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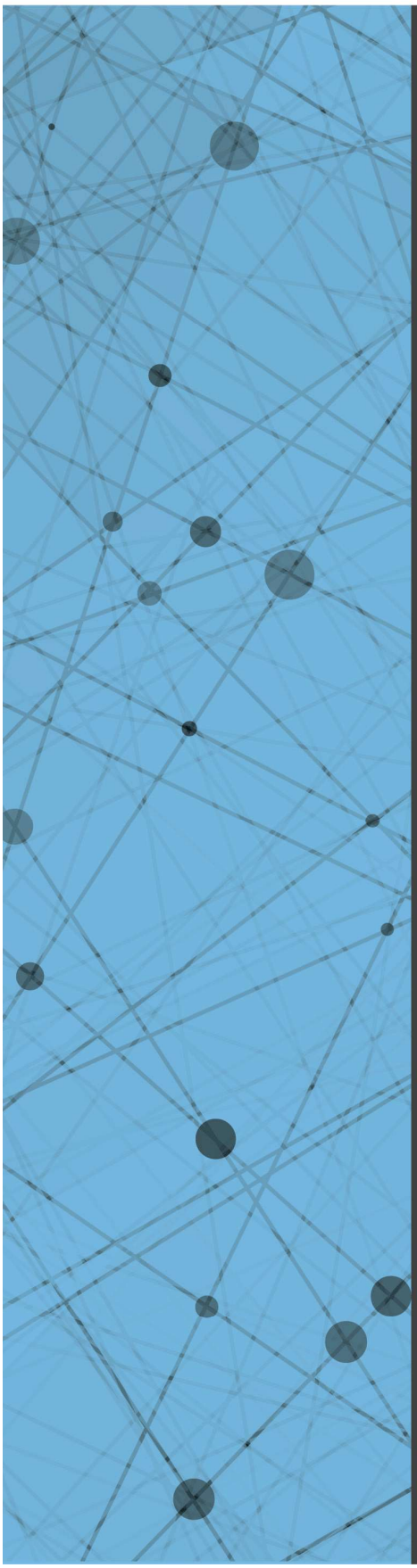

Returns to adult education and training in New Zealand

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Motu Working Paper 20-03

Motu Economic and Public Policy Research

March 2020

Document information

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Acknowledgements

This research was supported by the Productivity Commission. We thank Judy Kavanagh, John MacCormick, Gail Pacheco, and Amelia Sharman for helpful discussion and comments on the research.

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 ISSN 1176-2667 (Print), ISSN 1177-9047 (Online).

Abstract

In this paper we analyse the impact of adult education and training on labour market outcomes. Using the New Zealand Household Labour Force Survey linked to administrative education and earnings data, we estimate that on average, studying for a tertiary qualification increases the likelihood of employment in the post-study period by 1-3 percentage points and raises annual earnings by about 5% for men and 12% for women. In general, women who study for a tertiary qualification realise positive and significant gains but the same is not necessarily true for men. For example, completing a qualification has a strong effect on earnings for women but not for men. In addition, compared to not studying, studying for a level 4-6 certificate yields significant returns for women but not for men, while studying for a degree-level qualification produces strong returns for both men and women.

JEL codes

I21, I26, J24

Keywords

Adult education, Training, Employment, Earnings

Summary haiku

Studying as adults

What effects on their outcomes

Results are nuanced

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1 Introduction

Education and training has long been considered the bedrock of a skilled workforce. There is growing concern that technological changes are creating an increasingly dynamic and fluid labour market, in which workers will need to continually study and retrain to stay actively productive. However, relatively little is known about the extent to which adult workers are undertaking study and training in New Zealand, nor about the value of such activity in terms of its effects on their subsequent labour market outcomes. Previous research by Crichton and Dixon (2011) on the labour market returns associated with education and training in New Zealand find that those who complete level 1-3[1] or level 4 qualification experience no significant gains in their earnings over the three years following completion, relative to a matched comparison group. It also finds that completing a level 5-6 qualification has benefits for women and that these benefits vary considerably across fields of study. However, little is known about the labour market returns to higher levels of education (level 7 and above).

The objective of this paper is to update the previous research in this area, and extend it to examine the effects of higher level education. We use various sources of data contained in Statistics New Zealand's Integrated Data Infrastructure (IDI). First, we use data from the Household Labour Force Survey (HLFS) to identify a representative sample of adults aged 25-59. The HLFS collects information on various socio-economic and labour market characteristics for the adult population. Second, we use Ministry of Education (MOE) data on tertiary education participation. The MOE data provides comprehensive population data on study patterns to document the nature of study undertaken over the period. Third, we link the HLFS sample to Inland Revenue's Employer Monthly Schedule (EMS), an administrative data source which provides detailed monthly wage and salary employment and earnings on individuals since 1999. Our contribution to the literature is that by using a data source that has 20 years of longitudinal earnings data, we are able to examine longer-term effects of education. This is especially important given that human capital gains acquired from education and training often take time to be realised. Moreover, by using an administrative data source on education participation, we are able to examine many aspects of education (eg., intensity, duration, level, completion status) on subsequent outcomes.

