ARE THE OUTCOMES OF YOUNG ADULTS LINKED TO THE FAMILY INCOME EXPERIENCED IN CHILDHOOD?

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Abstract

This study uses longitudinal data from the Christchurch Health and Development Study (CHDS) to estimate the effects of early family income on a wide variety of detrimental outcomes experienced by young adults. The CHDS data used for this project follow a birth cohort through to age 21. One advantage of this data source is that it provides information on the income of the family in which these young people resided between the ages of one and 14. Accurate and comprehensive measurements of income histories are critical to the estimation of income effects on any subsequent outcomes. We find that subjects living in families with higher income are significantly less likely to experience economic inactivity, early parenthood and criminal activity, and to enter adulthood without a school or post-school qualification. Among these detrimental outcomes, only alcohol or drug abuse or dependence appears to be unrelated to early family income. Once mediating factors are included in our regression models, however, many of these income effects weaken and become insignificant. This is a common finding in the literature, and raises the question of the extent to which the effects of family income operate through various indirect pathways.

INTRODUCTION

This study empirically estimates the association between early family income and a variety of outcomes experienced by young adults. The results of this research should be of interest in public policy discussions on the use of the tax-transfer system to redistribute income in targeting many of these outcomes (youth economic inactivity, early parenthood, alcohol or drug dependence, criminal activity, and not having a school or post-school qualification).

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Longitudinal data from the Christchurch Health and Development Study (CHDS) on the progress of approximately 1,200 individuals born in Canterbury hospitals and followed through to age 21 are used in this analysis. One key advantage of the CHDS data for this study is that the data provide multiple observations on family income from ages 1–14 of the subject. This should afford a better measure of the "permanent" income experienced by the child. It also offers the possibility of testing for how income at different stages of adolescence might have quite dissimilar effects on these various outcomes.

This article is part of an ongoing study commissioned by the Ministry of Social Development to explore both the overall associations between early family income and the subsequent outcomes of young adults, and the possible pathways through which family income might eventually influence these outcomes. In this paper, both base controls (factors that largely pre-date observed family income) and mediating variables (factors that may themselves be influenced by family income) are gradually added to our regression models. The goal is to shed light on the ways in which early family income might work to influence some of the critical outcomes experienced by young adults.

The remainder of this paper is organised in the following way. The next section provides a brief overview of some of the more recent and relevant empirical findings and methodological issues in the literature on the effects of family income on child or young adult outcomes. This is followed by a section that describes the CHDS and discusses the methodology that will be used in the present study. The subsequent section presents our regression results. The final section draws some broad conclusions from this study, and considers the potential value for more in-depth analysis in future work in this area.

LITERATURE REVIEW ON FAMILY INCOME AND CHILD OR YOUNG ADULT OUTCOMES

There have been a number of prominent empirical studies over the last few years on the effects of family income on various child and young adult outcomes. This has been partly prompted by mounting concerns in many countries over the implications of being raised in low-income families for the life prospects of children. Many of these studies have used data from the United States. More recently, however, empirical studies in this area using data from other countries have been published in economic journals.

Susan Mayer's book on this subject (1997) was followed by a report that she completed for the Ministry of Social Development (2002). Mayer began her report by reaffirming that "parental income is positively associated with virtually every dimension of child wellbeing that social scientists measure" (2002:6). Yet, when controls were introduced

for various family background factors that are also likely to influence child outcomes, she noted that the estimated effect sizes declined substantially. The net effects of income, she concluded, were small to modest. Income seemed to have its largest effects in the areas of cognitive achievement and educational attainment.

Mayer found some support for the conclusion that family-income effects on child outcomes may be relatively larger for children from low-income families. Evidence suggests, for example, that a $10,000 increase in family income would make a bigger positive difference in terms of outcomes for children from low-income than from high-income families. This is an important finding because it suggests that income transfer programmes would have at least the potential for increasing *net* child wellbeing. The gains in child outcomes from the low-income families (who primarily receive transfers) could more than offset the losses from high-income families (who primarily pay taxes).

The evidence for family income at different stages of child development having differential effects on most child outcomes is unclear, although educational attainment and early childbearing may be exceptions. For the majority of child and youth outcomes, the effects of family income at different stages of child development are not statistically different from one another. Yet there is some evidence to support the view that family income early in the child's life (ages 1–5) may be relatively more important for schooling outcomes, and family income in early adolescence (ages 11–14) may be relatively more important for early parenthood outcomes.

Mayer also cautioned that findings of modest effects of family income on child outcomes could be the result of effective government programmes that target children from low-income families (2002:69-70). Even universal programmes that do not specifically target children from low-income families can help narrow the gap between the outcomes of children from rich and poor families if the effects associated with family income on child outcomes are non-linear. Public education, for example, may substantially moderate the advantages that children from high-income families would otherwise possess.

David Blau (1999) used matched mother–child data from the National Longitudinal Survey of Youth (NLSY) in the United States to estimate the effects of family income on the cognitive, social and behavioural development of children by age five. Like many other researchers, Blau found that measures of more long-term or permanent income have larger estimated effects on child outcomes than short-term or current income. Multiple observations of family income during childhood are critical for gauging the magnitude of these effects on subsequent outcomes. Blau cautioned that interpretations of the estimated effects of family income change in regressions that include "mediating" variables.

> A specification that includes inputs or jointly chosen variables yields estimates of income effects that are not useful for policy purposes, because they hold constant variables that will actually change in response to changes in income. (1999:262)

Blau concluded that estimated income effects are too small in magnitude for income transfer programmes to be feasible in substantially improving the developmental outcomes among low-income children.

Yeung et al. (2002) extended some of Blau's analyses with the same NLSY data. The authors also examined cognitive achievement and behavioural problems by age five. They suggested two ways in which family income might influence child outcomes.

- The "child investment" mechanism hypothesises that higher incomes improve child outcomes through increased resources available to aid in child development.

- The "family stress" mechanism presumes that higher incomes improve child outcomes through their impact on improved emotional wellbeing of parents and better parenting practices.

The authors claim that they can differentiate between these two pathways by including mediating variables that proxy for both child investments (e.g., childcare expenditures, the quality of the home environment, access to medical insurance and the quality of the neighbourhood) and family stress (e.g., assessments of maternal emotional levels and positive and negative parenting practices). If the income effects are substantially reduced by the inclusion of a particular set of mediating variables, then the authors contend that it is that mechanism that predominates in transforming lower family income into poorer child outcomes.

Yeung et al. concluded that the child investment mechanism more likely accounts for the link between family income and cognitive achievement, while the parenting stress mechanism more likely accounts for the link between family income and behavioural problems. In this same study, the authors also found some empirical support for the claim that both the level and stability of family income matter for both child outcomes. It should be noted that the authors caution that single-point-in-time measures of child outcomes and the two sets of mediating factors hinder this empirical analysis.

