondary bursary and 65 percent towards SPSWs, tutoring and group activity operations.

<sup>17</sup> Whereas the average cost per college or university student can be calculated by dividing college or university operating costs by the number of students, only the marginal cost per student is required for the benefit-cost analysis. Our calculations below abstract from marginal costs given that they are expected to be much smaller than average costs.

to-cost ratio from Pathways eligibility at the Regent Park site is 1.85 ( $\$20,550/\$11,122 = 1.85$ ). If the indirect administrative (head office) costs are taken into account, the benefit-to-cost ratio is 1.38 ( $\$20,500/\$14,935 = 1.38$ ). This benefit/cost calculation assumes that the sole financial benefit arises from increased lifetime earnings for individuals. Including other possible pecuniary and nonpecuniary benefits, such as reduced crime and improvements to health would lead to even larger returns to the program (Oreopoulos and Salvanes, 2011; Lochner, 2011; Heckman, Humphries and Veramendi, 2018).

Instead of focusing on the private benefits, one can also estimate the benefit-to-cost ratio of Pathways using the expected fiscal benefits of the program. These benefits include higher labor income tax revenues and reduced spending on social assistance. Assuming a 20 percent average tax rate, our estimates imply that the discounted lifetime fiscal benefit from Pathways is \$17,773. Expected tax revenue gains exceed the direct and indirect administrative costs, leading to a benefit-to-cost ratio of 1.19 ( $\$17,773/\$14,935$ ). This suggests that public investments in the Pathways program are likely fiscally neutral.

While our estimates indicate that eligibility for Pathways leads to large increases in adult earnings, employment and postsecondary education attainment at the Regent Park site, our results do come with some caveats. The first is that with data that only goes up to 2013, we are only able to observe long term outcomes to age 26 (for the oldest Pathways-eligible cohort). Since earnings and other outcomes for young adults are notoriously volatile, some of our estimates are imprecise. The second caveat is that we are only able to estimate the effect of Pathways on long-term outcomes for the Regent Park site. In 2007, Pathways was introduced at two other Toronto sites, Rexdale and Lawrence Heights (LH), and later expanded to several other locations in Ontario and the rest of Canada. In our previous paper, we found that estimates of the impact of Pathways on

high school graduation rates and postsecondary enrollment were slightly lower at Rexdale and LH than at the Regent Park site. Estimating the long run education and earnings gains of Pathways at its expansion sites will help to better understand whether the program can be ‘scaled-up’ to alternative locations.

The methodology employed here is not able to determine whether the impacts of Pathways are due to one feature of the program or whether the integration of the various features drives the results. This is important not only for understanding how Pathways works, but for containing costs. Experimenting with variations of the program at some of Pathways’ expansion sites or further qualitative research through surveys and ethnographic work may help shed light on this question. Future research that exploits additional administrative data linkages, especially linkages to crime and health data, is also important to determine the extent to which Pathways improves non-pecuniary outcomes.

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Figure 1A

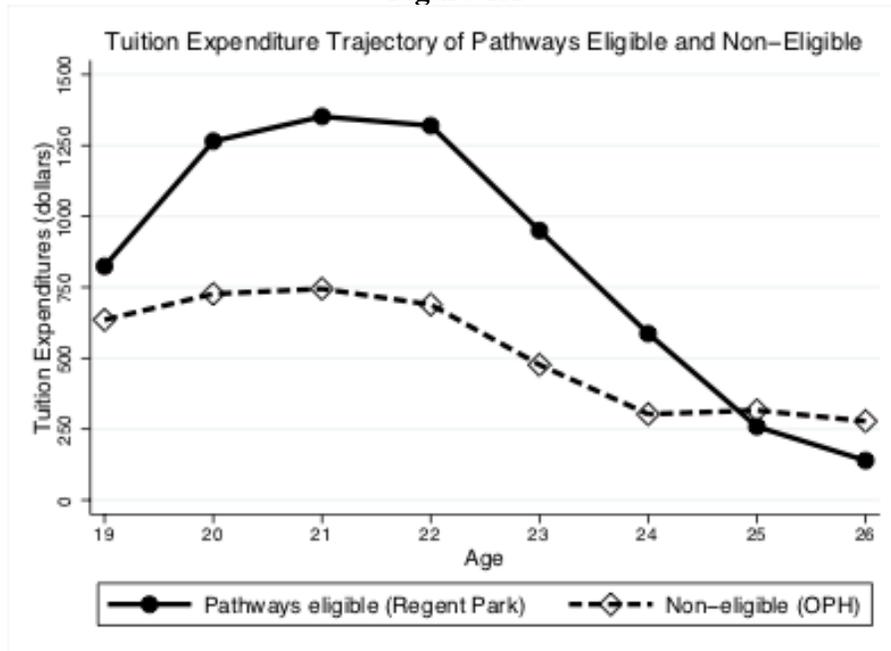
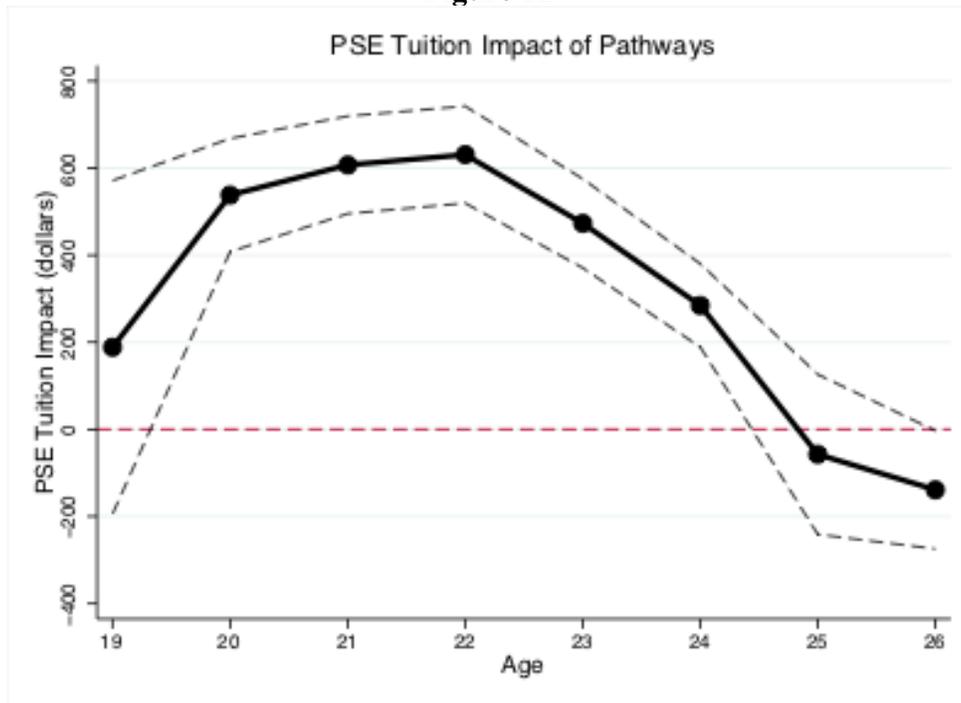


Figure 1B



Notes: Figure 1A plots the average tuition expenditures of youth that went to high school in Regent Park and other Toronto public housing (OPH) against age. The solid line represents the mean expenditure of Regent Park students while the dashed line represents the mean expenditure of OPH students. Figure 1B plots the tuition expenditure gains for those eligible for Pathways and the associated 95% confidence intervals (dashed lines).