Our estimation results indicate that, on average, studying for a tertiary qualification increases the likelihood of employment in the post-study period by 1-3 percentage points and

[1]Qualification levels in Crichton and Dixon (2011) as well as the current study are based on the New Zealand Qualification Framework (NZQF), where levels 1-6 correspond to non-degree certificates and diplomas, level 7 corresponds to Graduate certificates, Graduate diplomas, or Bachelor's degrees, while levels 8-10 correspond to post-graduate qualifications (including Bachelor Honours Degrees). More information is available at https://www.nzqa.govt.nz/studying-in-new-zealand/understand-nz-quals/.

raises annual earnings by about 5% for men and 12% for women. Completing a qualification has a strong effect on earnings for women but not for men. Compared to not studying, studying a level 4-6 certificate yields significant returns for women but not for men, while studying for a degree-level qualification produces strong returns for both men and women.

The remainder of the paper is organised as follows. In the next section, we summarise the literature on adult education and training in the context of the labour market. In section 3 we discuss the data sources, describe the characteristics of our estimation samples before presenting our estimation methods. Section 4 presents the estimation results, and the paper concludes in section 5.

2 Literature review

In this section we begin by summarising the international literatures that research on adult education and training evolves from. We then zoom in the recent New Zealand studies on the topic. The section concludes with key modelling in the literature.

2.1 International literature

Studies on the effects of adult education and training on labour market outcomes are built upon the enormous literature on the relationship between education and earnings. The dominant econometric issues in this literature are the possible endogeneity of the education choices with respect to ability and heterogeneous effects of education on earnings. In his summary of research designed to account for those econometric issues, Card (1999) finds that the *average* return to education is close to OLS estimates from a standard human capital wage regression controlling for other socio-economic factors that also affect workers' earnings. Recent research finds that an additional year of education in the US is estimated to raise log (hourly wages) by about 0.06–0.08 (6-8%).[2] Estimates based on studies of identical twins to control for unobserved ability differences suggest ability bias is relatively small (on the order of 10%).[3] In contrast, other instrumental variables estimates that exploit institutional features in education systems tend to estimate returns to education that are 20-40% higher than the average returns estimated by OLS. Card suggests this result may reflect higher *marginal* returns to education for the relatively disadvantaged population subgroups often affected by those institutional features.

Another related literature is on the effects of job training programmes for low-skilled workers – e.g., see seminal US research by Ashenfelter (1978), Ashenfelter and Card (1985), and

[2] See Table 4 in Card (1999). There is a long tradition in the US literature to measure the level of education as the number of years of completed education. In this literature, conditioning on other control variables, there is a remarkably linear relationship between log (earnings) and education (see Card's Figure 1). As well as earning higher wages, higher educated workers work more hours, so that the education returns to annual earnings are higher than returns to hourly wages.

[3] Similar conclusions were also reached in earlier reviews by Becker (1964) and Griliches (1977).

Lalonde (1986) and reviews of the US programs and issues by Lalonde (1995) and Heckman et al. (1999). While this literature often estimates that training has positive effects on workers' subsequent employment and earnings, it concludes that analysis based on observational data, as opposed to experimental trials, can lead to a large range of results, which are difficult to statistically discriminate between. Participation in such programmes is expected to be strongly non-random, due to incentives of both participants and programme administrators, which highlights the importance of adequately understanding and controlling for selection effects. Lalonde (1995) observes that, due to the relatively small investment in training per trainee, the expected effects will tend to be small, and difficult to measure precisely given the substantial variation that exists in individuals' earnings.

Notable studies in this literature include Jacobson, LaLonde, and Sullivan (2005a; 2005b) (JLS), who evaluate the effects of education and training on displaced workers' subsequent labour market outcomes. Using administrative data on earnings and Community College education in the US state of Washington over the 1990s, JLS compare the labour earnings of displaced workers who did and did not undertake education following displacement. They find that the earnings returns to retraining equivalent to 1-year of academic education was about 7% for displaced men and 10% for women. Estimated rates of returns also vary across different courses, with substantially higher returns to STEM-related technical vocational courses (of about 14% for men, and 29% for women), and low-to-zero returns to less technical courses. JLS (2005b) estimate that about two-thirds of these higher returns are associated with higher employment and hours worked, and one-third due to higher wages.

JLS's analyses also highlight several important modelling issues, namely the existence of non-linear effects of education which they model as a 'participation' effect associated with (completing) any education; temporal variation in the effects, including a transition period following training; and also time-varying worker heterogeneity. Their estimates imply implausibly large participation effects of education, which they infer likely reflects non-random selection of displaced workers into re-training. Finally, JLS (2005a) also analyse the effects of retraining on older (over 35) versus younger workers and conclude that, although there appears to be greater selectivity among older workers who retrain, the returns to retraining are similar across the age groups for both men and women. Overall, their estimates suggest adult education and training has comparable labour market returns to general schooling.