Jenkins and Schluter (2002) used German data to estimate the association between family income and the type of secondary school attended. The authors claimed that, in Germany, the type of secondary school attended is closely related to subsequent socio-economic attainment of young people.[2] They had access to annual information on family income from birth to age 14 of the child. These data are similar to the CHDS in both the number of annual income measures and the age range of children over which family income measures are available.

Jenkins and Schluter addressed two questions in their study. Firstly, are family income effects non-linear? Secondly, do these income effects vary with the age of the child? The authors acknowledged the two different mechanisms (child investment and family stress) through which family income might ultimately influence secondary school choice, and the importance of multiple observations of family income for accurately measuring the magnitude of these income effects (see the discussion of Blau 1999). Given the similarity of the available family income data in both the CHDS and the Jenkins and Schluter study, comparisons will be made in the last two sections of this article between the empirical findings in the two studies.

Unlike earlier studies from the United States, Jenkins and Schluter's German study concluded that family income from the later childhood period (ages 11–14) is relatively more important than income from earlier stages in influencing educational outcomes. However, it is difficult to know how much of these differences could be attributed to the quite dissimilar measures of educational outcomes used by the American and German studies (i.e., cognitive achievement or academic performance versus the type of secondary school attended).

Jenkins and Schluter also found no empirical evidence to support the hypothesis that income effects are greater for low-income relative to high-income families. Family income effects are generally statistically different from zero even when various control variables are included in regressions, but these income effects are smaller in magnitude in comparison to other important variables like parental education. An increase in income necessary to lift the family from the lowest to the highest family-income quartile would, on average, increase the probability that the child attends Gymnasium (the top-rated secondary school type) by 34 percentage points. Yet, changing the father's educational attainment from "no qualification" to "tertiary qualification" would, on average, increase the probability that the child attends Gymnasium by 51 percentage points.[3]

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2 The evidence for this assertion (2002:5) can be found in Table 1 of the working paper by Jenkins and Schluter, where the authors show that the earnings of working men and women varied substantially by the type of secondary-school leaving certificate obtained.

3 These calculations were based on the empirical results reported in Table 6 of Jenkins and Schluter.

DATA AND METHODOLOGY

The CHDS is administered by the Christchurch Health and Development Study Unit within the Christchurch School of Medicine under the direction of Professor David Fergusson. This longitudinal study follows the progress of over 1,200 children ("subjects" of the study) born in hospitals in the Canterbury region between April and August 1977. Parents, or the custodial adults in the households in which these children resided, were interviewed at the time of birth and every subsequent year until the 16th birthdays of this cohort. The subjects were also interviewed when they had reached their 15th and 16th birthdays. In the most recent interview waves (at ages 18 and 21), only the young people themselves were interviewed.

It is important to recognise that the child (or youth) is the relevant "unit of observation" in the CHDS. The nature of the family unit can change over time because of the death, separation, divorce or marriage of parents or custodial adults. Where the family undergoes changes that involve family members moving into other households, the study always follows the subjects.

The primary advantages of the CHDS for this study are the longitudinal nature of the data set, and the wide range of information available on family income, personal and family background characteristics, and the education and work histories of the young people. Its strength is the abundance of the data available on both the dependent and independent variables that will be used in this analysis.

The main disadvantages of the CHDS are the relatively small sample size and a potential lack of national representativeness of study participants and their families. The original design of this study (following children born in Canterbury area hospitals over a five-month period in 1977) meant that study participants are not necessarily representative of cohorts of children born elsewhere in New Zealand and at other times (at least in terms of ethnic composition).

Due to attrition, approximately four-fifths of subjects originally participating in this study (n=1,265) were interviewed at age 21 (n=1,011), and because of incomplete records and missing data on key variables, the number of valid observations for any analysis on these youths often falls below 1,000 observations. Previous work with the CHDS data on family income dynamics (Maloney 2001), however, has shown little evidence of attrition bias in this panel.

Stepwise regression analysis is used in this study to estimate the effects of family income on five specific detrimental outcomes experienced by youths at age 21. These outcomes were chosen to span a range of key social domains, including the labour market (economic inactivity), health (alcohol and drug dependence), justice (criminal

offending), human capital (no educational qualifications) and general "life course" outcomes (early parenthood). These dependent variables, and their particular definitions in the context of the CHDS, are listed below.

Economic Inactivity
Retrospective data from interviews at ages 18 and 21 are used to estimate the proportion of time over the five-year period between the ages of 16 and 21 that a youth was neither enrolled in formal education nor engaged in paid employment. The resulting variable can range continuously within a 0–1 interval.

Early Parenthood
Information taken primarily from the interview at age 21 is used to construct a binary variable that takes a value of one if a young person had given birth (in the case of a female) or fathered a child (in the case of a male); zero otherwise.[4] It is not necessary for the youth to be living with the child at the time of any particular interview. They simply need to have been responsible for the birth of a child by age 21.

Alcohol or Drug Dependence or Abuse
Youths were asked at age 21 about their histories of alcohol and drug use (of cannabis and other illicit substances). This information was used in the CHDS to determine whether or not the individual met the clinical criteria for alcohol or drug abuse or dependence between the ages of 18 and 21.[5] A binary variable takes on a value of one if a youth was deemed to have been dependent on or to have abused either alcohol or illicit drugs over the previous three years; zero otherwise.

Criminal Activity, Arrest or Conviction
Youths were asked at age 21 about their histories of criminal offending, arrest and conviction over the past three years. A binary variable takes on a value of one if a youth reported engagement in criminal activity, was arrested by police or was convicted in a criminal court over the previous three years; zero otherwise.

No Educational Qualifications
Substantial information is available on the school and post-school qualifications obtained by youths through to age 21. A binary variable is constructed that takes on a value of one if a youth had *not* received a school or post-school qualification by age 21; zero otherwise.

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4 Data are available on the results from any pregnancies experienced by females and the fathering of any children by males by age 21. Thus, information is available on pregnancies experienced by females in the CHDS even if live births did not occur. However, in order to score "1" on the early parenthood variable, a live birth must have occurred.

5 The criteria used to define abuse or dependence on alcohol, cannabis or other illicit drugs are taken from the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* (1994).

The main independent variable of interest for the regression analysis is the income of the family in which the subject resided during their childhood years (defined between the ages of one and 14). The CHDS provides data on labour and other income for both parents at the time of each annual survey between the ages of one and 14 for the child. Multiple observations of income provide a better picture of the "permanent" income of the family, and allow the estimation of separate income effects at different stages in the child's development.[6] Family income will be represented in these regressions in a range of alternative ways, including both linear and non-linear specifications. The latter allow an examination of differential income effects at high and low income levels.