Figure 2A

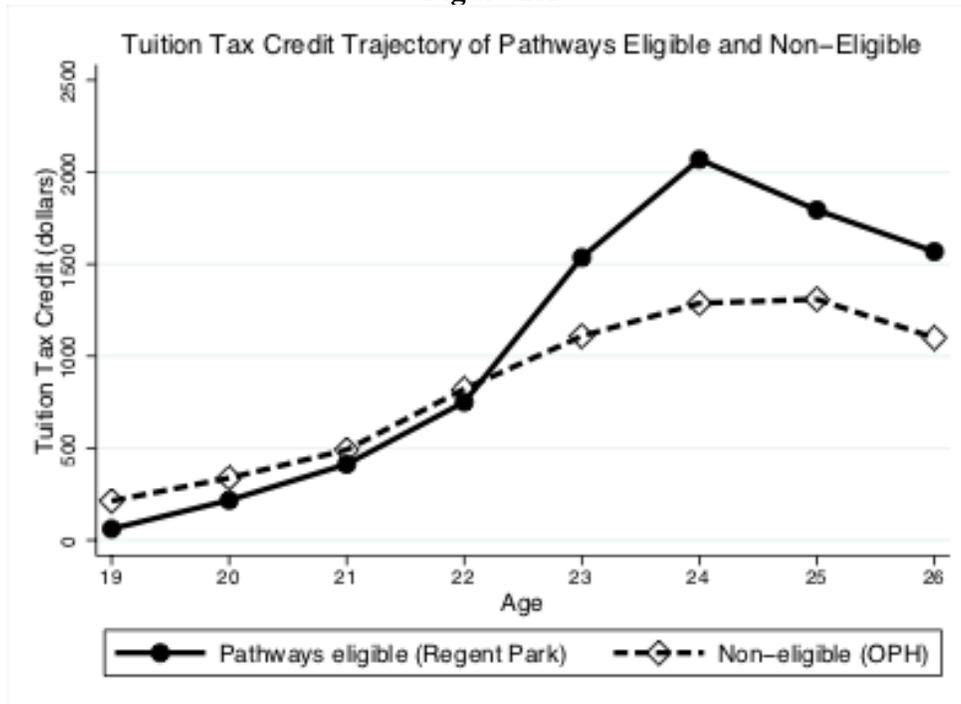
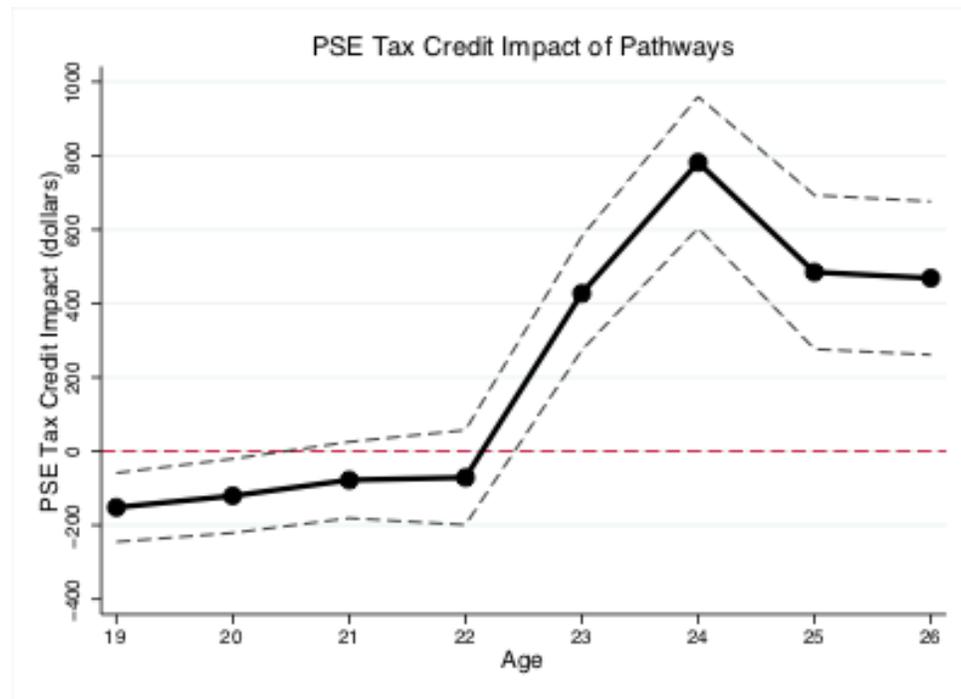


Figure 2B



Notes: Figure 2A plots the average tuition tax credit received for youth that went to high school in Regent Park and other Toronto public housing (OPH) against age. The solid line represents the mean tax credit for Regent Park students while the dashed line represents the mean tax credit for OPH students. Figure 2B plots the tuition tax credit gains for those eligible for Pathways and the associated 95% confidence intervals (dashed lines).

Figure 3A

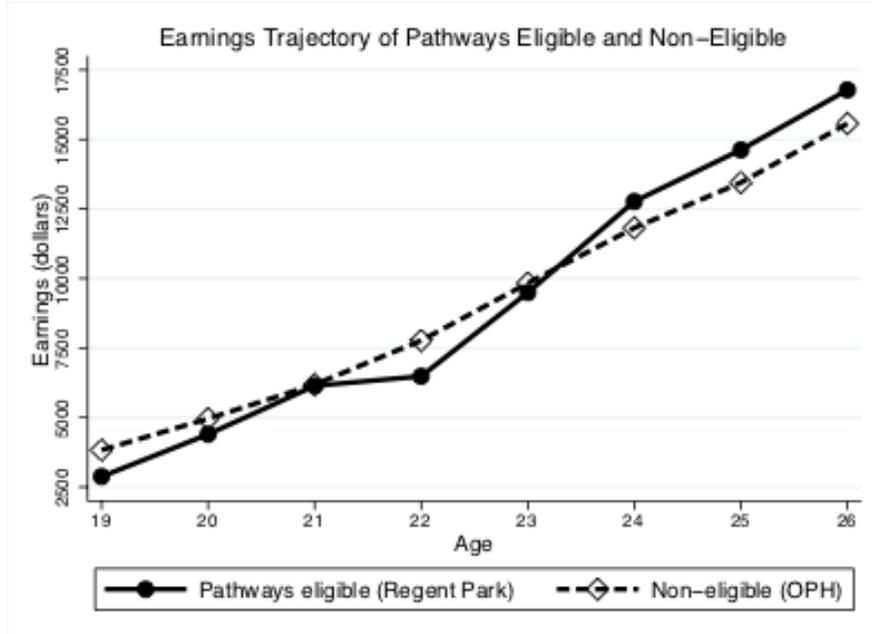
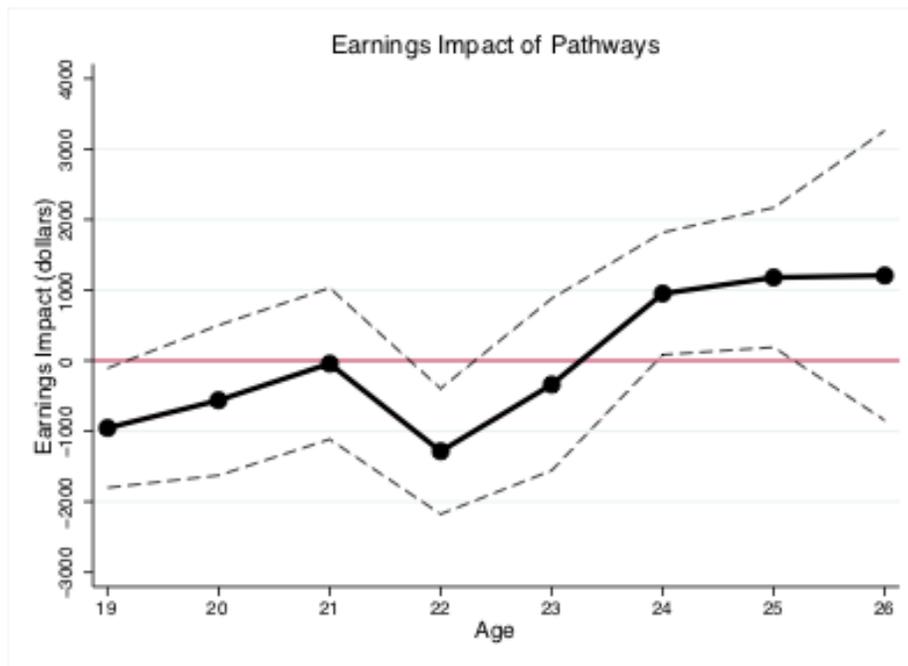


Figure 3B



Notes: Figure 3A plots the average earnings of youth that went to high school in Regent Park and other Toronto public housing (OPH) against age. The solid line represents the mean earnings of Regent Park students while the dashed line represents the mean earnings of OPH students. Figure 3B plots the earnings gain for those eligible for Pathways and the associated 95% confidence intervals (dashed lines).