There is relatively little international evidence on education and training effects for the general adult workforce. In a recent literature review of the impacts of adult education, Desjardins (2019) concludes education has positive effects on a range of labour market outcomes including career prospects, earnings, job satisfaction and innovative capacity. Jenkins et al. (2003) analyse the effects of 'lifelong learning' (i.e., adult education and training) on labour market outcomes, using the National Child Development Study longitudinal data for a cohort of individuals born in

the UK in 1958. Using first-differences to eliminate any person-specific effects, they find that adult education increased employment rates for those previously out of the labour force, but did little to increase earnings. Vignoles et al. (2004) find that workers who undertake work-related training are not randomly selected, and that employers positively select workers on the basis of their likely benefits from training. Accounting for this selectivity, they estimate that training raised the wages of these workers substantially. Jenkins et al. (2007) use the UK Labour Force Survey to estimate the returns to a wide range of qualifications. Assuming a model of additive returns across qualifications, they find zero or negative returns to low-level vocational qualifications overall, but find positive returns to these qualifications for those who have them as their highest qualification level. Most recently, in their analysis of the Household, Income and Labour Dynamics in Australia data, Coelli and Tabasso (2019) find little evidence that adult education leads to significant improvements in employment, hours of work or wage rates. However, they find evidence that such education increases job satisfaction and satisfaction with employment opportunities among adults, particularly among women.

2.2 New Zealand literature

The research that is closest to the present study is a pair of New Zealand papers by Crichton and Dixon (2011) on the effects of formal education on labour market outcomes, and Crichton (2012) on labour market returns to industry training. Crichton and Dixon (2011) use pre-IDI linked employer-employee data on workers' labour market outcomes, linked to MOE data on tertiary education enrolments. Their focus was on the impacts of tertiary qualifications completed between 2003 and 2005 on the earnings of 25-64 year olds over the following three years. In line with the UK literature, they find that workers completing low-level (level 1-4) qualifications generally did not increase their earnings relative to matched comparison workers. However, there was some evidence that those completing higher (level 5-6) qualifications experienced relative gains in their earnings. Their results also suggest the returns grow over time since completion, implying that focussing on the short-run impact would understate the true returns to education.

Crichton (2012) present a similar analysis of the impact of industry training on subsequent earnings for adults aged 20-64. About half of those in training completed either an NZQF qualification or a limited credit programme. Crichton estimates generally positive increases in earnings associated with completed training qualifications, ranging from 2% for those completing a limited credit programme to 7% for those completing a level-4 qualification. She also estimates that those who undertake training are more likely to be employed in the period after completing training than the matched comparison group, but this is because industry trainees are employed for a larger proportion of the training period than employees in the comparison group. By increasing trainees' work experience, that requirement also appears to underpin their relative

increase in earnings, which draws into question whether these are causal effects or reflect selectivity bias.

2.3 Modelling issues

Even though evidence on returns to adult education and training is rather limited, it is built on the long-established literatures on general returns to education and on the impact of training programmes targeted at disadvantaged workers (e.g. low-skilled workers or displaced workers). In contrast to the returns to education literature that implicitly focuses on the longer-run effects of education on employment and earnings, much of the research evaluating adult worker training programmes tends to focus on shorter-run impacts, typically over 3-5 years following the intervention. This is largely because the returns to education research tends to use cross-sectional survey data and identifies the effects from differences across the population, while the training programme research uses longitudinal data and identifies the effects by comparing outcomes of workers who receive the training to those who do not over a typically shorter follow-up period. Thus, to the extent that the returns to any human capital gains acquired from the education and training takes time to be realised, these analyses may underestimate the full impact of the education and training.

Regardless, these literatures are subject to the same modelling issues, including selection bias (i.e. non-randomness) in participation in education and training, heterogeneous effects of education and training on outcomes, and possible non-linear relationships between the two. We seek to address these issues in our models.

3 Research design

To identify the effects of study undertaken by adult workers on their subsequent labour market outcomes, our main estimation strategy is regression adjustment. The longitudinal nature of our labour market data enables us to use individual fixed-effects regressions, which minimises potential selection bias. As a robustness check, we also use matching methods to construct a 'control' group and apply regression adjustment on the matched sample.

3.1 Data and estimation sample

Our analysis uses data from various sources contained in the IDI. We use the HLFS to identify a representative sample of adults aged 25-59. The HLFS collects information on various socio-economic and labour market characteristics for the adult population. These characteristics are used as control variables in our regressions. Our HLFS sample can then be linked to MOE data for tertiary education participation for and EMS for labour market outcomes. Combining with MOE and EMS data is necessary because the data on education participation and labour market

outcomes collected in the HLFS are too limited for our purposes. In particular, the HLFS does not collect details on studies undertaken by respondents, qualification level, field, number of credits taken and when the study starts and finishes. Labour market outcomes in the HLFS are restricted to the period during which a respondent is observed, which extends no more than two years, while up to 20 years of data can be available from the EMS.

