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Introduction

For a long time economists have thought of the participation in education as an investment that undoubtedly increases the future earnings and well-being of its recipient in addition to society as a whole. Indeed, as far back as the 18th century this notion was voiced by thinkers such as Adam Smith,

“The acquisition of such talents, by the maintenance of the acquirer during his education, study, or apprenticeship, always costs a real expense, which is a capital fixed and realized, as it were, in his person. Those talents, as they make a part of his fortune, so do they likewise of that of the society to which he belongs.”
(Smith in *The Wealth of Nations*, Book II, Chapter 1)

However, despite the historical significance of this realization, it has been only recently that the benefits and costs of making such an investment, termed later by Schultz as an investment in “human capital”, have been formally analyzed.¹ More than forty years have passed since the pioneering work of Mincer (1958), Schultz (1961) and Becker (1964) first became published, addressing the theoretical underpinnings and empirical implications of investments in human capital. Over this period the literature in this area has blossomed producing a wealth of studies addressing investments in various forms of human capital including (but not limited to) health, migration and education. As the title of this manuscript suggests, the essays included in this book concentrate on the production of and investment in human capital of the latter type.

Initially, research on investments in education originated from the observation of growth in national income that could not be accounted for by growth in more traditional inputs such as physical capital and labor. The research took the form of both micro- and macroeconomic studies with an emphasis on estimating the direct effect of educational investment in terms of efficiency and equity on various measures of economic development (i.e. individual earnings, income distribution, gross national product, etc.). The work has also gained much importance in light of the fact that many countries dedicate a significant portion of their total expenditures to education so that accurate measures of outcomes attributable to these investments are paramount in the formation of educational policy.² Public financing of education is most commonly justified on the bases that education provides positive externalities for society as a whole in addition to promoting a more equal distribution of income. Indeed, research has almost invariably shown that investment in education is a main determinant of individual lifetime earnings suggesting that public financing of schooling can indeed play a role in decreasing income inequality. Finally, as education has been viewed as one of the rare cases in which a redistribution of resources does not necessarily result in a trade-off between equity and efficiency (referred to by Okun as the “leaky bucket” effect), further research has been prompted in this area. From Okun (1975, p.81),

“A vigorous social effort to narrow the educational financing gap can improve both equality and efficiency.”

¹ The term was coined by Schultz in his 1960 Presidential Address to the American Economic Association.

² For instance, the OECD reports 1998 public expenditures on educational institutions reaching as high as 7.17% of gross domestic product (Denmark) with an average of 5.75% among its members countries (see OECD (2001), p. 82).

Therefore, analysis of the investment in education is of great interest to those formulating educational policies that undoubtedly have consequences on individual and societal welfare.

A common goal throughout the following chapters is to measure the true impact of education on various outcomes. In order to do this it is necessary to identify the *causal effect* as opposed to the raw correlation between educational investments and various outcomes. For instance, although we may observe a positive correlation between education and earnings, interpreting the causal effect of education as the estimated coefficient from a simple linear regression of wages on years of schooling is almost certainly flawed. We would instead like to control for all factors that may be correlated with both education and wages, thus isolating the portion of earnings attributable to one's schooling (i.e. the "causal" effect of schooling on earnings.). However, it may be that individuals with greater amounts of schooling also have significantly greater values of other characteristics not observed by the researcher, such as motivation, which are also positively correlated with earnings. If we cannot control for these in our simple regression then the estimated schooling coefficient will also reflect the effects of the unobserved characteristics. This is more commonly referred to as "omitted variable bias". Additionally, bias might arise should there be heterogeneous returns to schooling, in which a significant correlation exists between the level or type of education one chooses and return it fetches. This is also known as "endogeneity bias".