Figure 4A

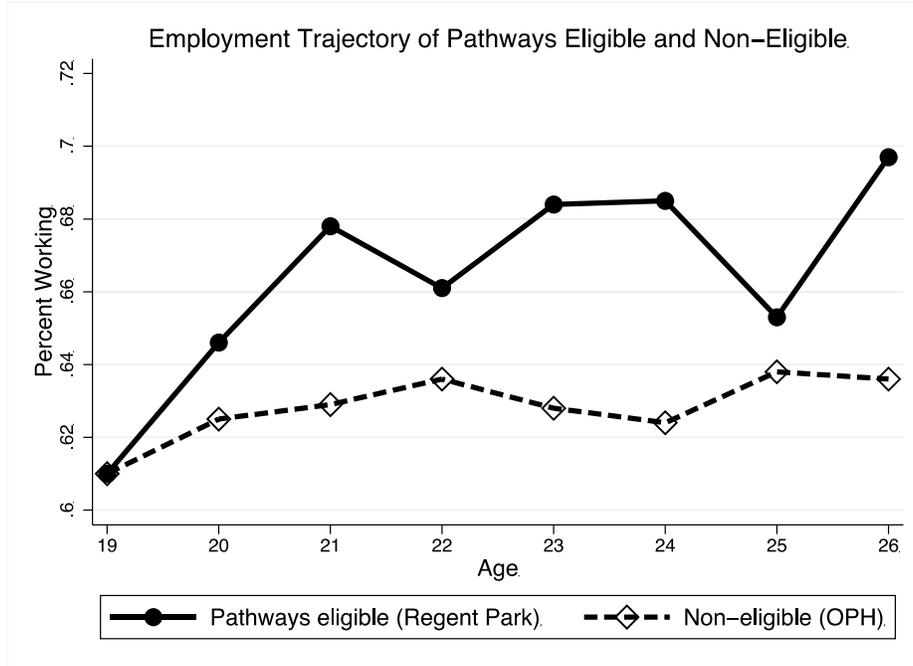
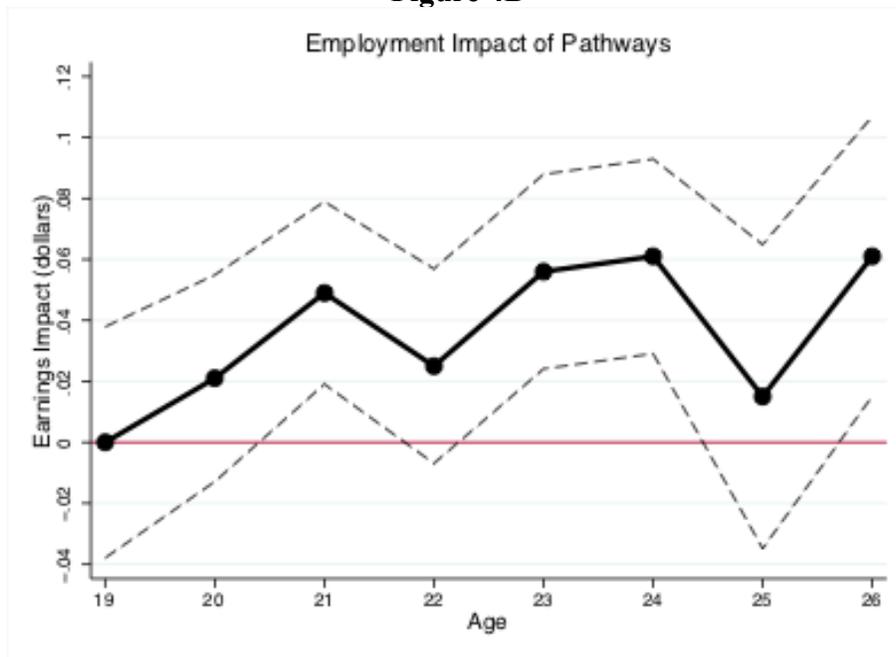


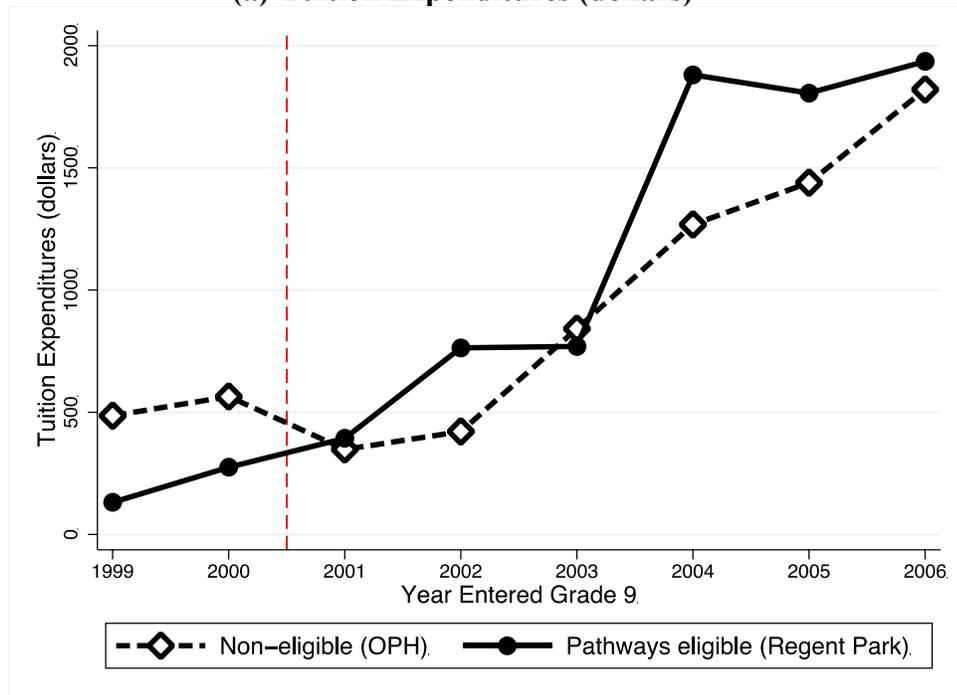
Figure 4B



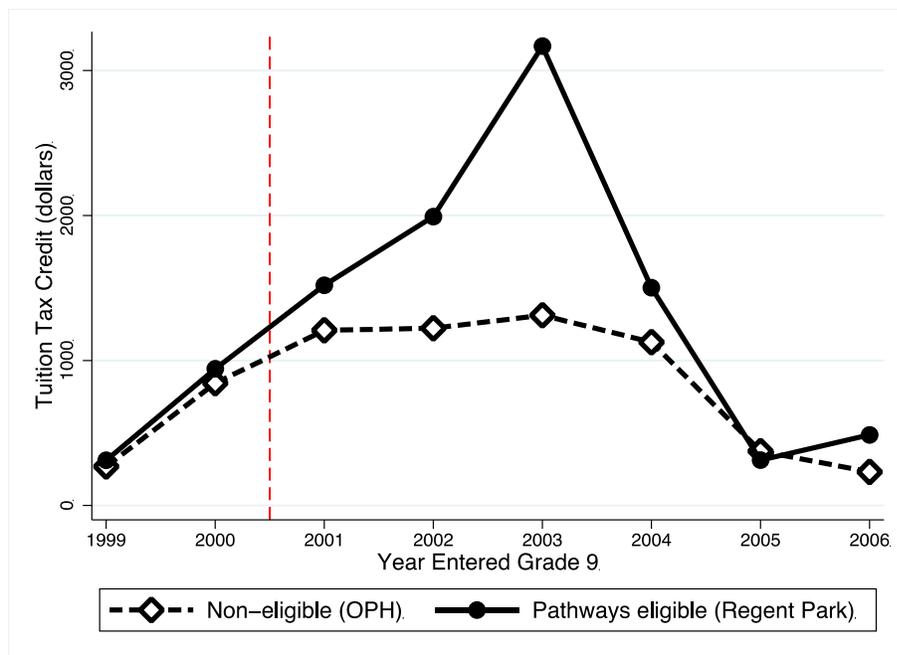
Notes: Figure 4A plots the fraction employed youth that went to high school in Regent Park and other Toronto public housing (OPH) against age. The solid line represents the fraction employed for Regent Park students while the dashed line represents the fraction employed OPH students. Figure 4B plots the employment gain for those eligible for Pathways and the associated 95% confidence intervals (dashed lines).