Three sets of regression results are reported for all five dependent variables and the various ways in which family income is measured. The first set of regressions includes only income as an explanatory variable. The second set of regressions includes some base-level control variables, which are largely independent of family income but may separately influence the five young-adult outcomes. These base-level controls include the gender and ethnicity of the subject, the educational qualifications of the parents, the age of the mother at birth of the subject, the proportion of years living in a single-parent family (ages 1–14 of the subject), the socio-economic status of the family (measured at birth of the subject) and the maximum number of siblings in the family (by age 15 of the subject). The third set of regressions includes these base-level controls plus the addition of two possible mediating variables, which may be influenced by family income. The two mediating variables are the mean scores on both the Revised Wechsler Intelligence Test (administered at ages eight and nine of the subject) and conduct-problem assessments (taken from reports at ages seven, nine, 11 and 13 of the subject).

It was mentioned in the previous section that Yeung et al. (2002) were concerned by the fact they had access to only single observations on key mediating variables. Measurement error may result in an underestimate of the effects of more permanent conditions on youth outcomes. The limitations on the analysis imposed by single-point-in-time measures of mediating variables could be offset by multiple measures on both sets of variables from the CHDS. In this sense, this current study uses a more robust set of mediating variables and builds on the insights gained from Yeung et al.

6 The advantage of multiple observations of income for reducing various forms of measurement error in regressions that include income as an explanatory variable has been widely recognised in the economics literature (e.g., Mazumder 2001). The estimation of separate income effects at different stages of childhood eliminates some of the advantage in reducing measurement error with a long panel, as well as introducing substantial multicollinearity.

DESCRIPTIVE STATISTICS AND REGRESSION RESULTS

Table 1 provides descriptive statistics on the 14 consecutive years of family income data available in the CHDS. The income measure used in this study is an estimate of annual gross family income at the time of each annual survey. It is a composite of responses to categorical questions on gross weekly income (from non-benefit sources) averaged over the three months preceding the survey, and open-ended questions on net weekly benefits received by each spouse at the time of the interview.[7] These non-benefit income categories were adjusted over this 14-year period to reflect the general increase in earnings.[8] There were 24–32 discrete weekly non-benefit income categories over the sample period.

Table 1 Correlation Coefficients, Means and Standard Deviations for Real Family Income

Family income measures	Pearson correlation coefficients					
	Average, ages 1–5	Average, ages 6–10	Average, ages 11–14	Average, ages 1–14	Means	Standard deviations
Average, ages 1–5	1.000	–	–	–	41.039	13.246
Average, ages 6–10	0.704***	1.000	–	–	46.071	15.765
Average, ages 11–14	0.537***	0.772***	1.000	–	57.712	26.667
Average, ages 1–14	0.791***	0.928***	0.913***	1.000	47.628	16.142

* Significant at a 10% level, using a two-tailed test.

** Significant at a 5% level, using a two-tailed test.

*** Significant at a 1% level, using a two-tailed test.

Notes: Annual family income in the CHDS is estimated from categorical personal and benefit income measures for both spouses taken from the time of each annual survey. These income statistics are reported in thousands of constant March 2002 dollars. All families had a minimum of two valid reports of positive income in each of the three sub-periods. The final sample size is 797 CHDS children and their families.

7 All net weekly benefit figures were converted to gross figures using standard tax rates in each year. See Maloney (2001) for more information on the specific procedure used to convert net to gross weekly benefit amounts.

8 For example, the top weekly income category increased six times over the 14 years, from $300 in 1978 to $1,400 in 1991. This 366.7% nominal increase was equivalent to a 40.5% real increase in this highest income category. This is almost identical to the 39.7% increase in real median family income in the CHDS over this sample period.

The following steps were taken in estimating real annual family income in each of the 14 years.

Firstly, each parent was assigned the midpoint associated with the weekly non-benefit income category. This could not be done, however, for those in the top, opened-ended income category. Slightly more than 6% of subjects lived in families where at least one parent (most often the father) reported income in the top category. The CHDS assigned the minimum weekly non-benefit income level to a parent in the top income category (e.g., $1,300 per week). This would generally underestimate the actual income of those in this top category (e.g., parents earning $1,300 or more per week). A procedure developed by Maloney (2001) was used to estimate the conditional expectation for weekly non-benefit income separately for male and female parents in this top income category. This involved estimating linear approximations of the right-hand tails of these respective income distributions.[9]

Secondly, these weekly dollar amounts for the non-benefit and benefit incomes of the parents were summed and multiplied by 52 to convert to an annual income figure for the family.

Thirdly, nominal annual family income figures were converted to constant March 2002 dollars using the Consumer Price Index.

Like Jenkins and Schluter (2002), no attempts have been made to "equivalise" these income statistics for family size or composition. The number of adults and children will be directly included among the explanatory variables in later regressions.

All observations used in this study came from subjects with at least two valid annual measures of positive family income during each of the three stages of childhood (ages 1–5, 6–10 and 11–14). These restrictions were necessary to test differences in income effects at these different stages of development. Due to these restrictions and other restrictions on the availability of key data required for this analysis, the final sample size was 797.

For our sample of subjects, there was a substantial increase in average real family income over the 14-year period. On average, children lived in families with $41,039 in annual income (March 2002 dollars) from ages 1–5. This increased to an average of $57,712 by ages 11–14. This represents a 40.6% increase in real family income between the early and late stages of childhood. Jenkins and Schluter (2002) found a somewhat

9 See this earlier study (Maloney 2001) for more details on the procedure for estimating non-benefit incomes in these open-ended income categories.

smaller increase in real family income between these stages (32.9%) in their sample of German children.[10]

A more striking difference between the studies occurs in the dispersion in family income over time. Jenkins and Schluter reported a 36.4% increase in the standard deviation in family income over a 15-year period. It is shown in Table 1 that the standard deviation in family income grew over the 14-year period in the CHDS by 101.3%. Previous work on income dynamics suggests that this is not due to the categorical nature of the personal income data of the spouses (Maloney 2001). It may at least partly be attributed to the fact that this sample period (1978–1991) corresponds with structural changes, economic reforms and a cyclical downturn (especially in the last four years during this sample period) in the New Zealand economy.

One of the goals of the empirical analysis in this study is to estimate possible differences in the effects of family income at various stages in childhood development on several detrimental outcomes for youth. This task would be impossible without independent variation in mean incomes at these stages. Table 1 reports Pearson correlation coefficients from average real family incomes at ages 1–5, 6–10 and 11–14. They indicate a slightly greater level of family income mobility than that reported among German (Jenkins and Schluter) and American children (e.g., Duncan et al. 1998). For example, the correlation in mean family income between early and late stages of childhood is 0.537 in the CHDS. The correlation between family income at the same stages reported by Jenkins and Schluter is 0.63 (2002:22 Table 2). Other correlations in the CHDS are approximately the same or lower than those in the Jenkins and Schluter study.