Our estimation sample consists of individuals aged 25-59 at any time during their HLFS survey over the period 2006–2013. Dwellings are generally in the HLFS sample frame for eight quarters, so that individuals can be surveyed between one and eight quarters. We first summarise the HLFS information on each individual during the period they are surveyed, so that there is one observation per individual. This summary includes their time-invariant socio-demographic characteristics (such as gender and ethnicity) and the modal values (i.e., the most frequently reported value)[4] of time-varying characteristics (such as their marital status and number of dependent children), as well as the period during which they are surveyed.

We classify our HLFS sample into three groups. First, we characterise a person as 'studying' if, according to MOE enrolments data, they are enrolled for a qualification requiring at least 0.25 equivalent full-time (EFT)[5] during the period that overlaps with when they are surveyed in the HLFS, the period of study begins from 2004 and ends by 2013, and the person is aged 25-59 throughout the duration of the study. This group of individuals will constitute our main 'treatment' group. The requirement for time overlap between the MOE study and the HLFS survey period is to ensure that a person's socio-economic characteristics observed in the HLFS are directly linked to their 'treatment' spell, while the year criterion allows for at least five years of pre- and post-study EMS labour market outcomes. Second, we characterise individuals as 'never studying' if we never observe them in the MOE enrolments data during our estimation period 1999-2018, unless they finish their study by the age of 24 or start their study from age 60 onwards. This group of individuals will form the main sample for selecting a comparison group of those who do not study. Third, the remaining group consists of individuals who are observed in the MOE enrolments data, but not overlapping with their HLFS period. The third group is largely excluded from our analysis, so that conceptually we focus on the effects of study undertaken relative to no study during the wider estimation period.

For individuals classified as 'studying', we also identify the level and intensity of their study from the courses taken, and whether or not they completed a qualification during their study-period.[6] We classify their level of study according to the highest observed study level.

[4] When there are multiple modes, the earliest reported mode is chosen.
[5] EFTS are determined for each tertiary course, with one EFTS being equivalent to one year's full-time study.
[6] Over 10% of our estimation sample who are in 'enrolment' data are not found in 'course' data and over half are not found in 'completion' data. We define completing a qualification as being found in 'completion' data or completing at least 90% of the EFTS required for the qualification.

Labour market outcomes are derived from EMS data, which provides longitudinal monthly wage and salary employment and earnings on individuals during 1999-2018. EMS data are aggregated to annual frequency, both to smooth some of the month-to-month variation and also to reduce the amount of data. Given that we can observe each individual for at least five years before, and five years after, their study spell, we can analyse the medium-to-longer run effects of study on their subsequent outcomes, and also control for relatively rich labour market history before and during their study spell.

In a robustness analysis, we create a matched sample by identifying up to five non-study individuals to provide counterfactual observations for each person in the treatment group. To do this, we use a combination of exact and propensity score matching to match each study person to non-study individuals on the basis of their first HLFS quarter and their demographics. As well as providing an analytical comparison group with similar characteristics, this method enables us to assign a counterfactual 'study spell' to each non-study match which can then be used to provide pre- and during-study control measures. Matching is done with replacement, so that the same non-study person may be matched to more than one study person, in which case each match will have its counterfactual 'study spells' defined by the matched study person's.

Table 1 provides descriptive statistics about the study and non-study groups for both samples. In general, the matched sample, as expected, shows that the study and non-study groups are very similar, whereas the full sample shows very different characteristics between the study and non-study groups. Women are more likely to study – comprising 58.7 percent of the study group in the full sample, whereas in the non-study group, women comprise 51.6 percent.[7] With respect to ethnicity, the percentage of Europeans in the study group is much lower than in the non-study group, 54 percent and 63 percent respectively. For Māori, the percentage in the study group is 14.4 percent compared to 8.5 in the non-study group. The study group also has fewer full-time employees relative to the full sample, 44.7 and 51.1 percent respectively. Similarly, those not in the labour force (NILF) are a greater percentage of the study group (18.6 percent) than in the non-study group (14 percent).

3.2 Estimation methods

To estimate the effects of study on outcomes we use regression-adjusted difference-in-differences methods used by Jacobson, Lalonde and Sullivan (2005a; 2005b) in their analysis of the impacts of community college study on the earnings of displaced workers. In particular, we will estimate regressions of the form:

$$y_{it} = \tau_{it}(D_i^s, D_i^c, dur_{it}^s, l_i^s, c_i^s, z_i) + X_{it}'\beta + \alpha_i + \omega_{it} + \gamma_t + \epsilon_{it} \quad (1)$$

[7] Hyslop et al (2020), who define study based on self-reports in the HLFS, find that 58 percent of those in the study group were female and 59.2 percent of the formal study group were female (Table 1, ibid).

where y_{it} is a labour market outcome of interest – e.g. employment or log(earnings) – for person *i* in period *t*. The effects of study on the outcomes is captured by τ_{it}, which may vary over time and depend on several factors: whether they study, which we define as a dummy variable (D_i^s); whether the study led to the completion of some qualification (D_i^c); the time duration since the end of study (dur_{it}^s); the level of study (l_i^s), and/or the intensity of study, as measured by number of credits taken (c_i^s); and possibility of different study effects by workers' characteristics (z_i). We will assume that the effects of study only accrue following the end of the study spell, and that $\tau_{it} = 0$ until then. Our regressions will also control for other factors that affect individuals' outcomes, including observed socio-economic and labour market history factors (X_{it}'), unobserved individual effects which may vary over time ($\alpha_i + \omega_{it}$), aggregate time effects (γ_t), and idiosyncratic factors (ϵ_{it}).