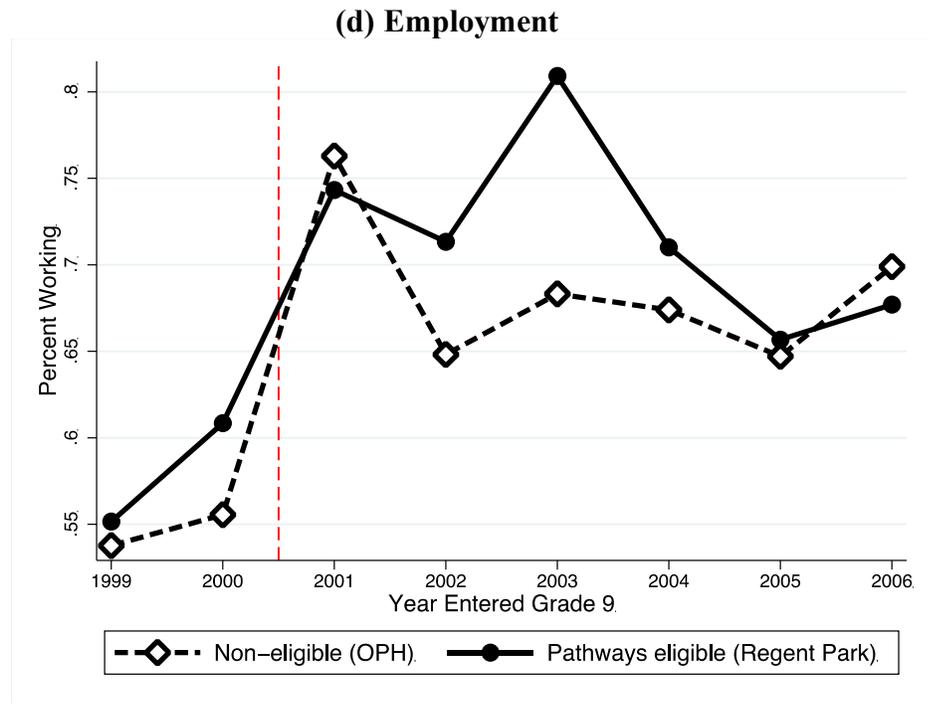
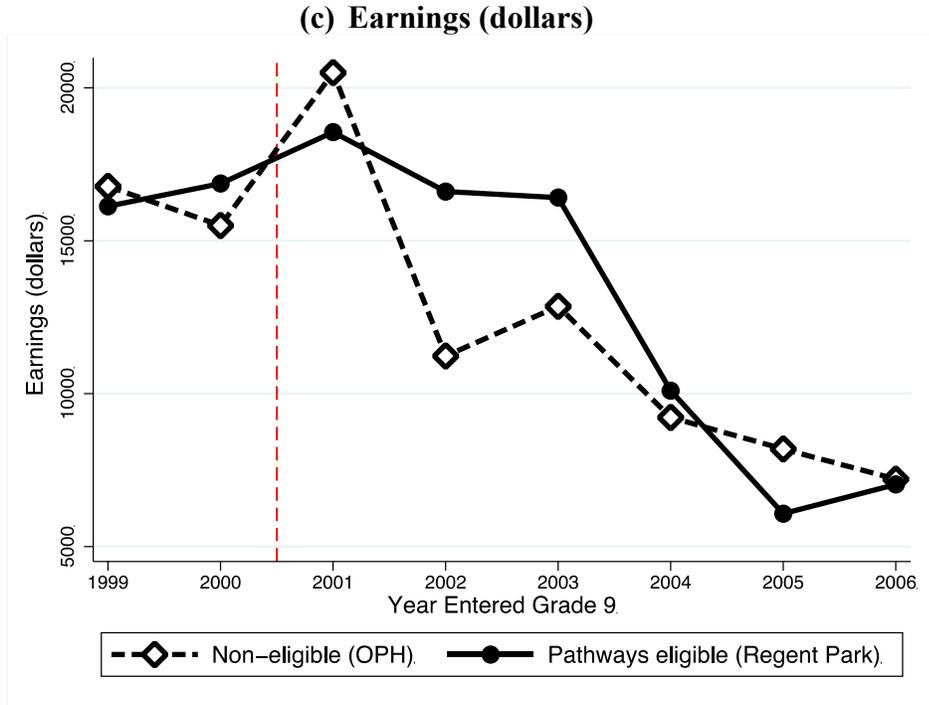
**Figure 5**  
**Effect of Pathways on Long-Term Outcomes: Legacy Toronto Projects Comparison Group**

**(a) Tuition Expenditures (dollars)**



**(b) Tuition Tax Credit (dollars)**





Notes: Figures 5A-5D plot the average 2012-2013 tax year outcomes among 1999-2006 grade 9 students from Regent Park and other public housing projects (OPH) in pre-amalgamation Toronto. Regent Park refers to students who enrolled in grade 9 in the RSDC and who live in the Regent Park housing project. OPH refers to students who enrolled in grade 9 in the TDSB and who live in the seven other public housing projects in pre-amalgamation Toronto. Figure 5A shows 2012-2013 tax year postsecondary tuition expenditures by cohort (year entered grade 9). Figures 5B-5D show the same relationship for the tuition tax credit receipt, earnings and employment, respectively.

**Table 1**  
**Summary Statistics**

	(1)	(2)	(3)
	Regent Park	Rexdale/LH	Other Public Housing
Earnings	11,050 [15,735]	9,556 [16,241]	10,154 [16,065]
Working	0.676 [0.468]	0.625 [0.484]	0.649 [0.477]
Tuition Tax Credits	1,116 [4,020]	574 [2,893]	790 [3,271]
Tuition Deduction	1,359 [2,830]	873 [2,099]	987 [2,437]
Female	0.503 [0.500]	0.455 [0.498]	0.483 [0.500]
Immigrant	0.525 [0.500]	0.34 [0.474]	0.318 [0.466]
Observations	1,297	905	5,680

Notes: The sample is individuals (students) who entered a TDSB high school between 2000 and 2008 and lived in a public housing project. The time-varying variables (earnings, working, tuition tax credits and tuition deduction) are for the 2013 calendar year. The table reports means and standard deviations [brackets].

**Table 2**  
**Intent to Treat (ITT) Estimated Effects of Pathways on Adult Outcomes by Age**

	(1) Tuition Expenditures	(2) Tuition Tax Credit	(3) Earnings	(4) Working
pathways*1[age = 19]	189 [192]	-152 [47]***	-955 [425]**	0.000 [0.019]
pathways*1[age = 20]	538 [65]***	-121 [50]**	-563 [534]	0.021 [0.017]
pathways*1[age = 21]	607 [56]***	-78 [52]	-43 [538]	0.049 [0.015]***
pathways*1[age = 22]	631 [56]***	-71 [64]	-1,287 [446]***	0.025 [0.016]
pathways*1[age = 23]	473 [51]***	428 [77]***	-340 [611]	0.056 [0.016]***
pathways*1[age = 24]	284 [48]***	782 [89]***	950 [435]**	0.061 [0.016]***
pathways*1[age = 25]	-58 [92]	485 [104]***	1,179 [496]**	0.015 [0.025]
pathways*1[age = 26]	-139 [68]**	468 [104]***	1,207 [1,029]	0.061 [0.023]***
1[age = 20]	92 [149]	125 [20]***	1,129 [255]***	0.015 [0.013]
1[age = 21]	109 [173]	278 [20]***	2,355 [2301]***	0.019 [0.014]
1[age = 22]	54 [175]	608 [46]***	3,940 [230]***	0.026 [0.015]*
1[age = 23]	-158 [186]	896 [66]***	6,005 [356]***	0.018 [0.013]
1[age = 24]	-332 [200]	1,075 [87]***	7,990 [333]***	0.014 [0.013]
1[age = 25]	-319 [201]	1,096 [104]***	9,620 [405]***	0.028 [0.021]
1[age = 26]	-357 [163]**	887 [106]***	11,746 [622]***	0.026 [0.016]*
1[age = 27]	-374 [169]**	856 [142]***	11,945 [557]***	0.037 [0.015]**
Constant	6,830 [711]***	4,734 [646]***	16,713 [7,695]**	1.529 [0.332]***