Another way of capturing the mobility in real family income is to compute transition frequencies between the early and late stages of childhood development. Jenkins and Schluter used quartiles and found that 51.3% remained in the same quartile in these periods, while 7.8% moved either two or three income quartiles between the early and late stages (2002:23 Table 3). Transition frequencies between these same stages in the CHDS are reported in Table 2. Less than one-half of CHDS children lived in families whose income remained in the same quartile between the early and late stages of child development (43.3%), and more than one in 10 (11.3%) lived in families whose income moved either two or three quartiles over this time. Of course, differences in sample design and income measures may play a role in the relatively higher income mobility among subjects in the CHDS.

10 Although the age ranges for the late stage of childhood are identical in the two studies, the age range for the early stage of childhood in Jenkins and Schluter is birth to age 5. This slightly earlier start in their study in measuring family income would tend to *widen* the gap in mean income between the two stages relative to what we find in the present study.

Table 2 Real Family Income Transition Frequencies

Family income quartile, ages 1–5	Family income quartile, ages 11–14				
	1st	2nd	3rd	Top	Row totals
1st	0.530	0.293	0.121	0.057	1.000
2nd	0.230	0.340	0.320	0.110	1.000
3rd	0.135	0.225	0.335	0.305	1.000
Top	0.101	0.151	0.221	0.528	1.000

Notes: See the notes at the bottom of Table 1 for a definition of family income and sample restrictions. Youths are placed in one of the quartiles based on mean family income in the first five and last four years over the sample period. The demarcations of the quartiles are based on the CHDS sample. The numbers in this table are the frequencies of being in a quartile toward the end of the sample period, conditional on being in a given quartile toward the beginning of the sample period (i.e., the figures sum to one in each row).

Table 3 displays some descriptive statistics on the five measures of detrimental youth outcomes that will be used as dependent variables in our regression analysis. The first variable – economic inactivity of youths between their 16th and 21st birthdays – is an estimate of the proportion of time over this five-year period in which the youth was neither enrolled in education nor in paid employment. The variable can freely range between zero (never economically inactive) to one (always economically inactive). The mean of 0.124 says that the average youth in our sample was out of both education and work for 12.4% of the time over the five years.

Table 3 Correlation Coefficients and Means for Five Detrimental Outcomes of Youth

	Pearson correlation coefficients					
	Economic inactivity, ages 16–21	Responsible for birth of a child by age 21	Alcohol or illicit drug abuse or dependence, ages 18–21	Criminal activity, arrest or conviction, ages 18–21	No school or post-school qualification by age 21	Means
Economic inactivity, ages 16–21	1.000	–	–	–	–	0.124
Responsible for birth of a child by age 21	0.386***	1.000	–	–	–	0.123
Alcohol or illicit drug abuse or dependence, ages 18–21	0.065*	-0.014	1.000	–	–	0.334
Criminal activity, arrest or conviction, ages 18–21	0.243***	0.082**	0.405***	1.000	–	0.216
No school or post-school qualification by age 21	0.557***	0.213***	0.028	0.193***	1.000	0.166

* Significant at a 10% level, using a two-tailed test.

** Significant at a 5% level, using a two-tailed test.

*** Significant at a 1% level, using a two-tailed test.

Notes: See the notes at the bottom of Table 1 for sample restrictions (n=797). The first variable in this table measures the proportion of time that a youth was economically inactive (i.e., neither enrolled in education nor in paid employment) between the ages of 16 and 21. This variable can take on any value within the 0–1 interval. The remaining variables are all dichotomous in nature. The second variable takes on a value of one if a youth was responsible for the birth of a child by age 21; zero otherwise. The third variable assumes a value of one if a youth met the criteria established by the American Psychiatric Association for alcohol or illicit drug abuse or dependence; zero otherwise. The fourth variable takes on a value of one if a youth ever offended, was arrested or was convicted of a criminal offence between the ages of 18 and 21; zero otherwise. The fifth variable assumes a value of one if a youth did not receive a school or post-school qualification by age 21; zero otherwise.

All other measures of the detrimental outcomes for youth are dichotomous, and are defined in the previous section. Approximately one out of eight youths (12.3%) had given birth to a child (in the case of females) or fathered a child (in the case of males). One out of three youths (33.4%) were deemed to have recently abused or been dependent on either alcohol or illicit drugs. Around one in five youths (21.6%) had engaged in criminal activity, had been arrested or had been convicted of a criminal offence. One out of six youths (16.6%) had no formal school or post-school qualification by age 21.

Since all five variables measure different aspects of what would be considered "poor outcomes" for youth, it is useful to know something about their interrelationships. For this reason, Pearson correlation coefficients are also reported in Table 3. The highest correlation exists between Economic Inactivity and No Qualification (0.557). This is followed in order by the correlations for Criminal Activity and Alcohol or Drug Abuse (0.405), Economic Inactivity and Early Parenthood (0.386) and Economic Inactivity and Criminal Activity (0.243). At the other end of the spectrum, the estimated correlation coefficients between Alcohol or Drug Abuse and both Early Parenthood and No Qualification are (at a 10% level) not significantly different from zero.

Among these detrimental outcomes for young adults, nine of the 10 pairwise correlation coefficients are positive in Table 3, and eight of the 10 are significantly different from zero at better than a 10% level. Yet, these positive relationships are not as high as some might expect. Alcohol or Drug Abuse is only weakly correlated with everything except Criminal Activity. Another way of capturing the interrelationships among these dependent variables is to examine the proportion of youths who simultaneously experienced all (or none) of the detrimental outcomes. Nearly one-third of the youths in our sample (30.1%) were always economically active during this five-year period and experienced none of the other negative outcomes (i.e., all binary variables were zero). Only six of the 797 youths in our sample (0.8%) were economically inactive at least 50% of the time over the five-year period and experienced all of the other negative outcomes (i.e., all binary variables were equal to one). Thus, a reasonable proportion of our sample experienced none of the negative outcomes, while very few of these young adults experienced all of these negative outcomes.

Regression Results without Controls

Table 4 displays the results from the first set of regressions that include alternative measures of family income as the sole explanatory variable. Because the dependent variables are either dichotomous or range between zero and one, maximum likelihood probit estimation is used in all regressions reported in the study. A minimum chi-squared estimation routine is used for the first dependent variable (Economic Inactivity) because it can range freely within the bounded 0–1 interval.