The ideal way to estimate an unbiased causal effect of education is to conduct a *randomized experiment* or *randomly* assign various levels or types of schooling (educational treatment) to individuals in the population. Unfortunately, this option is rarely available in a social science setting such as ours. Therefore, we rely to a large extent on the discovery of *natural experiments* that can be used in instrumental variables (IV) or selectivity-corrected regression models in order to mimic the random assignment of educational treatment in the attempt to calculate unbiased causal effects of education.³

To this end, the following work attempts to contribute to this literature by analyzing various mainstream topics in the economics of education and labor economics with a focus on the Netherlands. The analyses therefore serve not only to expand the international evidence on these topics, but also to provide a robustness test of common results found in other countries. The chapters can be grouped into two parts with the first three addressing *educational production* and last two *rates of return to education*.

The first chapter focuses on the controversial issue of class size reduction. Indeed, this issue is quite relevant in the Netherlands where minimizing class size was the focal point of recent long-term budgetary decisions. The commonly held view that reducing class size significantly increases average student performance is tested using an IV approach based on a regression discontinuity design similar to that employed by Angrist and Lavy (1999). Furthermore, the chapter incorporates a peer effect to test whether having similar classmates (with respect to IQ) exerts a significant influence on individual performance.

The efficacy of class size reduction as a viable means to increase scholastic achievement is also analyzed in Chapter 2. However, whereas Chapter 1 focussed on estimating the *average* causal effects of class size and similar peers on scholastic achievement, Chapter 2 allows for the estimation of heterogeneous effects of these variables across individuals with varying levels of achievement by using a quantile regression (QR)

³ For good overview of the various techniques used to estimate consistent causal effects see Angrist and Krueger (1999).

technique. This makes it possible to evaluate not only the general effectiveness of class size reduction, but also the equity implications of such a policy. In turn, the question posed here is more precise, where the researcher asks not what the effect of a reduction in class size is on average but for whom such effects are significant and how large they might be.

Chapter 3 explores the phenomenon of superior achievement of Catholic over other (public and Protestant) primary schools in the Netherlands. The relative effectiveness of Catholic versus public schools has fueled the current debate in the US over public financing of private education. Although this is a common finding in the US (cf Coleman et al (1982a)), the case of the Netherlands differs in that it is unlikely the premium to Catholic versus public and Protestant education has to do with differences in funding or administrative selection across these educational sectors. However, self-selection of individuals by one's parents may be a significant source of selectivity bias. Therefore, extra attention is taken in controlling for self-selection of students (by their parents) into the three main school sectors (Catholic, public and Protestant) when estimating the causal effect of each on scholastic achievement through the use of an IV technique. In addition, the study controls for a wide variety of (potentially achievement enhancing) educational practices that may be more pervasive and/or efficient in the Catholic sector.

The purpose of Chapter 4 is to obtain consistent estimates of the rate of return to schooling in the Netherlands. Earnings estimates using the standard ordinary least squares (OLS) regression may be plagued by various biases due to endogeneity, ability bias and measurement error. The possibility of biased estimates is addressed empirically via implementation of instrumental variables (IV) technique using two Dutch data sets. In addition, the chapter includes a brief literature survey of ten mainstream studies that have employed various IV techniques paying special attention to the various identification strategies used.

Using the fourth chapter as a point of departure, Chapter 5 examines the extraordinary phenomenon in the Netherlands of a lack of return associated with the choice to complete an intermediate vocational program (MBO) after lower secondary general education (MAVO).⁴ Specifically, it attempts to answer the question: what can account for this finding and why would individuals participate in education for which there is no significant payoff? To this end, seven hypotheses are proposed and tested in search of possible explanations and/or supplements to conventional human capital theory in which individuals are assumed to make educational investment decisions based on certain pecuniary gain. Among these are: controlling for potential bias caused by the endogeneity of schooling; assessing risk attitudes and wage premiums to risk, testing for differentials in training and employment probabilities, and measuring the match between education and vocation.

⁴ MAVO is the acronym for Middelbaar Algemene Voortgezet Onderwijs, which can be literally translated as intermediate general continuing education and serves as the lowest form of secondary general education in the Netherlands. MBO stands for Middelbaar Beroepsopleiding or intermediate occupational education and is generally a four-year post-secondary educational program that a majority of MAVO graduates enter.