Observations	35,772	35,772	35,772	35,772
R-squared	0.081	0.042	0.078	0.027

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Notes: The sample is individuals (students) who entered a TDSB high school between 2000 and 2008, lived in a public housing project and are at least 19 years old between 2005 and 2013. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with  $70-1 = 69$  degrees of freedom. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 3**  
**Intent to Treat (ITT) Estimated Effects of Pathways on Adult Outcomes by Age for the**  
**2000-2003 cohorts**

	(1) Tuition Expenditures	(2) Tuition Tax Credit	(3) Earnings	(4) Working
pathways*1[age = 19]	97 [302]	-170 [48]***	-1,325 [421]***	-0.028 [0.022]
pathways*1[age = 20]	497 [77]***	-124 [52]**	-695 [564]	0.037 [0.017]**
pathways*1[age = 21]	492 [57]***	-67 [52]	487 [585]	0.066 [0.017]***
pathways*1[age = 22]	505 [60]***	-43 [70]	-850 [449]*	0.045 [0.016]***
pathways*1[age = 23]	367 [56]***	495 [81]***	232 [469]	0.075 [0.014]***
pathways*1[age = 24]	273 [48]***	789 [89]***	1,019 [428]**	0.061 [0.017]***
pathways*1[age = 25]	-69 [93]	481 [101]***	1,217 [505]**	0.015 [0.026]
pathways*1[age = 26]	-153 [69]**	463 [102]***	1,200 [1,034]	0.060 [0.023]**
1[age = 20]	-17 [245]	126 [29]***	1,150 [382]***	0.001 [0.015]
1[age = 21]	-7 [275]	236 [29]***	2,239 [404]***	-0.008 [0.021]
1[age = 22]	-43 [269]	596 [55]***	3,861 [328]***	-0.000 [0.018]
1[age = 23]	-228 [277]	851 [71]***	5,530 [375]***	-0.012 [0.016]
1[age = 24]	-421 [277]	1057 [89]***	7,887 [341]***	-0.004 [0.016]
1[age = 25]	-408	1088	9,541	0.010

	[275]	[104]***	[429]***	[0.024]
1[age = 26]	-442	871	11,641	0.008
	[240]*	[104]***	[662]***	[0.018]
1[age = 27]	-456	838	11,828	0.018
	[238]*	[144]***	[627]***	[0.016]
Constant	6,453	5,910	22,311	1.543
	[870]***	[823]***	[8,837]**	[0.355]***
Observations	25,464	25,464	25,464	25,464
R-squared	0.08	0.042	0.074	0.033

Notes: The sample is individuals (students) who entered a TDSB high school between 2000 and 2003, lived in a public housing project and are at least 19 years old between 2005 and 2013. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with  $70-1 = 69$  degrees of freedom. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Table 4A**  
**ITT Estimated Tuition Deduction Expenditure Effects for Pathways to Education Using**  
**Alternative Comparison Groups**

	(1)	(2)	(3)	(4)
	Baseline	Large Density Projects	Priority Neighbourhoods	Legacy Toronto Projects
pathways*1[age = 19]	189 [192]	-60 [386]	445 [71]***	396 [161]**
pathways*1[age = 20]	538 [65]***	475 [110]***	642 [97]***	193 [269]
pathways*1[age = 21]	607 [56]***	581 [84]***	686 [95]***	556 [186]**
pathways*1[age = 22]	631 [56]***	542 [89]***	709 [88]***	479 [189]**
pathways*1[age = 23]	473 [51]***	373 [60]***	451 [78]***	364 [118]**
pathways*1[age = 24]	284 [48]***	290 [75]***	370 [57]***	267 [118]*
pathways*1[age = 25]	-58 [92]	-128 [156]	-54 [146]	128 [99]
pathways*1[age = 26]	-139 [68]**	-225 [79]**	-162 [80]*	79 [114]
1[age = 20]	92 [149]	-94 [301]	244 [48]***	644 [249]**
1[age = 21]	109 [173]	-11 [352]	289 [53]***	370 [40]***
1[age = 22]	54 [175]	-116 [357]	240 [42]***	431 [88]***
1[age = 23]	-158 [186]	-346 [377]	108 [35]**	166 [76]*
1[age = 24]	-332 [200]	-622 [381]	-150 [35]***	-24 [110]

1[age = 25]	-319 [201]	-532 [401]	-18 [120]	-157 [115]
1[age = 26]	-357 [163]**	-479 [327]	-77 [74]	-315 [38]***
1[age = 27]	-374 [169]**	-547 [327]	-187 [169]	-394 [71]***
1[age = 28]				-456 [227]*
Constant	6,830 [711]***	6,992 [1,225]***	7,619 [822]***	8,281 [1,013]***
Observations	35,772	18,310	15,195	12,899
R-squared	0.081	0.087	0.073	0.085

Notes: The baseline sample is the same as in Table 2. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. For column 2, the large density projects include: Alexandra Park, Bleecker Street, East Mall, Edgeley Village, Jane Finch, Firgrove Crescent, Flemingdon Park, Lawrence Heights, Malbern, Moss Park, Pelham Park, Regent Park, Rexdale (Thistletown) and Warden Woods. For column 3, the priority neighbourhoods are comprised of the following 11 housing projects: Duncanwoods Drive, Edgeley Village, Firgrove Crescent, Flemingdon Park, Lawrence Heights, McCowan Road, Pelham Park, Rexdale (Thistletown), Scarlettwoods, Yorkwoods Village, and ‘Other’ projects (several small projects grouped together to create a publicly available dataset). For column 4, the legacy Metro Toronto projects include: Alexandra Park, Blake Street, Bleecker Street, Don Mount Court, Edgewood Avenue, Greenwood Park, Pelham Park and Regent Park. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with G-1 degrees of freedom (G denotes number of housing projects). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 4B**  
**ITT Estimated Tuition Tax Credit Effects for Pathways Using Alternative Comparison Groups**

	(1)	(2)	(3)	(4)
	Baseline	Large Density Projects	Priority Neighbourhoods	Legacy Toronto Projects
pathways*1[age = 19]	-152 [47]***	-199 [60]***	-209 [77]**	-140 [121]
pathways*1[age = 20]	-121 [50]**	-136 [79]	-171 [94]*	-517 [277]
pathways*1[age = 21]	-78 [52]	-142 [83]	-182 [99]*	-46 [132]
pathways*1[age = 22]	-71 [64]	-122 [96]	-12 [69]	2 [168]
pathways*1[age = 23]	428 [77]***	409 [119]***	516 [110]***	580 [252]*
pathways*1[age = 24]	782 [89]***	662 [126]***	868 [90]***	759 [140]***
pathways*1[age = 25]	485 [104]***	262 [136]*	479 [147]***	312 [191]
pathways*1[age = 26]	468 [104]***	427 [172]**	429 [190]**	285 [292]
1[age = 20]	125 [20]***	92 [26]***	117 [32]***	533 [345]
1[age = 21]	278 [20]***	295 [29]***	325 [41]***	256 [34]***
1[age = 22]	608 [46]***	620 [76]***	514 [45]***	552 [108]***
1[age = 23]	896 [66]***	873 [85]***	766 [63]***	728 [153]***
1[age = 24]	1,075 [87]***	1,155 [132]***	936 [99]***	1,109 [70]***

1[age = 25]	1,096 [104]***	1,277 [168]***	1,066 [171]***	1,306 [110]***
1[age = 26]	887 [106]***	931 [161]***	915 [176]***	1,031 [263]***
1[age = 27]	856 [142]***	562 [150]***	545 [159]***	599 [103]***
1[age = 28]				127 [98]
Constant	4,734 [646]***	5,642 [608]***	6,068 [959]***	4,828 [463]***
Observations	35,772	18,310	15,195	12,899
R-squared	0.042	0.045	0.044	0.049

Notes: The baseline sample is the same as in Table 2. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. For column 2, the large density projects include: Alexandra Park, Bleecker Street, East Mall, Edgeley Village, Jane Finch, Firgrove Crescent, Flemingdon Park, Lawrence Heights, Malbern, Moss Park, Pelham Park, Regent Park, Rexdale (Thistletown) and Warden Woods. For column 3, the priority neighbourhoods are comprised of the following 11 housing projects: Duncanwoods Drive, Edgeley Village, Firgrove Crescent, Flemingdon Park, Lawrence Heights, McCowan Road, Pelham Park, Rexdale (Thistletown), Scarlettwoods, Yorkwoods Village, and ‘Other’ projects (several small projects grouped together to create a publicly available dataset). For column 4, the legacy Metro Toronto projects include: Alexandra Park, Blake Street, Bleecker Street, Don Mount Court, Edgewood Avenue, Greenwood Park, Pelham Park and Regent Park. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with G-1 degrees of freedom (G denotes number of housing projects). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 4C**  
**ITT Estimated Earnings Effects for Pathways Using Alternative Comparison Groups**