Table 4 Estimated Effects of Family Income on Various Detrimental Outcomes for Youth (No Other Explanatory Variables Included in these Probit Regressions)

	Dependent variables:				
Real family income measured in tens of thousands of constant March 2002 dollars	Economic inactivity, ages 16–21	Responsible for birth of a child by age 21	Alcohol or illicit drug abuse or, dependence ages 18–21	Criminal activity, arrest, or conviction ages 18–21	No school or post-school qualification by age 21
Using income data from entire childhood, ages 1–14					
Mean	–0.043***	–0.041***	0.007	–0.029***	–0.067***
	(0.007)	(0.007)	(0.010)	(0.009)	(0.008)
Log of mean	–0.192***	–0.173***	0.024	–0.138***	–0.297***
	(0.030)	(0.031)	(0.047)	(0.041)	(0.035)
Linear spline: below 60% of median	–0.130**	–0.108*	0.009	–0.037	–0.181**
	(0.060)	(0.061)	(0.111)	(0.091)	(0.071)
Linear spline: above 60% of median	–0.037***	–0.036***	0.007	–0.028***	–0.059***
	(0.009)	(0.009)	(0.012)	(0.010)	(0.010)
Binary measure: being above 60% of median	–0.146***	–0.125***	–0.009	–0.102**	–0.220***
	(0.032)	(0.032)	(0.055)	(0.044)	(0.037)
Depth of poverty below 60% of median	–0.254***	–0.226***	0.034	–0.133	–0.386***
	(0.058)	(0.058)	(0.104)	(0.084)	(0.070)
Using income data from separate stages of childhood					
Mean, ages 1–5	–0.014	–0.015	0.002	0.002	–0.049***
	(0.012)	(0.012)	(0.018)	(0.016)	(0.014)
Mean, ages 6–10	–0.007	0.008	–0.004	–0.014	–0.001
	(0.013)	(0.013	(0.019)	(0.017)	(0.015)
Mean, ages 11–14	–0.019***	–0.026***	0.007	–0.011	–0.023***
	(0.007)	(0.007)	(0.010)	(0.009)	(0.008)
P-value of Wald test on equality of splines	0.143	0.266	0.990	0.926	0.101

* Significant at a 10% level, using a two-tailed test.

** Significant at a 5% level, using a two-tailed test.

*** Significant at a 1% level, using a two-tailed test.

Notes: See the notes at the bottom of Table 1 for a definition of family income and sample restrictions (n=797), and the notes at the bottom of Table 3 for definitions of these five dependent variables used in these regressions. Maximum likelihood probit estimation was used in all regressions reported in this table. A minimum chi-squared estimation routine was used for the first dependent variable because it can be continuous within the 0–1 interval. The reported parameters and their standard errors are partial derivatives.

The estimated parameters in all regressions reported in the following tables can be interpreted in a similar way. Each one is the estimated change in the probability of the occurrence of some negative outcome for a one-unit change in the income variable. For convenience of interpretation, real family income is measured in tens of thousands of constant March 2002 dollars.

When the dependent variable is economic inactivity between the ages of 16 and 21, the estimated parameter in the first column on mean family income measured over ages 1–14 for the child is –0.043. This estimated effect is statistically different from zero at better than a 1% level. It indicates that on average a $10,000 increase in average real family income (slightly less than one-fifth of mean family income in our sample) lowers the probability of being economically inactive by 4.3 percentage points. This income effect is approximately one-third of the mean for this dependent variable (12.4%).

The remainder of the results in the upper panel of Table 4 experiment with other ways of including family income in this estimation, using four additional detrimental outcomes for youth. In the next set of regressions, the natural logarithm of family income is used as the sole regressor. The estimated effect shows what would happen if family income doubles. This estimated effect (a decline in the probability of being economically inactive by 19.2 percentage points) is also negative and significantly different from zero at a 1% level. It allows for a particular form of non-linear relationship between the probability of being economically inactive and family income.

A third regression produces the next two parameter estimates in the first column. Linear splines are used to test for a difference in income effects among children from low-income and high-income families. An arbitrary breakpoint at 60% of median family income is used. Slightly more than one in 10 children in our sample (10.3%) were below this 60% cut-off. There is only weak statistical evidence of a relatively higher incremental income effect among poor households. The estimated income effects are –0.130 and –0.037 for low-income and high-income levels respectively and both estimated income effects are statistically different from zero at better than a 5% level. However, a Wald test of the hypothesis that the slopes of the two splines are identical cannot be rejected at a 10% significance level (p-value of 0.143 on the chi-squared statistic).[11]

Two additional regressions are used to estimate the effects of the depth of poverty on the probability of being economically inactive. The first regression uses a binary measure of whether or not the child was raised in a family with income below 60% of

11 Jenkins and Schluter (2002) found that there was some evidence that income effects were larger among high-income households. Like the current study, however, these differences were not statistically significant. However, Jenkins and Schluter used a different dependent variable (quality of secondary school attended at age 14) and a different breakpoint for their linear splines (median family income).

median family income (approximately the poorest 10% of households in our sample). The estimated effect is –0.146. On average, rising out of poverty lowers the probability of being economically inactive by 14.6 percentage points. The second regression uses a continuous measure of family income below 60% of median income, and truncates it at 60% of median income for those at or above this breakpoint. This measures the effect of income below this poverty line. The estimated effect is –0.254. A $10,000 increase in family income below this poverty threshold, on average, lowers the probability of being economically inactive by 25.4 percentage points. Both estimated effects are statistically significant at better than a 1% level.

Finally, family income data from across the 14-year period are used to estimate how income at three stages of a child's development may have different effects on economic inactivity. This single regression includes three measures of mean family income when the child was between the ages of 1–5, 6–10 and 11–14. Note that multicollinearity among these three explanatory variables shown in Table 1 causes the standard errors to increase on these estimated effects. Multicollinearity limits our ability to isolate any separate age-specific income effects. Jenkins and Schluter (2002) found that middle-childhood income was less important than either early or late-childhood income in determining the quality of secondary school attended. We could reach a similar conclusion in this study with respect to a different dependent variable – economic inactivity. Yet only the estimated partial effect associated with income between the ages of 11 and 14 has a negative and significant effect on the probability of economic inactivity.

The remainder of the regression results in Table 4 can be quickly summarised. The estimated effect for the probability of being responsible for the birth of a child are roughly similar to what we have already seen for the probability of being economically inactive. Again, there is weak evidence of a relatively larger impact of family income below 60% of median, but the equality of these splines could only be rejected at a 26.6% significance level. Most striking, however, is the substantially larger relative effect of family income from late childhood. The incremental effect is –0.026 and statistically significant at better than a 1% level, while the other two age-specific effects are insignificant. This suggests that early parenthood outcomes are predominantly influenced by family income received during early adolescence. Duncan et al. (1998) reach a similar conclusion – that family income during adolescence has a relatively stronger effect on early childbearing than income at other ages.

Regressions on the probability of alcohol or drug abuse or dependence show no evidence of any effects associated with family income. Seven of the nine estimated income effects are positive, but none are statistically different from zero at conventional test levels. There is no statistical evidence of any link between family income and youth alcohol or drug problems by age 21.

The estimated income effects on the probability of criminal activity, arrest or conviction appear to be slightly weaker than those found for the probabilities of economic inactivity and early parenthood. Yet four of the six estimated income effects, using income data from ages 1–14, are negative and statistically significant. There is no statistical evidence of any differences in the income effects below and above 60% of median income. The links between low family income and probability of criminal activity are fairly imprecise (the depth of poverty below 60% of median income does not have a significant effect on criminal activity), and none of the age-specific effects are statistically significant.