We will estimate various specifications of the model, with the main focus being on identifying the various dimensions of study effects on labour market outcomes. For this, we will begin with a simple specification that assumes a constant effect of study:

$$\tau_{it}(D_i^s, D_i^c, dur_{it}^s, l_i^s, c_i^s, z_i) = \delta_0 D_i^s. \quad (2)$$

We will extend this simple specification to allow for the effects to vary with level and/or intensity of study,

$$\tau_{it}(D_i^s, D_i^c, dur_{it}^s, l_i^s, c_i^s, z_i) = \delta_0 D_i^s + \tau_1(l_i^s, c_i^s);^{8} \quad (2a)$$

and for the effects to vary with time since study ended,

$$\tau_{it}(D_i^s, D_i^c, dur_{it}^s, l_i^s, c_i^s, z_i) = \delta_0 D_i^s + \tau_1(l_i^s, c_i^s) + \tau_2(dur_{it}^s); \quad (2b)$$

or for a qualification-completion effect (δ_1),

$$\tau_{it}(D_i^s, D_i^c, dur_{it}^s, l_i^s, c_i^s, z_i) = \delta_1 D_i^c + \tau_3(l_i^s, c_i^s); \quad (2c)$$

Finally we will investigate the variability in the effects of study across various dimensions (z_i).

4 Estimation results

We will start with estimation results for unconditional earnings on the full sample. We then present results on other outcomes, such as conditional earnings, employment, and benefit receipt. For robustness checks we will also examine alternative samples. To allow for heterogeneous effects across genders, we estimate the models separately for each gender.

[8] We will investigate various specifications for $\tau_2(l_i^s, c_i^s)$, such as relatively simple additive effects between alternative levels of study and the number of courses taken, as well as more complex specifications that allow for possible non-linear effects, such as polynomial effects of the number of credits and/or interactions between the level of study and number of credits taken.

4.1 Full sample, unconditional earnings

4.1.1 Basic specifications

Tables 2 and 3 show the estimation results for unconditional earnings on the full sample. We consider several specifications. The specification shown in column (1) is an OLS regression that includes three dummy variables – one for the post-study period, one for the during-study period, and one for the study group – based on equation (2). Specification (2) is the same as (1) but is estimated based on an individual fixed-effects (FE) regression (thus the 'study group' dummy drops out as this variable is time-invariant for each individual). These two specifications allow us to estimate the long-term effect (δ_0) of enrolling in any study on post-study earnings. For men (Table 2), the OLS estimate is not significant, while the fixed-effects estimate indicates that on average studying raises men's annual earnings by \$1,360 after the study spell. For women (Table 3), this coefficient is almost identical across the two specifications, indicating that women who enrol in study, on average, increase their earnings by \$2,560 after the study spell. These results suggest that for men, there may be negative selection into studying, so not accounting for that selection bias understates the effect of studying on their earnings, yet no such bias is apparent for women. In the remaining specifications we will use the FE model to minimise potential selection bias.

4.1.2 Controlling for intensity of study

Next, we examine the overall effects of intensity of study by adding an interaction term between the post-study dummy and the total equivalent full-time student years taken by the student. We will call this the 'credits' effect. As shown in column (3), for men the post-study enrolment effect is similar to in column (2), and the credits effect is significantly positive (\$1,330). For women, the post-study enrolment effect is now small and insignificant, while the credits effect is large and significant (\$2,310). This indicates that longer study spells are more important than just studying for women.

4.1.3 Controlling for time after study

So far, we have examined the average overall earnings effects after a study spell for those who study. Given that earnings are generally affected in the short term immediately following study as students transition back into the labour force or into better jobs that reward their study, we separate the long-term earnings effects from the short-term effects by interacting the post-study dummy and the post-study credits interaction term respectively with the duration of time since the end of the study spell, $\tau_2(dur_{it}^s) = \delta_2 D_i^S \frac{1}{dur_{it}^s} + \delta_3 D_i^S c_i^s \frac{1}{dur_{it}^s}$, as shown in model (2b). Adding the short-term effects to the previous specification, we find results (column 4) that are similar to those without the short-term effects (column 3) in that the credits effect dominates the enrolment effect for both men and women. Hence, the long-term credits effect is positive and significant but

the short-term effect (δ_3) is negative and significant. For men, the short-term credits effect is about twice the long-term effect in absolute value (-$2,620 vs. $1,380), implying that the total effect takes two years to become positive.