	(1) Baseline	(2) Large Density Projects	(3) Priority Neighbourhoods	(4) Legacy Toronto Projects
pathways*1[age = 19]	-955 [425]**	-1,863 [711]**	-2,044 [622]***	-1,347 [1,520]
pathways*1[age = 20]	-563 [534]	-1,231 [1,148]	-1,495 [665]**	-2,618 [2,123]
pathways*1[age = 21]	-43 [538]	-801 [1,157]	-1,371 [769]*	-1,447 [1,963]
pathways*1[age = 22]	-1,287 [446]***	-1,810 [819]**	-2,321 [677]***	-2,209 [1,934]
pathways*1[age = 23]	-339 [611]	-1,227 [1,287]	-1,654 [1,273]	-444 [2,216]
pathways*1[age = 24]	950 [435]**	85 [448]	761 [464]	985 [2,007]
pathways*1[age = 25]	1,179 [496]**	397 [710]	464 [829]	1,472 [1,632]
pathways*1[age = 26]	1,207 [1,029]	-918 [2,098]	-956 [1,089]	623 [2,641]
1[age = 20]	1,129 [255]***	893 [548]	969 [163]***	2,797 [815]**
1[age = 21]	2,355 [231]***	2,179 [508]***	2,587 [322]***	3,283 [480]***
1[age = 22]	3,940 [230]***	3,578 [409]***	4,015 [461]***	4,542 [450]***
1[age = 23]	6,005 [356]***	5,890 [759]***	6,338 [880]***	5,662 [618]***
1[age = 24]	7,990 [333]***	8,043 [662]***	7,312 [456]***	7,553 [460]***
1[age = 25]	9,620 [405]***	9,374 [672]***	9,409 [717]***	8,845 [789]***
1[age = 26]	11,746 [622]***	12,454 [1,110]***	12,791 [894]***	10,761 [394]***
1[age = 27]	11,945 [557]***	11,729 [859]***	11,780 [974]***	12,562 [401]***
1[age = 28]				14,109 [693]***

Constant	16,713 [7,695]**	32,808 [10,061]***	27,899 [10,867]**	29,787 [11,232]**
Observations	35,772	18,310	15,195	12,899
R-squared	0.078	0.068	0.108	0.067

Notes: The baseline sample is the same as in Table 2. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. For column 2, the large density projects include: Alexandra Park, Bleecker Street, East Mall, Edgeley Village, Jane Finch, Firgrove Crescent, Flemingdon Park, Lawrence Heights, Malbern, Moss Park, Pelham Park, Regent Park, Rexdale (Thistletown) and Warden Woods. For column 3, the priority neighbourhoods are comprised of the following 11 housing projects: Duncanwoods Drive, Edgeley Village, Firgrove Crescent, Flemingdon Park, Lawrence Heights, McCowan Road, Pelham Park, Rexdale (Thistletown), Scarlettwoods, Yorkwoods Village, and 'Other' projects (several small projects grouped together to create a publicly available dataset). For column 4, the legacy Metro Toronto projects include: Alexandra Park, Blake Street, Bleecker Street, Don Mount Court, Edgewood Avenue, Greenwood Park, Pelham Park and Regent Park. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with G-1 degrees of freedom (G denotes number of housing projects). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 4D**  
**ITT Estimated Employment (Extensive Margin) Effects for Pathways Using Alternative Comparison Groups**

	(1) Baseline	(2) Large Density Projects	(3) Priority Neighbourhoods	(4) Legacy Toronto Projects
pathways*1[age = 19]	0.000 [0.019]	-0.052 [0.022]**	-0.029 [0.022]	0.037 [0.041]
pathways*1[age = 20]	0.021 [0.017]	-0.006 [0.026]	0.018 [0.028]	-0.016 [0.034]
pathways*1[age = 21]	0.049 [0.015]***	0.028 [0.021]	0.020 [0.024]	0.038 [0.038]
pathways*1[age = 22]	0.025 [0.016]	0.002 [0.025]	0.012 [0.027]	0.009 [0.053]
pathways*1[age = 23]	0.056 [0.016]***	0.022 [0.024]	0.024 [0.028]	0.054 [0.049]
pathways*1[age = 24]	0.061 [0.016]***	0.019 [0.014]	0.019 [0.016]	0.057 [0.039]
pathways*1[age = 25]	0.015 [0.025]	-0.025 [0.024]	-0.032 [0.026]	0.039 [0.037]
pathways*1[age = 26]	0.061 [0.023]***	-0.004 [0.026]	0.006 [0.027]	0.027 [0.045]
1[age = 20]	0.015 [0.013]	-0.011 [0.020]	-0.011 [0.023]	0.089 [0.016]***
1[age = 21]	0.019 [0.014]	-0.013 [0.023]	0.019 [0.014]	0.064 [0.016]***
1[age = 22]	0.026 [0.015]*	0.000 [0.024]	0.012 [0.020]	0.086 [0.017]***
1[age = 23]	0.018 [0.013]	-0.003 [0.020]	0.016 [0.017]	0.059 [0.021]**
1[age = 24]	0.014 [0.013]	0.002 [0.020]	0.022 [0.016]	0.054 [0.012]***
1[age = 25]	0.028 [0.021]	0.012 [0.028]	0.036 [0.025]	0.038 [0.016]**
1[age = 26]	0.026 [0.016]*	0.022 [0.027]	0.030 [0.026]	0.057 [0.024]**
1[age = 27]	0.037 [0.015]**	0.017 [0.022]	0.035 [0.024]	0.039 [0.012]**
1[age = 28]				0.062

				[0.019]**
Constant	1.529 [0.332]***	1.862 [0.490]***	2.044 [0.487]***	1.576 [0.365]***
Observations	35,772	18,310	15,195	12,899
R-squared	0.027	0.029	0.028	0.054

Notes: The baseline sample is the same as in Table 2. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. For column 2, the large density projects include: Alexandra Park, Bleecker Street, East Mall, Edgeley Village, Jane Finch, Firgrove Crescent, Flemingdon Park, Lawrence Heights, Malbern, Moss Park, Pelham Park, Regent Park, Rexdale (Thistletown) and Warden Woods. For column 3, the priority neighbourhoods are comprised of the following 11 housing projects: Duncanwoods Drive, Edgeley Village, Firgrove Crescent, Flemingdon Park, Lawrence Heights, McCowan Road, Pelham Park, Rexdale (Thistletown), Scarlettwoods, Yorkwoods Village, and ‘Other’ projects (several small projects grouped together to create a publicly available dataset). For column 4, the legacy Metro Toronto projects include: Alexandra Park, Blake Street, Bleecker Street, Don Mount Court, Edgewood Avenue, Greenwood Park, Pelham Park and Regent Park. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with G-1 degrees of freedom (G denotes number of housing projects). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 5**  
**Intent to Treat (ITT) Estimated Effects of Pathways on Additional 2013 Outcomes**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	No. Years PSE Tuition	Ever on Social Assistance	Ever on UI	Social Assistance Payments	UI Benefit Payments	Married or Common Law	Has Child
pathways	0.465 [0.160]***	-0.051 [0.018]***	-0.058 [0.015]***	-525 [128]***	-183 [55]***	0.012 [0.012]	-0.081 [0.015]***
Constant	12.19 [1.825]***	-0.489 [0.320]	-0.500 [0.419]	-3,846 [2,393]	-382 [2,006]	-0.243 [0.195]	-0.825 [0.408]**
Observations	8,065	8,605	8,605	8,605	8,605	8,605	8,605
R-squared	0.077	0.136	0.062	0.097	0.020	0.041	0.076

Notes: The sample is individuals who entered a TDSB high school between 2000 and 2003, living in a public housing project and are at least 19 years old in the 2013 tax year. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with 70-1 = 69 degrees of freedom. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 6**  
**Distribution Effects of Pathways on 2013 Adult Earnings**

	(1)	(2)	(3)
	p25	p50	p75
pathways	1 [172]	6,132 [2,824]**	3,884 [3,619]
Constant	0 [1,605]	43,495 [26,354]*	100,907 [33,776]***
Observations	3,369	3,369	3,369

Notes: The sample is individuals who entered a TDSB high school between 2000 and 2003, living in a public housing project and are at least 19 years old in the 2013 tax year. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with  $70-1 = 69$  degrees of freedom. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## **Online Appendix A (Data)**

This appendix provides additional details about the administrative datasets described in Section 3 and the construction of key variables. Appendix Table A1 summarizes the key variables used in our analysis.