The strongest relationship between family income and detrimental youth outcomes occurs with the probability that a youth did not obtain a school or post-school qualification by age 21. Eight of the nine estimated effects are statistically significant. A $10,000 increase in mean family income over 14 years lowers the probability of being unqualified by 6.7 percentage points. The estimated income effect at low-income levels is three times greater than at high-income levels. These linear splines are statistically different from one another at a 10.1% level, which is still, however, above the 10% level of significance.

Two measures of the incidence and depth of poverty have particularly large estimated effects on the probability of not obtaining a school or post-school qualification. The stage-specific effects at early and late childhood are both negative and significant in influencing the probability of not receiving a qualification. The estimated income effect from early childhood (–0.049) is more than double the estimated effect from late childhood (–0.023). Overall, of the five outcomes of young persons considered, family income appears to have the strongest effect on educational failure.

Regression Results with Base Controls

All 30 regressions discussed in the previous subsection were re-estimated with the inclusion of a set of base-level control variables. These are background factors that may independently influence the subsequent detrimental outcomes for young people. These controls include dummy variables on the gender and ethnicity of the youths, the educational qualifications of parents, and the socio-economic status of the family measured at the birth of the child.[12] Quantitative variables among the controls include the mother's age at the birth of the child, the proportion of years that the youth lived in a single-parent family and the number of siblings in the family by the time the subject had reached the age of 15.

12 The socio-economic status of the family is summarised in the CHDS by three categories related to the occupation of the father at the birth of the child (professional or managerial; clerical, technical or skilled; and semi-skilled, unskilled or unemployed). Two dummy variables were included in all regressions for the top two socio-economic groups.

Table 5 Estimated Effects of Family Income on Various Detrimental Outcomes for Youth (Basic Explanatory Variables Included in these Probit Regressions)

	Dependent variables:				
Real family income measured in tens of thousands of constant March 2002 dollars	Economic inactivity, ages 16–21	Responsible for birth of a child by age 21	Alcohol or illicit drug abuse or, dependence ages 18–21	Criminal activity, arrest, or conviction ages 18–21	No school or post-school qualification by age 21
Using income data from entire childhood, ages 1–14					
Mean	–0.033***	–0.019**	0.014	–0.022**	–0.035***
	(0.009)	(0.009)	(0.013)	(0.011)	(0.010)
Log of mean	–0.151***	–0.080**	0.054	–0.105**	–0.169***
	(0.037)	(0.036)	(0.060)	(0.049)	(0.041)
Linear spline: below 60% of median	–0.110*	–0.071	0.029	–0.009	–0.140**
	(0.061)	(0.058)	(0.115)	(0.088)	(0.068)
Linear spline: above 60% of median	–0.027***	–0.015	0.014	–0.023*	–0.027**
	(0.010)	(0.010)	(0.014)	(0.012)	(0.011)
Binary measure: being above 60% of median	–0.095***	–0.052*	0.002	–0.071	–0.124***
	(0.032)	(0.030)	(0.059)	(0.046)	(0.035)
Depth of poverty below 60% of median	–0.170***	–0.104*	0.060	–0.057	–0.201***
	(0.059)	(0.055)	(0.110)	(0.084)	(0.066)
Using income data from separate stages of childhood					
Mean, ages 1–5	–0.007	0.002	0.009	0.012	–0.029**
	(0.013)	(0.012)	(0.019)	(0.016)	(0.014)
Mean, ages 6–10	–0.007	0.006	–0.003	–0.009	0.002
	(0.013)	(0.012)	(0.020)	(0.016)	(0.014)
Mean, ages 11–14	–0.015**	–0.018***	0.009	–0.013	–0.012
	(0.007)	(0.007)	(0.010)	(0.009)	(0.008)
P-value of Wald test on equality of splines	0.203	0.366	0.896	0.877	0.116

* Significant at a 10% level, using a two-tailed test.

** Significant at a 5% level, using a two-tailed test.

*** Significant at a 1% level, using a two-tailed test.

Notes: See the notes at the bottom of Table 1 for a definition of family income and sample restrictions (n=797), and the notes at the bottom of Table 3 for definitions of the five dependent variables used in these regressions. Maximum likelihood probit estimation was used in all regressions reported in this table. A minimum chi-squared estimation routine was used for the first dependent variable because it is continuous within the 0–1 interval. The reported parameters and their standard errors are partial derivatives. These base controls include: youth gender and ethnicity, parental educational qualifications, mother's age at birth of child, proportion of years in single-parent family (ages 1–14), family's socio-economic status (measured at birth) and number of siblings in the family by age 15.

To minimise the volume of reported parameters, only the estimated effects and their standard errors on the family income variables are reported in Table 5. However, all interpretations of these estimated effects must be made conditional on these control variables. For example, we saw in the previous table that a $10,000 increase in family income lowered the probability of economic inactivity by an average of 4.3 percentage points. Once all of these control variables are held constant, this estimated effect declines in magnitude to 3.3 percentage points, and continues to be statistically significant at a 1% level. Similar conclusions can be reached with the other regressions. Around one-quarter (25.9%) of the previously estimated effects of income on economic inactivity is eliminated by the inclusion of these additional explanatory variables.[13] Yet a statistically significant link between family income and youth economic inactivity is preserved with the inclusion of these controls.

The average income effects on the probability of early parenthood are reduced by approximately one-half (52.1%) with the inclusion of these base-level control variables. The income effects for the probability of criminal activity are reduced by an average of more than one-third (38.1%) when these controls are held constant. Although most of the income effects that were statistically significant in Table 4 continue to be statistically significant in Table 5 at a 10% level, the significance levels decline markedly with the inclusion of these base-level control variables. The income effects, whether unconditional or conditional, on alcohol or drug abuse are nonexistent.

Family income continues to have negative and generally significant effects on the probability that a youth will not receive a school or post-school qualification. However, the magnitudes of these income effects have been reduced by an average of 42.5% with the inclusion of the base-level control variables. For example, the estimated unconditional and conditional effects for mean income over the 14 years on the probability of being unqualified are –0.067 and –0.035 respectively.

Another way to judge the magnitude of these estimated income effects is to compare them to other key estimated determinants in the same regression. For example, the receipt of a school qualification by both the youth's mother and father is estimated to reduce the probability that the youth will be unqualified by 13.3 percentage points.[14] This is almost four times larger than the effect of a $10,000 increase in family income on the same outcome. Having school-qualified parents has the equivalent impact on the probability of the subject having a qualification of an increase in mean family income of $38,000, or an increase amounting to four-fifths of the sample mean. The receipt of a

13 The reported figure is the average decline in the income effects using data on family income from ages 1–14 across the six effects from the economic inactivity regressions between Tables 4 and 5. Similar calculations are reported in the text for the other dependent variables.