4.1.4 Controlling for completion

Next, we look at the effect completing a qualification has on post-study earnings as opposed to simply enrolling in study. The results in column 5 (based on equation 2c) indicate that the long-term effect of completion is very similar to the long-term effect of simply enrolling (δ_0) for men. However, for women the completion effect is almost twice as large as the enrolment effect ($4,650 vs. $2,550). These results indicate that for women completing a qualification makes a significant difference to earnings, while for men there are little returns in completing a qualification beyond enrolling. Taken with the results on the credits effect, it appears that for women to realise strong gains from studying, they need to study for more intensive (i.e., longer duration) qualifications and complete them.

4.1.5 Controlling for level of study

The previous specifications pool all levels of study together. In order to examine the effects of the level of qualification studied, we start with a simple specification interacting the post-study dummy with the qualification studied. As reported in column (6) of Tables 2-3, compared to men who do not study, men who study for a level 1-3 qualification experience a significant decrease ($2,590 a year) in earnings after study. This negative effect is hard to explain, but could indicate a negative selection bias into studying, as shown in section 4.1.1. The returns to studying for a level 4-6 qualification are positive, but insignificant while the returns to studying for a level 7 qualification is only weakly significant. Strikingly, men who study for a level 8-10 qualification experience strong improvements in earnings afterwards (over $14,000 a year). Hence for men, the results increase in magnitude and statistical significance as the qualification level is increased.

For women, the effects for all qualification levels are positive and generally significant. The one exception is the positive but insignificant coefficients for the level 1-3. There is also a considerable increase for those women who study for at least a level 7 qualification (over $10,000) compared to the premium commanded by studying for a level 4-6 qualification ($3,730). These results for women are markedly different for men, for whom the gains in earnings seem to be mainly realised by studying for a post-graduate qualification.

So far our results are generally robust across specifications. Our preferred model is the basic FE specification (column 2 of Tables 2-3) as it captures the long-term effect of studying. In the sensitivity analysis below we will therefore only use our preferred specification.

4.2 Full sample, other outcomes

Table 4 contains the estimation results for other outcomes on the full sample based on our preferred specification. The result for unconditional earnings is presented in column (1) for reference.

The next outcomes we consider are the likelihoods of being in employment or receiving income support. We define two forms of employment: wages and salaries employment (i.e., having positive wages and salaries in the EMS data), and total employment, which additionally includes self-employment.[9] Income support receipt is defined as receiving any tier-one government benefits, as recorded in the EMS data. We find that adult education increases employment prospects for both genders but the effects are much stronger for women. For example, adult education increases the likelihood of being in wages and salaries employment by 1.3 percentage points for men and 3.3 percentage points for women (column 2). The effects are similar on total employment (column 3). Mirroring the results for employment, we find that adult education decreases the likelihood of receiving income support by just under 1 percentage point for men and about 1.6 percentage points for women (column 4).

Unconditional earnings includes both an employment effect and, conditional on employment, an earnings effects. We next examine the effect of adult education on earnings conditional on employment (i.e. conditional earnings). This specification reduces our estimation samples by 15-20% because it excludes observations which have zero earnings. The results (column 5) show that the long-term effects of adult education on conditional earnings are less than those on unconditional earnings, but they are still significant. For men, studying increases conditional annual earnings by $990, whereas the corresponding increase is $2,090 for women. Since all conditional earnings are positive, we can also use this measure in logarithmic form. The use of log earnings is convenient in that the point estimate of (δ_0) is roughly a percentage effect of adult education on conditional earnings. For example, the results in column (6) suggest that studying leads to increases in annual earnings of 5.2% for men and 12.2% for women. Since the effect on unconditional earnings is larger than that on conditional earnings (see column 1 vs. column 5), we expect that the effect of adult education on unconditional annual earnings is at least 5.2% for men and at least 12.2% for women.

Since the effects on conditional earnings represent a lower bound of the effects on earnings, and since using log earnings produces estimates that are unit free and scale free, we will use log earnings as our preferred outcome when examining the robustness of our results across alternative samples. Indeed, log earnings is the common outcome in the 'returns to education' literature discussed in section 2.1.

[9] Self-employment is defined as deriving working proprietors' income based on a variety of tax data. The data for this comes from the work by Fabling and Maré (2015) (which has been updated to 2018).

4.3 Alternative samples

The next sample that we consider is the matched sample as discussed in 3.1. Also based on the matched sample, we consider a tighter sample ('trimmed' sample) that only includes people with at least three years of earnings before study and three years after study. [10] We also consider a 'young' sample which is restricted to people who finish study by age 40. Table 5 shows the estimation results for log earnings on alternative samples based on our preferred specification. Since log earnings is conditional on wages and salaries employment, for completeness we also include the results for employment.