### ***A1. Toronto District School Board Data***

The TDSB data contain information on the demographic characteristics and academic performance of students that entered Grade 9 in a TDSB school between September 2000 and September 2008. Importantly, the TDSB data contain information on students' first and last names, date of birth and address, including postal codes. This information allows us match the TDSB data to a list of public housing projects provided by Toronto Community Housing (TCH).

### ***A2. Toronto Community Housing (TCH)***

The Toronto Community Housing Corporation (TCH) is the public housing agency for the City of Toronto. The TCH is the second-largest public housing provider in North America (behind the New York City Housing Authority). As of 2017, TCH owns 2,100 buildings, including more than 350 high- and low-rise apartment buildings that house more than 110,000 residents in 60,000 low-income households.<sup>1</sup> TCH residents pay rent geared to income, with approximately 25 to 30 percent of a household's gross income being charged as rent. All

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<sup>1</sup> For more details about TCH, refer to <https://www.torontohousing.ca/About>.

households wishing to obtain a unit in a TCH property must fill out a standardized application form. Since the demand for units is greater than the supply available in any given year, the TCH must ration spots in its properties. Beginning in 1995, the TCH allocates units in chronological order, with special consideration given to newly arrived immigrants, the homeless and those facing domestic violence. Even those that qualify for special consideration, wait times were often substantial. For example, average wait times in 1998 were 5 to 7 years (Toronto Social Housing Connections, 1998).

Our data focuses on the 113 housing projects built before 1976. To create a publicly available dataset, some nearby and small projects are grouped together. This leaves us with 70 housing projects ranging in size across various neighborhoods in Toronto. The TCH data is matched with the TDSB data using the postal codes on school registration forms.

### ***A3. Administrative Data from Statistics Canada***

The long-term outcomes of used in this study are derived from six administrative datasets provided by Statistics Canada. These datasets are: the T1 Family File (T1FF), the T1, T2, T3 and Payroll Deduction (PD7) tax files, and the Longitudinal Immigration Database (IMDB). In this section, we briefly describe each of these datasets, how the data are matched to the TDSB-TCH data and the construction of key variables.

*T1 Family File (T1FF)*: The T1FF is an administrative file that combines information from three tax files provided by the Canada Revenue Agency (CRA). The three files that comprise the T1FF are: the individual T1 file, the T4 file and the Canada Child Tax Benefit

(CCTB) file.<sup>2</sup> The individual T1 file contains the information from all individual tax filers. Variables of interest include earnings, deductions, taxable income, as well as limited demographic characteristics and family identifiers. The T4 file supplements the information provided in individual tax returns with information submitted by third parties (employers and financial institutions). These third-party reports include information on earnings from employment, public and private pension contributions, payroll tax deductions and interest income. The CCTB file includes information on non-filing children, including year of year of birth. We use this information to construct an indicator variable for whether a tax filer has any children, as well as the filer's number of dependents in each year.

*T2, T3 and Payroll Deduction (PD7) files:* The T2 administrative file contains information from corporate income tax returns beginning with the 2000 tax year. In particular, variables in the T2 file include firm sales, gross profits, taxes, business equity and assets. The T3 Trust Income Tax and Information Return file contains information on the sales and income of communal farming organizations. The PD7 administrative file is derived from payroll deduction forms remitted by employers to the Canada Revenue Agency. For each year, the file contains information on total gross payrolls, the total number of employees, as well as summary statistics about the earnings of employees of the firm. For example, the PD7 file contains information on the mean and median wage paid to employees of the firm.

*Longitudinal Immigration Database (IMDB):* The IMDB file combines administrative immigration and tax files to provide data on the socio-economic outcomes of Canadian immigrants. The file contains information on labour market outcomes, country of origin,

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<sup>2</sup> <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=4105>

education, as well as knowledge of English or French.<sup>3</sup> We use the IMDB file to confirm the immigrant status of individuals in our sample.

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<sup>3</sup> <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5057>

## Online Appendix B (Additional Results)

This appendix summarizes the results from additional analyses. We explore whether eligibility for Pathways causes youth to enter into better jobs, conditional on working. Appendix Table A2 reports ITT estimates of the effect of eligibility for Pathways on two measures of job quality available in the administrative data. Both measures use information from firm administrative tax files that we link to personal income tax records. The first measure (column 1) is the median earnings of employees at one's primary employer. Intuitively, more productive firms pay higher wages (Card et al., 2018). The second measure (column 2) is the total payroll at the firm (in dollars). This captures the fact that firms that have a bigger payroll tend to be larger and more productive, on average.<sup>4</sup>

The estimates in column 1 suggest that Pathways leads to higher job quality, as measured by the median earnings at one's primary employer. For example, eligibility for Pathways increases the median earnings at one's employer by \$1,916 to \$2,938 between ages 19 and 22. This effect is somewhat smaller at older ages but the estimates become more imprecise. The estimates in column 2 are more mixed but suggest that on balance, eligibility for Pathways also leads individuals to work at larger firms (measured by total payroll).

The main results in the main carry out statistical inference using standard errors based on the clustered robust variance estimator (CVRE). Our tests for statistical significance compare the  $t$  statistic computed using the CVRE to the critical value of the  $t$  distribution with  $70-1 = 69$  degrees of freedom (since there are 70 TCH public housing projects in our data). Recent evidence from Monte Carlo simulations by MacKinnon and Webb (2017) suggests that the

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<sup>4</sup> Unfortunately, neither the individual nor the corporate tax return data have information on non-wage benefits or measures of job satisfaction.

CVRE can be biased downwards in applications where the number of treated clusters is small, as in our application. Consequently, tests of statistical significance will tend to over-reject true null hypothesis. MacKinnon and Webb (2017) show that the main alternative to the CVRE, the wild cluster bootstrap, also performs poorly when the number of treated clusters is very small. They show that the wild cluster bootstrap has the opposite problem – tests of a true null hypothesis are never rejected.

To the best of our knowledge, there is no consensus about the best alternative to the CVRE for applications with very few treated clusters such as ours. Given that hypothesis tests based on the CVRE and  $t$  distribution with  $P - 1$  ( $70 - 1 = 69$ ) degrees of freedom tend to over-reject the null, one way to test the robustness of our main results is to reduce the degrees of freedom. Table A3 presents results using the degrees of freedom correction proposed by Young (2016). Column 1 reports the coefficient estimate for  $\beta^a$  based on the estimation of equation (1) in the main text. Column 2 reports the standard error for the estimate of  $\beta^a$  that uses the bias correction proposed by Young (2016). Column 3 reports Young's effective degrees of freedom and column 4 the associated p-value for the hypothesis test that  $\beta^a = 0$ . Panels A-D of Table A3 report results for the case where the dependent variable of interest is postsecondary tuition expenditures, tuition tax credit receipt, earnings and employment, respectively.

One important caveat to keep in mind when interpreting the results in Table A3 is that the bias correction and effective degrees of freedom procedure proposed by Young (2016) also has undesirable properties when the number of treated groups is very small, as in our application. Monte Carlo simulations by MacKinnon and Webb (2018) show that procedure proposed in Young (2016) either severely under-rejects or severely over-rejects true null hypothesis when the number of treated clusters is small and there is heteroskedasticity in the error terms of the treated

and untreated clusters. In our application, the standard deviation of earnings and employment rates is lower in Regent Park than for the other public housing projects (see Table 1). On the other hand, the standard deviation of postsecondary tuition expenditures and the tuition tax credit received is larger for Regent Park than for the untreated housing projects. This suggests that the error terms for the projects that do not receive the Pathways intervention are different from the error term for outcomes from Regent Park. MacKinnon and Webb (2018) show that the procedure suggested by Young (2016) almost never rejects a true null hypothesis in situations where there is only one treated group and where the variance of outcomes in the treated cluster is smaller than the variance of outcomes in the untreated clusters. The procedure has the opposite problem of over-rejecting when outcomes of the treated cluster are more variable than the outcomes of the untreated clusters (see Figure 14 in MacKinnon and Webb (2018)). This suggests that the p-values calculated using the procedure suggested by Young (2016) are likely to be conservative for the earnings and employment outcomes and too small for the postsecondary tuition expenditure and tuition tax credit outcomes.