14 This is the sum of the estimated effects on the dummy variables for the receipt of a school qualification by both the mother and father changing from zero to one.

post-school qualification for both the youth's mother and father is estimated to reduce the probability that the youth will be unqualified by 19.9 percentage points.[15] This is almost six times larger than the effect of a $10,000 increase in family income on the same outcome (or equivalent in size to an increase in mean family income of $56,900, or 119.5% of the sample mean). Family income still matters for determining whether or not a youth leaves education without a qualification, but the direct effect of parental qualifications is considerably more important for this outcome.

Regression Results with Base Controls and Mediating Variables

These same regressions were re-estimated using an expanded set of explanatory variables that include both the base controls and two mediating variables. These additional regressors were factors that may independently influence these detrimental outcomes of youth or, alternatively, may themselves be influenced in part by family income. These new explanatory variables were:

- mean scores on the Revised Wechsler Intelligence Test administered at ages eight and nine
- mean scores on conduct problem assessments made by parents and teachers at ages seven, nine, 11 and 13.[16]

Only those children resident in the Canterbury region at ages eight and nine were given these IQ tests. In the other situations, we assign the sample mean IQ score to the youth and allow a dummy variable to take on a value of one for missing IQ data.[17] The coefficient on this dummy variable should capture any systematic differences between subjects with and without these IQ test scores. This estimated effect would also capture any differences among the subjects related to their area of residence at ages eight and nine. This approach was considered to be superior to the alternative of eliminating nearly one in five subjects because of missing IQ data and losing their other benefits to this regression analysis. Excluding observations without IQ data would have eliminated their contributions in estimating other parameters in these models.

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15 This is again the sum of the estimated effects for both the mother and father. The estimated impact on the subject is interpreted relative to no qualifications of parents. Thus, post-school qualifications of parents have nearly a 50% larger impact on the probability of the subject being qualified relative to school qualifications for the parents.

16 These assessments by parents and teachers on conduct problems included reports on disruptive and oppositional behaviour, destructive behaviour, lying, stealing and cheating, and various forms of aggressive behaviour. The number of items ticked by both parents and teachers were aggregated and means were taken across the four years. The sample mean score on conduct problems is 49.2, with a standard deviation of 7.5.

17 Valid IQ information was available for 82.7% of all children in our sample. The sample mean for those with valid IQ data is 103.3, with a standard deviation of 15.8.

It is acknowledged that these mediating variables may partly capture the overall effects of family income on these detrimental outcomes for youth. Yet their inclusion in these regressions should provide new insight into the nature of the transmission mechanism. For example, if the additional covariates eliminate any direct influence of family income on these detrimental youth outcomes, then it may be inferred that the pathway for the influence of income operates almost exclusively through these mediating variables.

Table 6 reports the results from this final set of regressions. We saw earlier that the estimated income effects on the probability of being economically inactive declined when the base-level control variables were included. These estimated income effects decline in magnitude again with the inclusion of the mediating variables. For example, the estimated partial derivatives of overall mean family income on the probability of being economically inactive decline in magnitude from –0.043 to –0.033 with base controls, and then to –0.025 with base controls and mediating variables. All three estimated effects are statistically significant at a 1% level. This suggests that approximately one-quarter of the link between family income and youth economic inactivity may operate through both IQ scores by age nine and conduct problem indicators by age 13.

The inclusion of these mediating variables has minimal effects on the estimated partial derivatives in the early parenthood regressions. Yet, they have much more substantial effects on the results from the criminal activity regressions. When these mediating variables are included, all estimated partial derivatives in these regressions are statistically insignificant. Any link between family income and criminal activity appears to operate through these mediating variables (particularly the measures of early conduct problems).

The inclusion of base controls halved the estimated income effects on the probability of leaving education without a qualification. These effects are halved again when the mediating variables are included. The inclusion of these mediating variables also reduces the effects of the qualifications of parents on this same outcome. The receipt of a school qualification by both the youth's mother and father is estimated to reduce the probability that the youth will be unqualified by 7.4 percentage points. This is again four times larger than the effect of a $10,000 increase in family income on the same outcome. The receipt of a post-school qualification by the youth's mother and father is estimated to reduce the probability that the youth will be unqualified by 6.5 percentage points. Family income still matters for determining whether or not a youth leaves education without a qualification, but the sum of the estimated direct effects on the qualifications of parents are still considerably more important for determining this outcome.

Table 6 Estimated Effects of Family Income on Various Detrimental Outcomes for Youth (Basic and Mediating Explanatory Variables Included in these Probit Regressions)

	Dependent variables:				
Real family income measured in tens of thousands of constant March 2002 dollars	Economic inactivity, ages 16–21	Responsible for birth of a child by age 21	Alcohol or illicit drug abuse or, dependence ages 18–21	Criminal activity, arrest, or conviction ages 18–21	No school or post-school qualification by age 21
Using income data from entire childhood, ages 1–14					
Mean	–0.025***	–0.018**	0.012	–0.013	–0.017*
	(0.009)	(0.009)	(0.014)	(0.011)	(0.009)
Log of mean	–0.113***	–0.073**	0.041	–0.063	–0.088**
	(0.037)	(0.036)	(0.062)	(0.050)	(0.036)
Linear spline: below 60% of median	–0.076	–0.062	0.029	0.039	–0.073
	(0.060)	(0.058)	(0.116)	(0.090)	(0.059)
Linear spline: above 60% of median	–0.021**	–0.014	0.011	–0.016	–0.015
	(0.010)	(0.010)	(0.015)	(0.012)	(0.012)
Binary measure: being above 60% of median	–0.067**	–0.047	–0.011	–0.043	–0.064**
	(0.032)	(0.031)	(0.060)	(0.046)	(0.031)
Depth of poverty below 60% of median	–0.118**	–0.091	0.052	0.008	–0.099*
	(0.058)	(0.056)	(0.112)	(0.087)	(0.056)
Using income data from separate stages of childhood					
Mean, ages 1–5	–0.003	0.003	0.011	0.016	–0.022*
	(0.012)	(0.011)	(0.019)	(0.016)	(0.012)
Mean, ages 6–10	–0.007	0.005	–0.006	–0.009	0.002
	(0.013)	(0.012)	(0.020)	(0.016)	(0.012)
Mean, ages 11–14	–0.010	–0.016**	0.008	–0.009	–0.003
	(0.007)	(0.007)	(0.010)	(0.009)	(0.007)
P-value of Wald test on equality of splines	0.387	0.442	0.877	0.563	0.323

* Significant at a 10% level, using a two-tailed test.