Compared with the full sample, the effect for the matched sample (column 1) is slightly smaller for men but remains the same for women. In particular, the results for the matched sample suggest that adult education raises conditional earnings by 3.9% for men (vs. 5.2% for the full sample) and 12.1% for women (vs. 12.2%). The results are similar when we further restrict the matched sample to people with at least three years of earnings before and after study (column 2). Interestingly, for the 'young' sample, the effect is small and insignificant for men (column 3).[11] However, for women in the 'young' sample, adult education is estimated to increase conditional earnings by 18%. This suggests that younger women benefit more from adult education than older women, while the opposite is true for men. The results on employment (columns 4-6) further reinforce that the effects of adult education are stronger for women than for men. Overall, this analysis shows our results are robust across alternative samples, especially for women.

5 Concluding discussion

This study has examined the effects that studying for tertiary qualifications by prime-aged adults (ages 25-59) have on their labour market outcomes. In general, our results reveal that the relationship between study and labour market outcomes for this group is complicated. Using data from the HLFS linked to MOE data for enrolments and with EMS data for earnings, we find that on average, studying for a tertiary qualification increases the likelihood of employment in the post-study period by 1-3 percentage points and raises annual earnings by about 5% for men and 12% for women. In general, women who study for a tertiary qualification realise positive and significant gains but the same is not necessarily true for men. For example, completing an enrolled qualification has a strong effect on earnings for women but less so for men. In addition, compared to not studying, studying a level 4-6 certificate level yields significant returns for women but not for men, while studying for a degree-level qualification produces strong returns for both men and

[10] As discussed in 3.1, non-study people have 'counterfactual' study start and end dates according to their study match.
[11] Propensity score matching can be problematic and lead to overstated standard errors in large samples (Abadie and Imbens 2016). Even though we use regression adjustment here, to the extent that our matched samples are subject to a margin of sampling error, the standard errors surrounding our regression estimates are also affected.

women. On the other hand, our results also indicate that men seem to gain much more than women by studying for a level 8-10 qualification relative to a level 7 qualification.

From these more in-depth analyses, our results also indicate that differentiating short-term and long-term effects is important and that the intensity of study matters. For example, completing a qualification and increasing the number of equivalent full-time student years during the study spell tend to yield positive and significant effects. Moreover, in the short-term after completing a qualification, there is an adjustment period during which the long-term gains are generally not fully realised.

Our results are in line with some international evidence. For example, JLS estimate that the returns on earnings to one year of academic education is about 7% for displaced male workers and 10% for women. However, our results are much stronger than most of the 'returns to adult education' literature, which typically finds negative to little returns on subsequent labour market outcomes. This could be because our data enables us to examine longer-term effects, which are believed to exceed short-term effects, given that human capital gains acquired from education and training take time to be realised. Our finding that the returns to adult education are greater for women than for men is also a common finding in the literature. This could be due to many reasons, such as differences in earnings levels and educational levels across genders, or occupational segregation. Unfortunately the EMS does not contain occupational codes, but this could be a fruitful avenue for future research using alternative data.

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Table 1. Descriptive statistics for the study and non-study groups in the matched and full samples

	Matched sample		Full sample	
Variable	Study	Non-study	Study	Non-study
Female	0.587	0.586	0.587	0.516
Age (HLFS minimum)	38.0	38.0	38.0	41.2
Migrant	0.414	0.408	0.413	0.396
Partnered	0.574	0.628	0.563	0.632
No. children[a]	0.020	0.020	0.022	0.018
Household size[a]	3.5	3.5	3.5	3.4
Ethnicity				
European	0.555	0.594	0.540	0.630
Maori	0.148	0.139	0.144	0.085
Pacifika	0.053	0.048	0.051	0.057
Asian	0.088	0.072	0.085	0.077
Euro/Maori	0.058	0.053	0.057	0.043
Misc. ethnicity	0.098	0.094	0.096	0.088
Missing			0.028	0.020
Highest qualification in HLFS				
No quals	0.062	0.062	0.065	0.134
Level 1-3	0.187	0.187	0.187	0.274
Level 4-6	0.299	0.299	0.298	0.258
Level 7+	0.420	0.421	0.416	0.297
Missing/Not specified	0.031	0.030	0.035	0.037
Labour force status[a]				
FT employee	0.457	0.527	0.447	0.511
PT employee	0.111	0.090	0.109	0.086
Self-employed	0.054	0.091	0.053	0.098
Unemployed	0.037	0.023	0.036	0.022
NILF	0.189	0.138	0.186	0.140
Missing	0.152	0.131	0.169	0.142
No. Individuals	17,322	40,131	17,826	92,052
	0.302	0.699	0.162	0.838

Note: For both samples, those who studied during 2001-2018 but outside their HLFS interview period are excluded. [a]Modal value.