Panel A column 2 of Table A3 shows that the standard errors calculated using the bias correction procedure proposed by Young (2016) are much larger than the standard errors from the CVRE for postsecondary tuition expenditure claims. For example, the standard error on the  $\beta^{20}$  coefficient is nearly three times larger than the CVRE standard error estimate in Table 2 (\$163 versus \$65). However, the coefficient estimates for  $\beta^{20} - \beta^{23}$  remain statistically significant at the one or five percent levels. Similarly, when the dependent variable is the tuition tax credit received, the estimates for  $\beta^{23}$  to  $\beta^{25}$  in panel B are statistically significant at the 5 or 10 percent levels.

Since the earnings of the young adults in our sample are more volatile than tuition expenditures, it is not surprising that the degrees of freedom correction leads to large standard error estimates. For example, the p-value on the test for statistical significance of Pathways on earnings at age 26 jumps from  $p = 0.02$  to  $p = 0.39$ . In general, the Young (2016) degrees of freedom suggests that the estimates of the effect of eligibility for Pathways on earnings and employment are not statistically significant at conventional levels. The estimates for  $\beta^{23}$  and  $\beta^{24}$  are nearly significant at the 10 percent level for the employment outcome in Panel D.

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**Appendix Table A1: Descriptions of Key Variables**

<b>Variable</b>	<b>Description</b>
Earnings	Total earnings from employment at all jobs in a given year (earnings set equal to zero for those without any earnings)
Fraction working	Dummy variable equal to 1 for individuals with positive earnings and zero otherwise
Tuition deduction	Total tuition payments to eligible colleges and universities in a given year
Tuition tax credit	Total tuition tax credit received in a given year
Female	Dummy variable equal to 1 for women and zero otherwise
Immigrant	Dummy variable equal to 1 for individuals who are not born in Canada and zero otherwise
English second language	Dummy variable equal to 1 for individuals who do not speak English as their first language upon enrolling in Grade 9
Cohort	Year entered Grade 9
Age in Grade 9	Age of individual upon enrolling in Grade 9 in a TDSB school
Age (current year)	$age = t - YOB = t - cohort - age\ in\ Grade\ 9$
Number of years claimed tuition deduction	Count of the number of years the variable "Tuition deduction" is positive
Ever on social assistance	Dummy variable equal to 1 for individuals who have ever received social assistance and zero otherwise
Ever on EI	Dummy variable equal to 1 for individuals who have ever received employment insurance (EI) and zero otherwise
Social assistance payments	Social assistance payments received in a given year

EI benefit payments	EI benefits received in a current year
Married or common law	Dummy variable equal to 1 for individuals that are married or are living with a common law partner and zero otherwise
Has child	Dummy variable equal to 1 for individuals who claim a dependant in the CCTB file and zero otherwise

**Table A2**  
**Intent to Treat (ITT) Estimated Effects of Pathways on Job Quality by Age**

	(1) Median Earnings at Primary Employer (dollars)	(2) Total Payroll (dollars)
pathways*1[age = 19]	2,939 [864]***	115,394 [28,532]***
pathways*1[age = 20]	2,635 [760]***	54,570 [23,114]**
pathways*1[age = 21]	1,916 [713]***	-9,297 [23,939]
pathways*1[age = 22]	2,050 [643]***	68,777 [26,910]**
pathways*1[age = 23]	333 [1,490]	22,887 [28,935]
pathways*1[age = 24]	177 [988]	2,200 [31,556]
pathways*1[age = 25]	2,073 [1,247]	77,524 [30,685]**
pathways*1[age = 26]	410 [1,043]	-68,772 [39,248]*
1[age = 20]	769 [714]	33,259 [15,373]**
1[age = 21]	2,258 [587]***	62,494 [16,890]***
1[age = 22]	4,339 [723]***	73,361 [16,134]***
1[age = 23]	6,923 [1,406]***	67,822 [20,051]***
1[age = 24]	9,216 [564]***	97,567 [19,649]***
1[age = 25]	10,905 [1,093]***	107,289 [22,181]***
1[age = 26]	13,124 [892]***	150,271 [25,916]***
1[age = 27]	12,967 [993]***	178,293 [34,337]***
Constant	29,775	1,837,074

	[12,083]**	[360,252]***
Observations	23,818	23,818
R-squared	0.069	0.017

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Notes: The sample is the same as in Table 2. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and inference is based on the critical values of the t distribution with 70-1 = 69 degrees of freedom. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table A3**  
**Intent to Treat (ITT) Estimated Effects of Pathways on Adult Outcomes by Age**  
**Young (2016) Degrees of Freedom Correction**

	(1)	(2)	(3)	(4)
	Coefficient	Standard Error	Effective Degrees of Freedom	p-value
<b>A. Tuition Expenditures</b>				
pathways*1[age = 19]	189	[479]	31.2	0.697
pathways*1[age = 20]	538	[163]	32.3	0.002
pathways*1[age = 21]	607	[138]	32.3	0.000
pathways*1[age = 22]	631	[140]	32.7	0.000
pathways*1[age = 23]	473	[130]	32.9	0.001
pathways*1[age = 24]	284	[125]	31.8	0.029
pathways*1[age = 25]	-58	[253]	31.4	0.821
pathways*1[age = 26]	-139	[210]	29.6	0.513
<b>B. Tuition Tax Credit</b>				
pathways*1[age = 19]	-152	[117]	31.2	0.202
pathways*1[age = 20]	-121	[125]	32.3	0.343
pathways*1[age = 21]	-78	[127]	32.3	0.544
pathways*1[age = 22]	-71	[161]	32.7	0.661
pathways*1[age = 23]	428	[196]	32.9	0.037
pathways*1[age = 24]	782	[232]	31.8	0.002
pathways*1[age = 25]	485	[287]	31.4	0.101
pathways*1[age = 26]	469	[321]	29.6	0.155
<b>C. Earnings</b>				
pathways*1[age = 19]	-955	[1061]	31.2	0.375
pathways*1[age = 20]	-563	[1333]	32.3	0.676
pathways*1[age = 21]	-43	[1322]	32.3	0.974
pathways*1[age = 22]	-1287	[1116]	32.7	0.257
pathways*1[age = 23]	-339	[1554]	32.9	0.828
pathways*1[age = 24]	950	[1132]	31.8	0.408
pathways*1[age = 25]	1179	[1363]	31.4	0.394

pathways*1[age = 26]	1207	[3178]	29.6	0.707
<b>D. Working</b>				
pathways*1[age = 19]	0.000	[.048]	31.2	0.995
pathways*1[age = 20]	0.021	[.043]	32.3	0.620
pathways*1[age = 21]	0.049	[.038]	32.3	0.198
pathways*1[age = 22]	0.025	[.040]	32.7	0.528
pathways*1[age = 23]	0.056	[.041]	32.9	0.175
pathways*1[age = 24]	0.061	[.043]	31.8	0.166
pathways*1[age = 25]	0.015	[.070]	31.4	0.830
pathways*1[age = 26]	0.061	[.070]	29.6	0.388

Notes: The sample is individuals (students) who entered a TDSB high school between 2000 and 2003, lived in a public housing project and are at least 19 years old between 2005 and 2013. Pathways is a binary variable equal to one for students who entered Grade 9 after 2001 and resided in the Regent Park housing project, and zero otherwise. All regressions include cohort (year started Grade 9) and housing project fixed effects, as well as the following covariates: age started Grade 9 and dummies for gender, immigrant status and English as a second language (ESL) status. Student immigrant status and first language status is based on TDSB administrative records. Standard errors are clustered at the housing project level and are adjusted using the bias correction in Young (2016). Inference is based on the t distribution using the effective degrees of freedom (EDF) from Young (2016).