** Significant at a 5% level, using a two-tailed test.

*** Significant at a 1% level, using a two-tailed test.

Notes: See the notes at the bottom of Table 1 for a definition of family income and sample restrictions (n=797), and the notes at the bottom of Table 3 for definitions of the five dependent variables used in these regressions. Maximum likelihood probit estimation was used in all regressions reported in this table. A minimum chi-squared estimation routine was used for the first dependent variable because it can be continuous within the 0–1 interval. The reported parameters and their standard errors are partial derivatives. See the notes at the bottom of Table 5 for a description of these base controls. The mediating variables are mean scores on the Revised Wechsler Intelligence Test (ages eight and nine) and conduct problem assessments (ages seven, nine, 11 and 13).

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER WORK

This study used data from the Christchurch Health and Development Study to report on a set of preliminary regression analyses of the overall link between childhood family income and subsequent detrimental outcomes of youth. The advantages of the CHDS for this work are the multiple observations on family income from ages 1–14 for the child, extensive information on personal and family background factors, and detailed histories of educational, work and other outcomes for youths to age 21.

A stepwise regression approach has been adopted. We first estimate these regressions on five specific youth outcomes using family income in various forms as the sole explanatory variable. We then sequentially add base-level control variables and mediating variables to gauge how this changes the estimated (conditional) income effects. The following results have been obtained from this study.

- The sample size for the present analysis (797) was somewhat smaller than the total number of subjects who were interviewed at age 21 (1,011) because of the need to include only cases with valid income data from three separate stages of childhood development and because of other restrictions on data availability.

- The CHDS provides evidence of slightly more family income mobility over time than other similar overseas studies.

- The five measures of detrimental youth outcomes used in this study (economic inactivity, early parenthood, alcohol or drug abuse or dependence, criminal activity and receiving no school or post-school qualification) are generally positively correlated with one another, but the linear association is not as high as might be expected. Only two of the 10 pairwise correlation coefficients are greater than 0.4. In particular, alcohol or drug abuse or dependence has a low correlation with outcomes other than criminal activity. This suggests that a single measure of a detrimental outcome may not be a good indicator of the presence of the wide range of other potential problems. The full set of variables provides a more comprehensive picture of the variety of negative outcomes experienced by youths.

- The outcome area that is most strongly related to prior family income is the absence of a formal school or post-school qualification when no other covariates are included in our regressions. The magnitudes of these estimated income effects are reduced substantially, but not eliminated, when base controls and mediating variables are included. With the inclusion of these other explanatory variables, family income has roughly similarly sized effects on economic inactivity, early parenthood and leaving education without a formal qualification.

- Family income has slightly smaller effects initially on the probabilities of economic inactivity and early parenthood. The inclusion of the other explanatory variables weakens these associations, but by a greater extent in the regressions on early parenthood relative to economic inactivity with the inclusion of the base-level control variables. The mediating variables have little impact on the income effects associated with early parenthood.

- Even smaller effects of family income are found initially in the regressions on the probability of criminal activity, arrest or conviction. These effects are weakened slightly by the inclusion of the base-level controls, and eliminated entirely by the addition of the mediating variables.

- No statistical relationships were found between family income and the probability of alcohol or drug abuse or dependence. This is true regardless of whether or not other explanatory variables were included in these regressions.

- The evidence presented in this study suggests that the effect of income on a range of youth outcomes may be greater among children from low-income families. However, differences in the slopes for the linear spline functions were never statistically significant at better than a 10% level, and these income effects became less distinct as other covariates were included in these regressions. It is possible that other cut-off points in the spline function may produce a significant difference in the slopes, thus indicating a significant income effect by age. Future work in this area might experiment with breakpoints at 75% and 100% of median family income.

- Data available in the CHDS allow us to estimate separate income effects for different stages of child development. When no other explanatory variables are included in these regressions, family income from the last stage (ages 11–14) has negative and significant effects on economic inactivity, early parenthood and the absence of qualifications. Family income from the middle stage (ages 6–10) never matters for any outcome. Only in the regression on the absence of a qualification does family income from the early stage (ages 1–5) have a negative and significant effect. And indeed, only in the regressions on the absence of a qualification does early family income have a larger impact than later family income. These results persist even after base control and mediating variables have been included in the regressions. These findings on the relative importance of late income for early parenthood and early income for educational attainment are similar to those reported in the United States by Duncan et al. (1998) and Mayer (2002).

There are several things that could be done in any follow-up work in this area.

- More could be done with available family income data in capturing the importance of persistent poverty or income instability on these youth outcomes. For example, Yeung et al. (2002) found evidence that both the level and instability of family income matter for early cognitive achievement and behavioural problems.

- The use of mediating variables in this analysis tells us something about the pathways that family income might take in ultimately affecting youth outcomes. The CHDS is rich in a variety of other background characteristics that could also be used in this regard (other dimensions of cognitive achievement, teacher assessments of academic achievement, etc.). We could estimate regressions where the first stages of these possible indirect transmission mechanisms (i.e., the link between earlier family income and these mediating outcomes) serve as dependent variables. This system of regressions would allow us to explore the overall causal pathways between family income and these various outcomes of young adults.

- It would be interesting to explore in greater detail the reasons behind the changes in family income. For example, a drop in family income may have quite different effects on subsequent youth outcomes if it came from a marital split or for some other reason. In fact, changes in the composition of the family may themselves influence youth outcomes.

- Yeung et al. (2002) try to differentiate between the "child investment" and "family stress" mechanisms that link family income to subsequent child outcomes. However, they were restricted to indicators from a single year for both intermediate outcomes. We have multiple observations on many of these factors, for example, eight years of data on maternal depression scores, 12 years of interviewer ratings of standards of living and financial difficulties for families, and three separate summary measures of childhood activities and experiences. This means that, in addition to the availability of ongoing information on family income, there are ongoing indicators of child investments and parental stress in the CHDS that may be valuable for empirically distinguishing between these competing hypotheses for the importance of family income on child development.

- Finally, we could explore possible "differencing approaches" in this analysis. By examining the change in outcomes over a long period of time, we can isolate income effects from any latent variables that may be related to family income. Differencing data in this manner removes unobserved omitted "fixed effects". However, this approach may accentuate the importance of measurement error in family income, and bias downward the estimates of the true income effects. Yet we have potentially a "wide window" to explore cumulative income effects. For example, we could look

at changes in test scores or teacher assessments over a 5–10-year period in relation to changes in family income in the immediately preceding years.

This is not an exhaustive list of what further work might be done in this area, but it does give some idea of the possible general directions that this research might take. Of course, all of this could be greatly enhanced by the availability of data from the interview at age 25. These data will allow us to extend our analysis into an age range when many of the earlier detrimental outcomes may have either disappeared or become more permanent in nature. For example, we may be more concerned by the persistence of alcohol or drug abuse and criminal offending beyond adolescence. How much stronger (or weaker) are the statistical relationships between these same negative outcomes and family income as our subjects approach their 25th birthdays? These data will allow us for the first time to distinguish between problems that are concentrated in adolescence and those that continue well into adulthood. Is family income related to the ability of young adults to overcome problems experienced in adolescence? The CHDS data should allow us to address these and many other related questions.

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