Table 2. Estimation results for unconditional earnings, full sample, men

	(1)	(2)	(3)	(4)	(5)	(6)
Regression type	OLS	FE	FE	FE	FE	FE
Post-study	696.9	1,362***	1,421**	209.1		
	(544.0)	(472.2)	(574.2)	(745.1)		
Credits*Post-study			1,330***	1,382***		
			(309.4)	(418.5)		
Post-study*$\left(\frac{1}{dur_{it}^{s}}\right)$				2,341***		
				(795.9)		
Credits*Post-study*$\left(\frac{1}{dur_{it}^{s}}\right)$				-2,618***		
				(469.0)		
Completed qualification					1,174*	
					(645.4)	
Post-study* Level 1-3						-2,589***
						(650.7)
Post-study* Level 4-6						1,049
						(950.9)
Post-study* Level 7						2,743*
						(1,403)
Post-study* Level 8-10						14,257***
						(2,065)
During study	-2,902***	-1,078***	655.0*	-993.5***	-1,830***	-838.8**
	(496.4)	(387.9)	(386.5)	(384.7)	(351.2)	(390.1)
Other covariates?	Study group dummy				Post-study* Level* Credit category	
N observations	754,260	828,483	828,483	828,483	828,483	828,483
N individuals	46,113	50,856	50,856	50,856	50,856	50,856
R-squared	0.217	0.691	0.683	0.691	0.691	0.691

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses. All regressions include an intercept and demographic controls.

Table 3. Estimation results for unconditional earnings, full sample, women

Regression type	(1) OLS	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
Post-study	2,566*** (321.4)	2,553*** (287.9)	415.6 (376.9)	-213.2 (482.4)		
Credits*Post-study			2,313*** (207.4)	2,947*** (270.6)		
Post-study*$\left(\frac{1}{dur_{it}^{s}}\right)$				654.3 (506.8)		
Credits*Post-study*$\left(\frac{1}{dur_{it}^{s}}\right)$				(506.8) (274.0)		
Completed qualification					4,650*** (376.3)	
Post-study* Level 1-3						530.7 (404.2)
Post-study* Level 4-6						3,727*** (606.9)
Post-study* Level 7						10,660*** (830.0)
Post-study* Level 8-10						12,546*** (1,115)
During study	-2,299*** (287.5)	-1,829*** (241.9)	-469.6** (237.7)	-1,186*** (239.3)	-2,244*** (224.9)	-1,408*** (242.1)
Other covariates?	Study group dummy				Post-study* Level* Credit category	
N observations	861,375	940,449	940,449	940,449	940,449	940,449
N individuals	51,882	56,847	56,847	56,847	56,847	56,847
R-squared	0.277	0.661	0.658	0.662	0.662	0.662

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses. All regressions include an intercept and demographic controls. Specification (5) controls for an enrolment effect through the interactions between the post-study dummy and study level and credits category.

Table 4. Estimation results for other outcomes, full sample

Outcome	(1) Uncond earnings	(2) WS employ-ment	(3) Total employ-ment	(4) Income support receipt	(5) Cond earnings	(6) Log earnings
a) Men						
Post-study	1,362***	0.0133***	0.00991***	-0.00857**	994.5**	0.0515***
	(472.2)	(0.00384)	(0.00343)	(0.00360)	(460.1)	(0.0112)
N observations	828,483	828,483	828,483	828,483	700,767	700,767
N individuals	50,856	50,856	50,856	50,856	49,260	49,260
R-squared	0.691	0.467	0.462	0.570	0.723	0.539
b) Women						
Post-study	2,553***	0.0332***	0.0318***	-0.0162***	2,093***	0.122***
	(287.9)	(0.00374)	(0.00358)	(0.00378)	(300.3)	(0.0128)
N observations	940,449	940,449	940,449	940,449	746,397	746,397
N individuals	56,847	56,847	56,847	56,847	54,849	54,849
R-squared	0.661	0.443	0.451	0.595	0.666	0.483

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses. All regressions use specification (2) described in section 4.1.1.

Table 5. Estimation results for alternative samples

	Log earnings			Wages and salaries employment		
	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Matched sample	Trimmed sample	'Young' sample	Matched sample	Trimmed sample	'Young' sample
a) Men						
Post-study	0.0390***	0.0435***	0.0255	0.00246	0.00429*	0.00353
	(0.0131)	(0.0127)	(0.0171)	(0.00477)	(0.00233)	(0.00603)
N observations	373,359	294,600	196,002	435,525	305,361	223,785
N cases + controls[a]	36,288	24,201	19,218	37,404	24,201	19,518
N individuals	22,560	15,381	12,186	23,196	15,381	12,375
R-squared	0.576	0.554	0.537	0.501	0.136	0.420
b) Women						
Post-study	0.121***	0.0821***	0.178***	0.0350***	0.00691***	0.0540***
	(0.0154)	(0.0157)	(0.0206)	(0.00471)	(0.00221)	(0.00606)
N observations	531,723	398,391	255,051	664,095	419,922	327,486
N cases + controls[a]	52,800	32,028	26,964	54,756	32,028	27,858
N individuals	28,689	18,042	15,024	29,745	18,042	15,510
R-squared	0.544	0.511	0.495	0.475	0.158	0.431

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses. All regressions use specification (2) described in section 4.1.1. The trimmed sample and young sample are based on the matched sample. [a]The number of cases and controls is greater than the number of individuals as a non-study person can be matched to multiple study persons.